

THE INNER MEANING OF OUTER SPACE: HUMAN NATURE AND THE CELESTIAL REALM*

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Abstract

Kant argued that humans possess a priori knowledge of space; although his argument focused on a physics of bodies, it also has implications for a psychology of beings. Many human cultures organize stars in the night sky into constellations (i.e., impose structure); attribute properties, behaviors, and abilities to objects in the celestial realm (i.e., impose meaning); and use perceived regularity in the celestial realms in development of calendars, long-range navigation, agriculture, and astrology (i.e., seek predictability and control). The physical inaccessibility of the celestial realm allows a potent source of metaphor, and also allows projection of myths regarding origin and ascension, places of power, and dwelling places of gods, immortals, and other souls. Developments in astronomy and cosmology influenced views of human nature and the place of humanity in the universe, and these changes parallel declines in egocentrism with human development. Views regarding alleged beings (e.g., angels, extraterrestrials) from the celestial realm (and to how communicate with such beings) are anthropocentric and ignore evolutionary factors in physical and cognitive development. It is suggested that in considering views and uses of the celestial realm, we learn not just about the universe, but also about ourselves.

Key words: constellations, origin and ascension myths, cosmic anthropic principle, Kant, extraterrestrials.

Resumen

Kant afirmaba que los seres humanos poseen un conocimiento *a priori* del espacio. Aunque este argumento se centra en la física de los cuerpos, también tiene implicaciones para la psicología del ser. Muchas culturas humanas organizan las estrellas en constelaciones (imponen estructura); atribuyen propiedades, conductas y habilidades a objetos en el reino celeste (esto es, determinan significado); y usan la regularidad percibida en los reinos celestes para el desarrollo de calendarios, navegaciones de grandes distancias, agricultura y astrología (buscan predicción y control). La inaccesibilidad física del reino celeste permite una potente fuente de metáforas, así como la protección de los mitos sobre el origen y la ascensión, los lugares del poder y aquellos donde habitan dioses, seres inmortales y otras almas. Los desarrollos en astronomía y cosmología influyeron las opiniones sobre la naturaleza humana y el lugar de la humanidad en el universo; estos cambios ponen en paralelo los descensos en el egocentrismo y el desarrollo humano. Las visiones acerca de los presuntos seres (como los ángeles y los extraterrestres) del reino celestial (y cómo comunicarse con esos seres) son antropocéntricas e ignoran factores evolutivos del desarrollo físico y cognitivo. Se sugiere que al considerar opiniones y usos del reino celeste, aprendemos no sólo acerca del universo, sino también sobre nosotros mismos.

Palabras clave: constelaciones, mitos sobre el origen y la ascensión, principio cósmico antrópico, Kant, extraterrestres.

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The objects and events seen in the sky have long fascinated human observers. Weather permitting, the Sun can be viewed as it travels across the sky each day, and a person far from the lights of a city can view planets, comets, meteors, and thousands of stars in the night sky. Contemporary views of astronomical phenomena based on radio astronomy, CCD photography, and computer simulation seem quite different from the stories and legends of ancient shaman-priests, but both contemporary and ancient views are parts of a larger tapestry in which meaning is sought in and attributed to elements of the celestial realm. Most discussions of human nature discuss how experience within the terrestrial realm nurtured human nature, and it will be suggested here that the way humans interpret objects and events in the sky, look to the sky for meaning, and ponder the possibility of life elsewhere in the universe, all reveal much about human nature. Unlike objects in the terrestrial realm, objects in the celestial realm cannot be touched by earthbound hands, and so information regarding the correctness of human perceptions and conceptions of celestial objects is less available. As a result, the celestial realm offers a purer mirror of human nature than does the terrestrial realm, and provides a blank slate upon which predispositions and biases in human nature may be projected.

Kant's question

In his *Prolegomenon to Any Future Metaphysics*, the 18th century philosopher Immanuel Kant (1783; trans. in Campbell, 1986, p. 27) asked "How is it that in this space, here, we can make judgments that we know with apodictic certainty will be valid in space, there?" In the centuries since Kant, scientific understanding of the universe has greatly increased, and many findings and theories suggest that the same physical and chemical laws operate across the breadth of the observable universe. Kant's analysis suggested to him that the laws of space are known to the mind because those laws are actually of the mind, and so knowledge of space reflects an a priori knowledge (i.e., a knowledge prior to experience and thus possibly innate to the organism). Such an a priori knowledge could be construed to be a

part of human nature. Therefore, by considering humanity's views of a distant "there" which is as yet not experienced, we might glean some insight into human nature "here," that is, by considering our views of the objects and events of the celestial realm, we might deepen our understanding of human nature.

