Chapter 2
A Brief History of Thinking About ETI

In cultural terms, the Enlightenment is the process of creative destruction with respect to medieval "godly" theocratic culture, including art, philosophy, "Christian science" exemplified by geocentric astronomy and biological creationism…

(Zafirovski 2011: 8).

The question of life on other worlds is intimately tied to how we think about the cosmos and how we conceptualize the relationship between Earth, its civilizations, and the universe. In other words, questions about the existence of alien civilizations raise questions of cosmology, which is the attempt to explain and understand the origin, structure, evolution, and ultimate fate of the universe. Cosmology is a very broad field of study, one that is pursued by scientists and theologians, although, as noted in Chap. 1, their approach normally differs significantly. Physical cosmology—which involves the work of astronomers and theoretical physicists—emphasizes a systematic examination of the structure of the universe, its history and future, and tries to identify the natural laws through which that order and structure is maintained over time. This is where we find research related to general relativity and ideas such as the Big Bang Theory. Mythological cosmology raises the same types of questions related to the history, future, and in some cases even the natural structure of the universe, but it draws upon religious texts, theological and philosophical treatises, and myths, as well as religious and spiritual experience and sometimes observation of the natural world, as a means of arriving at answers. Of course, this is where we find ideas such as the Abrahamic creation myth in Genesis or the Japanese myth of the brother/sister duo Izanagi and Izanami who were once believed to have created both the islands of Japan and many of the deities associated with Shinto.

The cosmology to which one adheres has a profound influence on the ways in which one thinks about not only this world, but the possibility of life existing on other planets. A technique I often use to engage my class on science, religion,

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and the search for extraterrestrial intelligence is to ask a daily question using technology that immediately projects the results as a graph on the screen at the front of the room. Early in the semester I ask the students to respond to the statement: *The idea of extraterrestrial civilizations emerged with the advent of modern science and technology—true or false?* Most students answer that this is true, particularly if they haven't done the reading for that week. While in some ways this is an accurate response, the actual answer to this question is actually a bit vague. Democritus, writing 2,400 years ago, was aware that the Earth is round and argued that it was one of many worlds in the universe (Dick 1998); he well may have imagined the possibility of life on those other worlds. And other Greek and Roman thinkers such as Epicurus and Lucretius (ca. 99–55 B.C.) of the atomist tradition imagined a vast universe governed by natural laws that seemed likely to generate life, and perhaps intelligence, in many places. Lucretius writes in *On the Nature of the Universe* (Melville 1997: 66), that the world is the product of laws that govern the formation and structure of matter. When the elements of matter are put together in an organized way according to natural law, similar patterns should emerge in other places.

Wherefore again amid again I say you must admit
That in other places other combinations
Of matter exist such as this world of ours
Which ether holds in ardent fond embrace.
And note this too—when matter is abundant
And space is there, and nothing checks and hinders,
Then action and creation must take place.
And if there exists so great a storm of atoms
As all the years of life on earth could never number,
And if the same great force of nature stands
Ready to throw the seeds of things together
In the same way as they have here combined,
Then of necessity you must accept
That other earths exist, in other places,
With varied tribes of men and breeds of beasts.

Lucretius elegantly describes a universe governed by laws of nature in which the logical conclusion is that if the formation of matter into humans and other forms of life can happen here, it ought to be able to happen elsewhere. The atomists, of course, did not win the day, unfortunately being pushed aside in favor the Aristotelian cosmology in which the Earth sits at the center of a hierarchy of nested spheres including the Moon, planets, and stars that were fixed in place.

2.1 Narrowing Imagination

Although the geocentric worldview has its roots in Aristotelian thought, it was Ptolemy (c. AD 90–168) who developed an observational basis to support the notion that the Earth sat at the center of the universe. Ptolemy's ideas are presented in a