Seeing patterns and meaning in the sky

Even the most casual and fleeting examination of the night sky reveals countless objects, but such objects are not seen as meaningless stimuli, nor are the stars, planets, and other celestial objects generally perceived to be randomly placed. Rather, human observers see patterns in the positions and movements of objects within the sky, and such observers impose meaning on the forms and patterns they perceive within the sky. These forms and patterns unfold in a single instant (e.g., constellations) as well as across time (e.g., phases of the moon). The celestial realm serves as a source of information regarding time (e.g., seasons) and space (e.g., navigation) on Earth, and also provides a potent source of metaphor. Although objects and events in the celestial realm have been at least partially demythologized by developments in science, throughout much of human history a perceived connection of a person to some celestial element or a perceived passage of a person through the celestial realm were considered meaningful experiences that imbued that person with great power.

Structuring the sky

Every known human culture has developed groupings of stars into constellations that reflect familiar individuals, objects, and shapes. The constellations of contemporary Western culture are based on groupings of stars made by Greek and Roman sources over two thousand years ago, but the constellations of Western culture are by no means the only way of structuring the night sky. For example, the belt of the Greek constellation of Orion forms the "turtle" constellation in Mayan astronomy, and the belt and lower portion of Orion form the "hand" constellation in Lakota astronomy. In most cases, the assignment of a given identity to a given group-

ping of stars by a given culture reflects individuals or objects of that culture. Just as Greek and Roman constellations reflect figures in Greek and Roman mythology, the European names of constellations in the sky over the southern hemisphere reflect common objects from the Age of Exploration during which those constellations were first viewed by Europeans. The tendency of humans to impose order and structure on the celestial realm reflects a more general tendency of humans to order and structure their environment (e.g., Kubovy & Pomerantz, 1981; Lockhead & Pomerantz, 1991). Thus, structuring of the stars in the night sky into constellations may reflect a basic part of our human nature.

There are several consequences of organizing the thousands of stars in the night sky into a smaller number of constellations and assigning names to those constellations. One consequence is that grouping multiple stars within a given region of the sky into a constellation decreases the mental effort involved in remembering the configuration of the stars within that region, because grouping multiple stars into a constellation allows an observer to exploit the meaningfulness of the name of the constellation as an aid for memory (i.e., rather than each individual star occupying a single “chunk” of short-term memory, an entire constellation occupies a single “chunk” of short-term memory; Miller, 1956). Grouping stars into constellations would thus make it easier for a single individual to recognize or reconstruct from memory a larger section of the night sky. Such recognition or reconstruction would be useful in comparisons of the sky across different nights and in the subsequent use of celestial information in navigation or in keeping an accurate calendar. Also, naming constellations after known individuals, events, or objects might provide a mnemonic or cue for remembering those individuals, events, or objects; such naming could contribute to the continuance of cultural memory, and would be especially valuable in cultures that were primarily oral or nonliterate.

Giving names to individual objects or to groups of objects in the celestial realm could influence how that object or group was remembered or interpreted (Bower, Karlin, & Dueck, 1975; Carmichael, Ho-

gan, & Walters, 1932). For example, the red planet Mars resembles the color of blood, and so was named after the Roman God of War; when that planet was relatively bright in the sky, it was believed that war or other conflict was imminent. More recently, the use of the name “canali” by Schiaparelli in descriptions of features he observed on Mars strongly influenced Lowell’s interpretations of his own observations of Mars. Also, the relationships between referent objects are often preserved in the relationships between celestial elements named after those referent objects, as in the case of Orion the hunter pursuing Ursa Major the big bear. In prescientific cultures, identification of a celestial object as corresponding to a person or object often resulted in properties, behaviors, or abilities of that person or object being attributed to the celestial object (Hubbard, 2002). For example, the word “planet” derives from the Greek word for “wanderer”, and the planets were so named because they appeared to wander across the sky. Also, depictions of the Egyptian Sun God Ra often showed human-like hands at the ends of the rays of light.