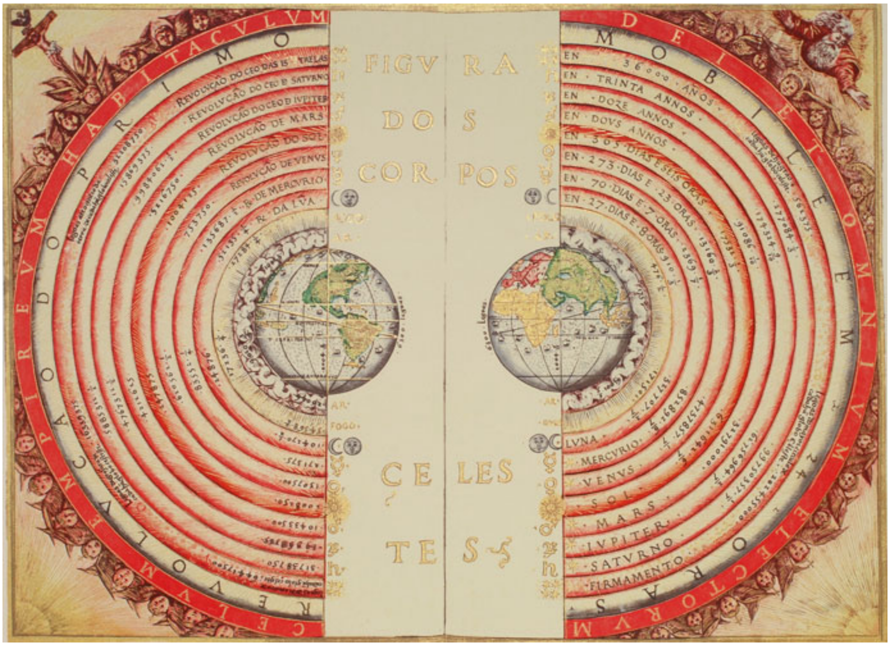

Fig. 2.1

work that has come to be known as *Almagest*, meaning the greatest, a title coined by its Arab translators. Published sometime around 150 A.D., Ptolemy's theory is complex and technically detailed, encompassing over 700 pages in 13 volumes. At the core of his ideas, however, is the creation of a system for calculating and predicting the movement of the planets. Indeed, Ptolemy's greatest contribution is not that he invented a new way of seeing the universe, but that he took ideas about the nature of the cosmos that had existed for several hundred years—again, the geocentric concept of the universe goes back at least to Aristotle—and developed a precise scientific theory that could be tied to empirical observation and used for prediction of cosmic events (DeWitt 2011: 114).

The Ptolemaic system, often simply referred to as the geocentric model, places Earth at the center of the cosmic order, where, as noted above, our planet rests amidst a nested hierarchy of celestial spheres that ranged from the Moon to the naked-eye observable planets to the fixed stars (see Fig. 2.1). In order outward from Earth, these are the Moon, Mercury, Venus, Sun, Mars, Jupiter, Saturn, and the fixed stars. This model represents observed features of the universe in terms of those things that appear to move and those that don't. Observationally, from the perspective of our planet, it appears as though the sun and the Moon revolve around us and this is the view taken by the Ptolemaic system. While this may seem counter-intuitive given our own understanding of the universe, it makes perfectly reasonable sense from an observational standpoint.

Imagine for a moment that you are sitting in an airplane traveling at 500 knots and decide to toss a ball straight up into the air and then catch it; later, after you've arrived at your destination, you sit in your parked car and try the same thing, apparently having little else better to do with your time. What's different in these two cases? Experientially, there isn't much that's different. In both instances the ball goes up and then comes down in what appears to be a straight line back into your hand. If you start to think about the two experiences, you might conclude that the ball on the plane must have actually moved in an arc, because everything on the plane was moving forward—you, the ball, the seat, the flight attendants, the annoying guy next to you, and the plane as a complete unit. Therefore, the ball had to be moving forward while it was also moving up and down, thus creating an arc-shaped motion. And because the ball and you have the same forward momentum, you both end up in the same place when the ball comes down. In contrast, while sitting in the car, you might conclude that the ball went in a straight line up and down, despite the fact that the car, you, the idiot who just backed into your left fender, and the ball are all moving along with the rotation of the Earth. That motion, however, is so minimal in terms of our experience that we can effectively treat the ball as though it simply moved in a straight line up and down—and that is how we usually perceive of tossing something up and down while standing still.

Now, suppose we change the parameters of our thought experiment slightly and assume that you don't know ahead of the time that the airplane is moving—you are flying on a cargo plane with no windows and the airline has given you incorrect or misleading information about the nature of your mode of transportation and destination (what a surprise!). What would you assume about the motion of the ball? My guess is that if you didn't already know the plane was moving and couldn't feel its motion you might assume that it was actually stationary and, thus, would conclude that the ball simply moved straight up and down. There is no necessary reason to believe that the plane is moving in this case and from an experiential perspective you, the ball, the seats, the flight attendants, the annoying guy next to you, and the ball are stationary—exactly like your experience in the car.

In fact, if you think a bit about the movement of the ball and you, it would be fairly easy to come to the conclusion that if you thought the plane were moving forward with you attached to it, then the ball would come down behind you—or hit you in the face if you didn't throw it high enough. You and the plane would move out from under the ball, which would go up and down in a straight line, while you were moving forward. Without an awareness and understanding that the entire complex of objects associated with the plane are moving forward together, it is not unreasonable to assume that you would move out from under the ball as you and the plane moved forward, while the ball went straight up and down. In other words, the context of your experience would make it perfectly logical to conclude that, despite the fact of being inside a moving object, you were actually inside a stationary object.

This is exactly what happened with many cosmologists both prior to and following Ptolemy—because experience does not *necessarily* confirm that the Earth is moving, there was no reason to work from the conclusion that it was doing so. In fact, a more reasonable and elegant solution to the problem of the motion of the Sun, Moon, and planets was to posit that they revolved around a stationary center that humans inhabited and tended to experience as a stationary object. This idea, as noted, was around long before Ptolemy. His major contribution was to provide mathematical confirmation for this intuition and to do so in a way that actually allowed for relatively accurate prediction of the movement of the Moon and visible planets. This also accounted for the fact that when observing the sky at night we do not observe a stellar parallax or the sense that the background is moving. Instead, the stars appear stationary all of the time. If the Earth were moving—whether orbiting the Sun or revolving on its axis—then we should observe stellar parallax or the apparent shift of the stellar background as our perspective changes in relation to our motion on the Earth. Because we do not experience this (due to the tremendous distances involved between Earth and the stars, making the parallax unobservable until techniques were developed to measure it in the nineteenth century), the conclusion that the Earth is stationary is supported on the basis of empirical observation from the perspective of geocentrists.