The sky as information

Even when human-like properties, behaviors, or abilities were not attributed to objects in the night sky, elements of the celestial realm could still have predictive or informative qualities. Many cultures used celestial events or configurations such as the passage of the equinox or the reversal of the Sun’s movement along the horizon at the solstice as calendrical markers of religious (e.g., rebirth of the sun) or secular (e.g., when to begin spring planting) events. More broadly, the sky exhibited an order and regularity that could be used to structure and predict events on an otherwise chaotic Earth, as in ancient Egypt, where the rising of Sirius foretold the imminent flooding of the Nile. The order and regularity of events in the sky could also provide information regarding location and navigation on the Earth. For example, Micronesian natives traditionally used an elaborate star compass for navigation between tiny islands scattered across vast distances of an otherwise empty ocean (Hutchins, 1983). Even today, information from the sky provided by orbiting satellites is used in global posi-

tioning and navigation and in weather forecasting. For ancient peoples, unpredictable astronomical phenomena such as comets were often viewed with alarm and were considered to be harbingers of impending doom or chaos (although there have been a few exceptions in which an unexpected celestial event was viewed positively, e.g., the legendary nativity star).

Given that celestial configurations and events could predict or provide information regarding general or large-scale events on Earth, it would not be surprising that some cultures tried to extend the predictive and informative power of celestial configurations and events to encompass local or small-scale events and even specific individuals. Such an attempted extension may be behind the development of astrology in many prescientific cultures and in the continued interest in astrology by some within Western culture. What does the existence of astrology reveal about human nature? It suggests that humans have a need or desire for information that might allow them to predict, control, or understand themselves and the world around them. Individuals who believe they can predict or control their environment generally exhibit better mental health than do individuals who believe they cannot predict or control their environment (Lefcourt, 1976), and so astrology might have developed as a type of control or coping strategy. Such a notion is consistent with observations that interest in astrology and in other forms of the occult typically increase during times of social unrest or uncertainty, as it is precisely at those times that information such as that promised by astrology would be most useful. Of course, individuals claiming special knowledge or ability in such areas might also gain in power, wealth, or influence. Even so, in its focus on the individual, astrology may have been one of the earlier attempts to understand human nature.

Sometimes information from the celestial realm came not from configurations or appearances of stars, planets, or other celestial bodies, but from visitors from the sky. Throughout human history there have been numerous stories of messengers from celestial realms who visited Earth, and in at least some cases, belief in such visitations may reflect a need or desire for predictability and control

analogous to the need or desire underlying a belief in astrology. Historically, it was often believed that such visitors were angels or other supernatural beings, but in recent decades, there are some who believe such visitors are extraterrestrials that arrive on board interstellar spacecrafts. Jung (1978) suggested sightings of UFOs (unidentified flying objects) and UFO occupants are analogous to visits from angels that were reported in prior times; in both angelic and extraterrestrial visitations, a more advanced being from a distant place often brings a message to humans. Within a Jungian framework, such experiences have been suggested to reflect expressions of archetypal imagery associated with the human collective unconscious, and so the appearances, behaviors, and information given by such “angels” or “extraterrestrials” could in fact originate deep within the unconscious mind of the person having the experience. Such a “visitation” might therefore reflect a basic aspect of human nature.

In recent years, reports regarding visitors from the celestial realm have exhibited a more sinister tone, and reports of “alien abduction” in which humans have been taken and experimented upon without their consent have become relatively common. Many investigators reject the possibility that such reports reflect actual abductions by aliens (but see Mack, 1994), and a number of alternative interpretations and explanations have been proposed. One alternative interpretation that is consistent with Jung’s framework is that the alien abduction experience reflects an unconscious realization of human exploitation and irresponsibility toward nature, and this realization is depicted in imagery involving unsympathetic aliens who exploit humans to revitalize their own dying species (e.g., Grosso, 1985). Additional alternative explanations for the phenomenology of the alien abduction experience include a high susceptibility to suggestion, fantasy-prone personality, sleep anomalies, psychopathology, partial resurfacing of memories of childhood abuse, false memory syndrome, nearby tectonic stress, temporal lobe lability, and effects of magnetic fields on brain function (for discussion, see Appelle, 1996). In the absence of an actual alien abduction, the phenomenology of the typical

alien abduction experience would presumably reflect at least some elements of human nature.