The point I want to emphasize with this example is that our basic assumption that the Earth is moving (and moving around the Sun) is a product of the knowledge generated through modern science—it is not something that we *must* naturally intuit about the world because our basic experience does not necessarily support the idea that the Earth is moving at all. This is the perspective that shaped the geocentric worldview and that dominated Western cosmology for about 1,500 years and thus provided an intellectual and cultural context within which ideas about the cosmos, and the place of humanity within that cosmos, were built and refined. The fact that it was based upon faulty observations of the natural world is irrelevant to the fact that the interpretations and conclusions based upon those observations made sense given the initial starting point. Humans are actually quite good at developing logical and rational explanations of our world that are not based upon accurate observations of our world—that's what a lot of religion is all about, but also can be a starting point in scientific inquiry. Religion has no monopoly on this tendency.

The main implications of the Ptolemaic system for our purposes here are: (1) the geocentric understanding of the universe created a cultural milieu in which Earth, and by extension humans, were perceived as inhabiting the center of the universe and (2) being at the center of everything, it became difficult to imagine a universe populated by other worlds with other intelligent beings, despite the fact that both Greek and Roman culture/cosmology allowed for this possibility.

This perspective, of course, was reinforced by the Abrahamic notion of humanity as the focal point of the creative activity of an omnipotent god who, according to the Bible, is lucky enough to be the generative core of the universe and for whom all material creatures are supposedly created (George 2005: 48). Although the Bible itself does not present a geocentric view of the universe, it does present a clearly anthropocentric worldview in that it centers itself on the relationships among humans, between humans and the rest of the created world, and between humans and the Abrahamic deity, which allows humans to see themselves as a special, and superior, element in the created order. Thus, the Ptolemaic and Abrahamic worldviews are mutually supportive or co-constructive, and within that framework the Ptolemaic cosmology provides a scientific foundation for the Christian perspective that both the Earth and humans are in some way unique in the universe.

This combination of philosophical and cultural themes shapes the basic context within which Europeans operated for about 1,500 years from the time of Ptolemy to the beginning of the Enlightenment and formed a cosmology that largely prevented the imaginations of European intellectual elites, at least, from considering the possibility of life on other worlds throughout that period. In other words, when the combined Aristotelian/Abrahamic worldview won the day, it also shut down the capacity of Europeans to imagine a universe of many worlds, inhabited by many different kinds of beings—self-centeredness always seems to have a way of narrowing one's imagination.

2.2 Expanding Imagination

The cultural and scientific innovations associated with the Enlightenment and the departure from Aristotelian/Abrahamic cosmology allowed for intellectual elites and eventually general populations to imagine a universe in which they were neither the center of creation nor alone. This expansion of imagination pivoted on the shift from a geocentric to heliocentric worldview in the sixteenth and seventeenth centuries with the emergence of modern astronomy via the mathematical and experimental approaches developed by Nicolaus Copernicus (1473–1543), Tycho Brahe (1546–1601), Johannes Kepler (1571–1630), Galileo Galilei (1561–1642), and Isaac Newton (1642–1727).

Copernicus got the ball rolling with his book *De Revolutionibus orbium coelestium* (*On the Revolutions of Heavenly Spheres*), first printed in 1543. While Copernicus maintained the Aristotelian notion of concentric spheres with the circle of fixed stars at the outer limit, he shifted from Earth to the Sun as being located at the center of European theology's celestial matryoshka doll. This allowed him to develop a simpler way of explaining the motions of the planets and, in particular, retrograde motion in which planets appear to move backwards across the sky at certain times of year. Copernicus hypothesized that he could better explain this phenomenon by placing the Sun at the center of the system of spheres and thus account for the apparent motion of the Sun and Moon as well as the apparent retrograde motion of the planets via the Earth's motion relative to the other celestial bodies. Note that Copernicus did not radically diverge from the basic paradigm of a universe consisting of concentric spheres; he simply moved the Sun to the center of that system while retaining the basic idea of spheres and also the notion that the planets moved in perfect circles. Nonetheless, the implications from a Christian theological perspective were significant because Copernicus's ideas opened the door for the possibility that humans no longer inhabited a special and unique place in the universe.

Copernicus lacked observational evidence to support his claims of a heliocentric model of the universe, but the writing was on the wall and increasingly accurate and careful observations of the skies were generating a variety of challenges to the Ptolemaic cosmology. One of these was the observation, by Tycho Brahe in 1573, of a supernova, which proved that the outer sphere of stars was not unchanging.

In addition to this, he made careful measurements to show that comets were not atmospheric and must be beyond the lunar orbit, further challenging the idea of an unchanging firmament.

The growing evidence against the geocentric model came to something of a head in the work of Johannes Kepler, a German mathematician and astronomer who in the early 1600s clearly showed that the planets moved in elliptical rather than the circular patterns assumed by Ptolemy and Copernicus. Drawing upon Tycho's observations of Mars, Kepler identified three laws of planetary motion indicating: (1) the elliptical orbits of planets, (2) that planets move faster closer to the sun, and (3) the squares of the revolution periods of the planets are proportional to the cubes of their mean distances from the Sun (Ferguson 2002). With Kepler's observations, there emerged better prediction of the movement of the planets and a much more complex understanding of how the solar system operates. These observations also further weakened the belief that Earth inhabits any kind of special position in that system.

In 1610, Galileo further undermined the geocentric model with his observations of the phases of Venus and the moons of Jupiter through the newly developed technology of the telescope. His work provided strong empirical evidence supporting the heliocentric model and Kepler's conclusions related to the motion of the planets; it also really irritated leaders in the Roman Inquisition who in 1633 tried and convicted him of heresy for supporting the heliocentric cosmology, and sentenced him to imprisonment, which was commuted to house arrest (such a kind bunch), where he remained for the rest of his life.

It was Newton who later in the 1600s put the final nail in the coffin of geocentrism when he showed that the planets were held in orbit through gravitational force. With Galileo and Newton, the Enlightenment produced the basis of empirical evidence and the theoretical framework to show that the geocentric model was simply wrong. The Earth did not sit at the center of the cosmos and, in fact, the Earth was not even particularly special in relation to other objects in the solar system and beyond. There are two points I want to emphasize here.

First, the process of generating scientific knowledge that moved us away from the geocentric model of the universe also provided an opening to think about—or given that the Greeks and Romans had already thought about it, to *rethink* about—the existence of extraterrestrial intelligence. Prior to this the capacity of Europeans to imagine other worlds with intelligent beings, or even other worlds beyond the observable realm of the planets, was very limited, because the scope of imagination was shaped by what social scientists have come to refer to as the *habitus* or overarching cultural milieu of a society that can powerfully construct the limits of imaginable thought and behavior.

Habitus is a term coined by French sociologist Pierre Bourdieu (1977, 1990), who used the concept in reference to the cognitive and social structures that motivate behavior but also shape and limit the range of ideas that naturally seem to fit into normal thought in a particular cultural context. *Habitus* is not deterministic; in other words, it does not prevent us from innovative thinking and creating new ideas, but it does have a tendency to limit the scope of our imaginations and, thus, tends to keep thought moving along a specific flow or path preventing many people within that flow from giving much consideration to alternatives. Occasionally, conditions arise that allow for rapid and dramatic changes in the course of the cultural flow, and during these periods we see significant conceptual innovations and the emergence of new ideas—this is what happened when the Aristotelian worldview won the day at the time of Ptolemy and again when that worldview collapsed and was replaced following the work of Enlightenment scientists like Kepler and Newton. *Habitus* has much in common with Kuhn's concept of paradigms of normal science, but *habitus* refers to more general cultural parameters that are embedded deeply into the minds and bodies of a group of people—so deeply that those people tend to be unaware of and unable to easily question the assumptions about worldview associated with a given *habitus.*

A good example of this can be found in the ways people in different cultures point to themselves when making a personal reference. In the US, people usually point to their chest; in Japan, people usually point to their nose. This example may seem a bit trivial, but it indicates the depth of *habitus*. In neither context do people give much of any thought to where on their body it is natural to point when referring to themselves. In fact, they pick this up through mimetic processes of cultural learning—as children, they see others do this and simply copy what they see and often do so unconsciously. When the situation arises to point to oneself, one just naturally points to nose or chest, depending upon the cultural context in which one was raised, without giving any thought to where is the proper place to point—it is completely internalized. This is what Bourdieu means when he talks about *habitus* and this can apply to trivial actions like self-pointing or to cosmologies like geocentrism or heliocentrism. Again, this is not cemented into our bodies and psyches; one can change, either consciously or unconsciously as one interacts with others in a given cultural environment or with outsiders who challenge conventional ideas. When I spend long periods of time in Japan, I find myself bowing on a regular basis without thinking about it simply because I pick it up from people I see around me. And I often continue to do this when I get back to the US for a while, until I unlearn—or un-embody—the practice.

One important difference between *habitus* and a paradigm is that unlike the subculture of science, human society more generally does not necessarily have a built-in assumption that inquisitiveness and openness to ignorance is to be valued. Thus, there often is little or no incentive to develop ideas and practices that run counter to general patterns of thought and behavior. In fact, most, perhaps all, societies tend much more in the direction of encouraging tacit conformity and provide few contexts in which individuals or groups can challenge the accepted norms of thought and behavior.

Second, although scientific paradigms may have more openness to radical innovation than the paradigmatic cultural patterns associated with *habitus*, a scientific paradigm is, in many respects, a subset of *habitus*. It is a way of seeing the world that shapes the parameters of acceptable scientific inquiry and deeply influences the ways in which most scientists conduct their research. Like with the broader culture, there are gatekeepers who shape and limit the range of acceptable questions and interpretations—think about the peer review process, as noted earlier—but there also are the more deeply embodied assumptions that have an influence on our capacity to imagine new questions and develop new interpretations. The Ptolemaic cosmology was based upon observation, but those observations were, in fact, wrong. Nonetheless, in part because they were based upon observations, they came to represent and construct reality and the overall *habitus* in which the Ptolemaic system emerged and was elaborated upon for 1.5 millennia, representing a cultural context in which challenging either the basic assumptions and calculations of Ptolemy or the theoretical framework of geocentrism was difficult and for much of the period very nearly impossible.

It would be a mistake to think that modern science operates any less within the context of a *habitus* that influences the limits of human imagination. The main difference is that the current cultural parameters are much more open to innovation and change than those of, say, the tenth century, at least when it comes to physical cosmology. However, scientists continue to have their questions and their conclusions shaped within the cultural context in which they conduct their research. One only need think about the recent debates over stem cell research, or creationism vs. evolutionary theory, to see that broader cultural trends and themes have the potential to significantly influence the course of scientific research.

We will return to this point later in the book, as it is important for understanding the manner in which SETI research has developed over the past 60 years. For now, I want to return to the historical dimensions of SETI, because the story does not end with Newton—in fact, the emergence of Newton's ideas are really just the beginning. His realization that there was a consistency to how the universe operated—a mathematics through which the motion of objects in the universe could be described and predicted—further opened a door to thinking about the existence of extraterrestrial intelligence. Newton showed that the laws of motion he described mathematically not only applied to the motion of objects on Earth, but also to celestial bodies. There is a very logical and ultimately inescapable conclusion that arises here: *If the universe is governed by universal laws, then life may not be limited to Earth.*

This conclusion was not missed by other thinkers of the time and by the late eighteenth century intellectuals such as Thomas Paine were postulating the possibility of numerous worlds beyond Earth. Paine wrote in his three-part pamphlet, *The Age of Reason* (1890: 66), published between 1794 and 1807, that "to believe that God created a plurality of worlds at least as numerous as what we call stars, renders the Christian system of faith at once little and ridiculous and scatters it in the mind like feathers in the air. The two beliefs cannot be held together in the same mind…" Indeed, Paine developed his notions about a plurality of worlds, as well as his critique of Christianity, around the idea that there is a basic consistency to the laws of the universe that should be open and visible to all beings, whichever planet they might inhabit: "The inhabitants of each of the worlds of which our system is composed, enjoy the same opportunities of knowledge as we do. They behold the revolutionary motions of our earth, as we behold theirs. All the planets revolve in sight of each other; and, therefore, the same universal school of science presents itself to all" (Paine 1890: 72).

This is a significant point that became amplified in the nineteenth century with the awareness that not only the laws governing physical motions of inanimate objects, but also laws governing biological change, might be universal. Right at the beginning of the century, there emerged a realization that the biological world might be subject to uniform laws that shaped its development and the process of change, just like what had been found by early physicists interested in the movement of celestial and other objects. French naturalist Jean-Baptiste Pierre Antoine de Monet, Chevalier de Lamarck, or Lamarck for short, published research in which he explored two basic themes: (1) that variation in animals is the product of the environments in which they live and (2) that life developed through specific forces that generated order and structure to organisms. The importance of Lamarck was that he was the first to develop a coherent theory of organic evolution, although he lacked an understanding of the process of inheritance and, thus, his ideas were eventually displaced by the much more elegant and accurate work of Charles Darwin and eventually Gregor Mendel. But Lamarck's fundamental observation that the development of life was a result of observable natural laws and that biological organisms evolved not at the whim of a god, but in relation to their environment, raised the possibility for thinking about all life as being governed by observable natural laws.

Evolution as a way of seeing the biological world became an increasingly powerful tool, of course, with the publication of Darwin's *Origin of Species*. This book, which is among the most important ever written, not only changed our understanding of the natural world, it also challenged our understanding of ourselves, because Darwin's process of natural selection effectively eliminates the necessity of a divine creator who has intimate interest in the design and development of life, either human or non-human, and who for some strange reason decides to put it only on Earth. Natural selection responds to the apparent improbability of a world of complexity arising either as a result of chance or some activity of an intelligent designer by recognizing the enormous power of accumulative change over a very long period of time (Dawkins 2006: 147).

Darwin was freed from the biblically inspired silliness of an absurdly short time span to geological history by the research of Sir Charles Lyell (1797–1875). The Earth's surface, Lyell realized, was formed over vastly long periods of time through uniform processes that continue to operate. This contrasted starkly with the widely accepted notion in England at the time (and elsewhere in the European sphere of influence, as well as, sadly, the contemporary US) of changes in the Earth occurring as a result of catastrophic events such as Noah's flood described in the Bible. Lyell's work was important for at least two key reasons. First, it was based upon empirical observations of the world, not upon culturally idiosyncratic myths such as those found in the Bible, Quran, or other religious texts. Second, it provided the long geological time span necessary for Darwin to show how minute changes in organisms can have sufficient time to accumulate (Darwin 1859: 282), forming the types of complex structures we see in humans and other animals in our world. Indeed, Darwin builds his theory of natural selection within the confines of an understanding of the world that necessarily has extremely long periods of geological time allowing for the possibility of the emergence of considerable biological complexity and variation. Given the incredibly long time that Earth has existed (by human standards), it becomes quite imaginable that the accumulation of minor changes in organisms would lead to complex structures like chimpanzees, dogs, and *homo sapiens*. Egotistical deities who create humans, and everything else, for their own warped pleasure and desire to be worshiped are no longer necessary in this way of seeing the natural world.

This rather brief history of the development of modern physical and biological science brings us to one of the key points of this chapter—that the emergence of modern science changed the capacity of humans to imagine the possibility of life on other worlds. First, this change was stimulated by the revolutionary work of astronomers from Copernicus to Newton that allowed humans to imagine a physical universe in which the Earth was no longer at the center or even particularly important. Second, the equally revolutionary work of scientists such as Lyell and Darwin showed that geological and biological change also can be understood in terms of observable laws, or at least observable patterns, and that it is completely reasonable, given the long periods of time involved, for minor changes to accumulate into the implausible forms of pigs, dogs, snakes, or even theologians. If the laws of physics and biology are uniform, then there is no reason to think life, or even intelligent life, could not emerge on other planets, and perhaps on many other planets.

By the middle of the nineteenth century, the universe humans inhabit—well really Europeans and their colonial descendants, since many in Asia such as Buddhists and Taoists never had this sort of worldview—had shifted from being a tiny place with a short history centered on a special Earth created by an egotistical god, to a vast place with a long history in which Earth was likely a very minor player and the reason for and source of creation was open to a great deal of uncertainty and debate. In short, from the beginning of the Enlightenment to the middle of the nineteenth century, human minds were not only opened to the way the universe actually is, they also were opened to imagine how it might be given what we were increasingly coming to know about how it is.

2.3 Imagining Aliens

By the later part of the nineteenth century, the stage had been set for the ability to imagine life on other worlds and several technological developments helped in energizing both scientific and popular curiosity related to the possibility of extraterrestrial civilizations. Perhaps the most notable of these improved technologies was the refinement of telescopes giving astronomers the capacity to view other planets in our solar system with increased clarity. And one of the best targets for observations was found in the planet that came to be viewed as analogous to Earth—Mars.

Lane has argued convincingly that the creation of Mars as a terrestrial analog drew heavily from the emphasis on geography and map-making that had become popular in the later nineteenth century, or as Lane (2011: 18) puts it "disciplinary geography and its imperial influences were fundamental to the emergence, entrenchment, and duration of the inhabited-Mars hypothesis." The process of mapping Mars, which occurred at a variety of different telescopes around the world, was, according to Lane, one of imprinting a terrestrial image on the Martian landscape through the creation of drawings generated through careful, albeit flawed, observations of the Red Planet.

This process took flight in 1877, when Italian astronomer Giovanni Schiaparelli trained his telescope on Mars and observed a network of seemingly straight lines he called *canali*, which actually means channels in Italian, but which was translated into English as canals: an unfortunate choice, because in English the word implies something constructed, rather than simply a natural channel. An intellectual debate rapidly emerged both in scholarly journals and in public media about the nature of Mars and the likelihood that there existed a civilization on the planet.

Indeed, it appeared to some, from the low resolution images that could be obtained by astronomers of the time, that Mars was a world with running water, oceans, and long channels along which the water moved. Both professional and amateur scientists began to argue in favor of the idea that Mars harbored intelligent life and that improved technologies would eventually confirm the idea that features such as the canals were artificial in nature (Lane 2011: 1). Some of these writers argued, as did one anonymous contributor to the British popular magazine *Chamber's*, that "the Martialites are probably much further advanced in the arts and sciences" than humans (quoted in Lane 2011: 1). In the US, it was Percival Lowell, a wealthy Boston businessman with an interest in astronomy, who at the end of the nineteenth century became fascinated with Mars and emerged as the leading proponent for the theory that Schiaparelli's observations were not simply the products of natural movement of water across the surface of the planet, but were canals constructed by an advanced Martian civilization (Hoyt 1996).

As Dick (1998: 31) has noted, Lowell did not develop his ideas about Martian civilization in a vacuum. His theory emerged within a scientific milieu where there was debate about the nature of the markings on the surface of Mars observed by Schiaparelli and others, and there were questions about the extent to which the existence of canals had or had not been empirically confirmed by the observations of other astronomers. Some astronomers reported canals, while others only saw shaded areas on the surface of the planet (Dick 1998: 28). Indeed, when Lowell weighed in on the scientific discourse about canals on Mars, most scientists believed that the canals were cracks in the crust of the planet (Dick 1998: 31).

In a series of lectures delivered at the Lowell Institute in 1906 and then published in *Century Magazine* and eventually as a book, Lowell argued a case for the presence of water, vegetation, and intelligent life on Mars that drew upon a variety of scientific frameworks ranging from astronomy to geology to Darwinian evolution. The gist of Lowell's argument was that the physical features of the planet—the "straight" lines and "oases" he was convinced he had observed through his telescope in Flagstaff, Arizona—could not be explained as natural phenomena (Lowell 1908: 196). Indeed, from Lowell's perspective, the circular structure of the oases, the straightness of the canals, their relations to each other, and a set of mathematical calculations about the movement of water, could only suggest one thing. "The deduction is inevitable; [the water] must have been artificially conducted over the surface of the planet. We are left no alternative but to suppose it intelligently carried to its end" (Lowell 1908: 202).

Lowell was a convincing writer and powerful orator who could make his case in such a way that had many scientists and far more lay people agreeing that the evidence for life on Mars was becoming increasingly conclusive. Although there were many detractors, it was not until the emergence of photographic images of Mars taken through the ongoing development of larger and higher resolution telescopes that it became clear that Lowell was wrong and there were no obvious signs of intelligent life on our celestial neighbor. In fact, by 1907, Lowell was backpedaling as improved techniques in spectroscopy and photography not only provided much better data, but also pointed out the inherent subjectivity of the astronomical maps that had been generated up to that point (Lane 2011: 57). Although by the early part of the twentieth century the idea of canals on Mars had largely died out among scientists, among the public the notion continued to persist—indeed, growing up in the 1960s I remember reading about and believing that there were canals on Mars and people still talked about canals as physical features of the planet. And despite lack of scientific evidence to support it, the idea of intelligent life and even a great civilization on Mars continued to fascinate both some scientists and the public into the early 1960s.

2.4 It Came From Outer Space

Of course, scientists were not the only ones imaging alien civilizations around the beginning of the twentieth century. Parallel to the growth of astronomy in the nineteenth century was an emergence of a new genre of literature—science fiction. In 1865, Jules Verne published *From the Earth to the Moon*, in which he imagines members of the Baltimore Gun Club in the post Civil War US building a huge cannon to send a spaceship carrying three people to the moon. Perhaps the most notable of the era's science fiction authors was H. G. Wells who, picking up on the Mars fever of the times, published in 1898 *The War of the Worlds* about an invasion from Mars and then in 1901 published his book *The First Men in the Moon* in which the protagonists discover an advanced civilization of insect-like creatures crawling around our nearest neighbor.

It is *The War of the Worlds* that I think is most instructive in exploring how the human imagination had opened to the idea of extraterrestrials. Not so much in the publication of the book, but in Orson Welles' broadcast in 1938 of the story as a radio drama for *The Mercury Theater on the Air* we see the extent to which the broad cultural conceptualization of alien intelligence had changed from less than 100 years earlier. Despite the fact that by 1938 the idea of Martian canals had been debunked, many in the public continued to believe that the canals existed and represented evidence of a Martian civilization. Welles, of course, took some liberties for dramatic purposes and presented the broadcast as though it was a news report of an actual event, although if one had tuned in from the beginning it was clear that it was a dramatization. The broadcast—in part due to general war fears that were becoming increasingly widespread by 1938—sent a scare across parts of the US and, at least at some level, a mild panic ensued about the possibility that Martians had, in fact, actually landed. Many police stations received calls asking about the verity of the reports as did radio stations and newspapers.

Orson Welles' broadcast was, of course, only one example of the expansion of science fiction stories in the public media. Comic strips like Buck Rogers (first appearing in 1928) and Flash Gordon (first published in 1934) brought the idea of space travel and exploration to the general public and represent expressions of a growing capacity to imagine the idea of intelligent life on other worlds and the development of technologies that both might get us to those alien worlds or bring the aliens to Earth. Superman, which first appeared in DC Comics in 1938 and became an American icon, is particularly interesting because he represents a human-like creature with unique—and superior—abilities who comes from an alien civilization, albeit a dying one, that is technologically, intellectually and morally superior; a fact that seems to be underscored by the inability of humans who see him constantly at the Daily Planet to notice that Superman is Clark Kent sans eyewear. In Superman, we see the development of the idea that aliens might be able to use their superior abilities to help humans emerge from their varied and complex problems and tendencies toward self-destruction and violence.

These fictional characters are the product of an early to mid twentieth century society in which new technologies were emerging very rapidly. Radio, the airplane, the automobile, motion pictures, Goddard's liquid fueled rocket launched in 1926, etc. provided the foundation for creating fictional characters from either an advanced human future or from other worlds. In other words, the shift from a geocentric to heliocentric worldview had, by the end of the nineteenth and middle of the twentieth centuries, opened the door for humans to imagine varieties of intelligent life on other planets, as well as to contemplate a future in which humans travelled to those other planets. Science fiction becomes a vehicle to think not only about aliens, but also to think about ourselves as we construct our own society in contrast to either superior/altruistic or dangerous/imperialist alien intelligence as well as in contrast to an imagined future.

Anthropologist Arjun Appadurai (1996: 31) argues that with the growth of global economies and the expansion of generative processes of cultural creation has come the emergence of "the imagination as a social practice." By this, he means that the capacity to engage in imaginative practices is no longer an elite pastime or the idle contemplation of the scholar, but has become "an organized field of social practices, a form of work (in the sense of both labor and culturally organized practice), and a form of negotiation between sites and agency (individuals) and globally defined fields of possibility." From Appadurai's perspective, the capacity to imagine has become central to human agency and in the process of that development there has formed an imaginary or a "constructed landscape of collective aspirations." Appadurai is interested in the emergence of this imaginary in relation to the expression of political power through media and other forms of globalizing structures and practices and the creation of what he calls ethnoscapes, or landscapes of people who create the shifting world around us and often briefly move in and out of our lives in a globalized world. The emphasis on this idea is one of instability and change and social practices that bend and warp more stable communities such as kinship and friendship networks.

I tend to disagree with Appadurai's notion that the imagination as a social practice is something new; human imagination is always a kind of social practice, even if the capacity to imagine is severely limited by a given social and ideological context. Humans always live within the context of an imaginary—or a way of putting together reality that links how we think the world is with how we think it ought to be. In other words, reality is not something out there that we touch, it is a consequence of the interaction between the physical and social context and individual imaginations that generate feelings among individuals with whom they share seemingly common ideas and experiences. It is in those feelings of a shared reality that we find imaginaries, which continually change in relation to the ways in which individuals interact with and imagine their surroundings.

What we see in the early part of the twentieth century in the US and Europe, at least, is the manifestation of a new type of imaginary with previously unimaginable repertoires of technologies, images, and narratives that stimulated a way of imagining humanity and its relationship to the cosmos that was only a few hundred years earlier largely unimaginable (Appadurai 1996: 35). In this imaginary, not only are people, with their various values and ideas, moving around the world and coming into contact with each other at an increasingly rapid pace, but the "world" as both a social and geographical construct is no longer limited to our planet. The conceptual geography of the Earth shrank with new technologies like radio and air travel, and along with it the conceptual geography of the universe shrank as it became possible to imagine a universe in which alien intelligences might travel to Earth and, eventually, we might travel to their worlds as well.

World War II, of course, accelerated the pace of technological innovation via the creation of jet airplanes, V1 and V2 rockets, and nuclear bombs, among many less visible innovations generated out of necessity during the conflict. My aim here is not to run through a history of technological innovation during the first half of the twentieth century; rather, I am interesting in stressing the idea that by the end of World War II, Americans, in particular, had experienced a array of technological and scientific advances combined with imaginative representations in fiction of a potentially widely inhabited universe such that the average person was faced directly with the idea that humans might be only tiny members of a cosmic chorus instead of a lone tenor belting out *Fly Me to the Moon* in front of the bathroom mirror.

For Americans, the end of World War II brought many significant changes particularly related to geopolitics. Our military was spread out across the world and, at least for a brief interval until the Soviet Union emerged as a nuclear foe, our political clout was uncontested. The end of the war also brought an influx of new ideas and people that came from conquered lands. For our purposes here, the most important of these arrived in the form of a German scientist named Wernher von Braun (1878–1972), who had been a key figure in the German rocket program during the war and became the central scientist in the creation of the space program in the US.

One of von Braun's biographers, Michael Neufeld (2007: 223), describes the German engineer who was brought to the US at the end of the war as "a true believer in science and technology, with a strong tendency to scientific utopianism." Indeed, von Braun became much more than a rocket scientist. As his role in the American rocket program expanded in the 1950s, von Braun became the chief salesman of a vision of the future in which humans colonized space and traveled to the stars. Where space travel had been limited to the realm of Flash Gordon and Buck Rogers during the late 1920s and 1930s, in a series of articles for *Collier's* in the 1950s, von Braun made a case that humans were ready to transfer space travel from science fiction to science fact. When the first issue of *Collier's* focused on space travel appeared in 1952, von Braun became a public spokesman for the space age, appearing on several television shows with major media characters like Dave Garroway and Garry Moore (Piszkiewicz 1998: 73). As *Collier's*—and von Braun—imagined the future of humanity, it was one in which humans engaged in a "conquest of space" drawing upon another imaginary related to American society—the frontier. The centerpiece of the *Collier's* discussion of space was an article by von Braun called "Crossing the Last Frontier," in which the author described a time 10–15 years in his future when humans had built a huge space station orbiting 1,075 miles above the Earth and built in a donut shape that would be 250 ft across. From this space station, von Braun describes a trip to the Moon as "just a step" and clearly imagines a rapidly coming future in which humans routinely access space.[1]

Obviously, von Braun's predictions were a tad optimistic, but they helped to extend the frontier imaginary of the American West to include the realm of space and in so doing further opened the imaginations of Americans (and others) to the possibility of extraterrestrial intelligence. If humans could go into space, why not intelligent beings from other planets? The cultural milieu of the 1950s, in fact, had many elements that contributed to the expanding of the American imagination to include the idea that humans might not be alone in the universe. Numerous movies—mostly bad ones and a few good ones—were produced by Hollywood depicting a wide array of potential encounters with aliens, from the morally and technologically advanced Klaatu in *The Day the Earth Stood Still* trying to help the infantile humans grow up, to the surreptitious pod people invading the Earth by taking over human bodies in *Invasion of the Body Snatchers*. On the silver screen, the imaginary of space travel and alien beings from space was playing out initially in black and white and then in full Technicolor.

2.5 It Came from Earth, Too

I have briefly explored a very long period of human history to make a simple point: By the 1950s, humans—and particularly Americans—had taken the seeds of a new imaginary that emerged during the Enlightenment and grown them to the point that it was now fully possible to conceive of the idea that humans were not alone in the

[1] It's interesting to note that as I write this page, NASA has just announced that the Voyager space probe has moved into interstellar space—the first human-made object to depart the solar system.

universe and to even imagine what alien others might look like, with their quasi-humanoid vast craniums, bug eyes, and the like. Starting with the Copernican revolution and the realization that our planet was not at the center of anything, an interpenetrating flow of new ideas and innovative technologies combined to lead humans, by the end of the nineteenth century, to a point where they could fairly easily imagine other planets inhabited by intelligent species. And by the 1950s, this imaginary had intensified and broadened significantly as it became clear that we were on the verge of developing the technologies that would allow humans to travel into space. People now had the cultural tools to imagine aliens—they could think about what they might look like and could ponder other planets where civilizations, and ones likely to be more capable than our own adolescent or toddler one on Earth, built great machines like the 30 km^2 underground computer of the Krell and Robbie the Robot in the movie *Forbidden Planet*. It was in this cultural milieu that scientists in the 1950s began to ponder the possibility of designing research projects that might generate the empirical evidence needed to determine if extraterrestrial intelligence actually existed.

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