The sky as metaphor

Even when the celestial realm does not provide explicit information, elements within the celestial realm can still provide a source of meaning for human language. Even a casual inventory of language reveals the celestial realm provides many metaphors, and some examples include: when a person is successful, he or she becomes a “star” in the field and “the sky’s the limit;” when a person is happy, he is “on cloud nine,” “in seventh heaven,” or “sky-high;” and when a person is captivated, he is “starry-eyed” or “has stars in his eyes.” It has been suggested that much of human thought is metaphorical or structured by metaphor (e.g., Lakoff & Johnson, 1980), but why might the celestial realm offer such a potent source of metaphor? One possibility is that many elements of the celestial realm appear constant across human experience; no matter where or when on Earth people lived, they experienced the sky, and the cycles of the moon and stars remain the same regardless of from where on Earth the moon and stars are viewed (allowing for differences in visibility related to latitude). Furthermore, examples of regularity and order in the sky such as the seasonal variations in the rising and setting of a given star or constellation, the paths of circumpolar stars, and the cycles of progressive and retrograde motions of the planets, could be seen as grounding, framing, or establishing a larger order or harmony for life on Earth (e.g., Freidel, Schele, & Parker, 1993).

Journeying the sky

Even though changes in the configurations or appearances of elements in the celestial realm provided calendrical or other information that helped frame and structure life in many human cultures, the Earth and sky were often viewed as separate, and the celestial realm was generally considered beyond the reach of typical earthbound humans. One exception to the general separation of Earth and sky involved the possibility that angels, extraterrestrials, or other beings from the celestial realm could journey to Earth. A second exception to the general separa-

tion of Earth and sky involved the possibility of a journey to the celestial realm by those few humans who received special training or assistance (e.g., in Hebrew mythology, Ezekiel and Enoch). Numerous legends of shamans and priests spoke of bridges between the stars and Earth, and individuals who during their life on Earth could cross such bridges and journey to the celestial realm and then return to Earth were viewed as able to draw on sources of great power and knowledge. Indeed, “skywalking” or “journeying the sky” remains a potent source of power in shamanic cultures. Unless the possibility of an actual physical journey to the celestial realms is acknowledged, the experiences during such an alleged journey would reflect the nature of the person who experienced the journey rather than the nature of the actual elements of the sky.

The importance of “journeying the sky” may also be found in a more literal sense in contemporary scientific culture. During the Cold War of the 1960s, the United States sought to demonstrate the superiority of its democratic and capitalist government over the form of government of Communist countries, and one of the prime demonstrations was the Apollo program in which the United States landed astronauts on the moon and then safely returned those astronauts to Earth. The astronauts of the Mercury, Gemini, and Apollo programs were revered as cultural heroes, and the “space race” between the United States and the Soviet Union was a contest not only for dominion of the sky, but for dominion of the political landscape of the Earth. In this case, journeying the sky was a literal physical voyage potent with political meaning. Similarly, the docking of American and Soviet spacecraft in the Apollo-Soyuz mission, the presence of international crews on the Soviet Mir station and American shuttle, and the construction of an international space station can be seen as political symbols. In ancient shamanic practices and in contemporary politics, the sky is conceived to be a realm of power, and by visiting the sky, both shaman and statesman gain in power and in stature. Only the vehicle of the metaphor has changed, the basic nature of the human who undertakes the voyage has not: in both ancient and contemporary cultures, one who journeys the sky becomes powerful.

Humanity's place in the universe

Within human history are numerous speculations that the origin of humanity and the destination of (at least some) souls after death are in the celestial realm. The place of humanity, as well as the place of Earth, is often defined relative to the celestial realm and elements observed in the celestial realm. Throughout much of human history and in many human cultures, Earth (or that part of Earth where a given cultural group lived) was believed to be at the center of the universe, but advances in science have relegated Earth to orbiting a minor common G-type star in a distant suburb of an unremarkable galaxy (for histories, see Ferris, 1988; North, 1995; Pannekoek, 1961). Although many discoveries in science moved the place of humanity increasingly further away from any supposed center of the universe, other discoveries regarding the formation of elements within stars and the chemistry of interstellar dust clouds suggest humanity is related to the celestial realms in ways more fundamental and intimate than mere geographic location.

Origin and ascension myths

Several aboriginal peoples have origin myths involving a descent from the sky. For example, the Dogon tribe of Africa claims life on Earth came from the Sirius star system, and in Pawnee mythology, the first man was the offspring of the sun and moon and the first woman was the offspring of Venus (for other examples, see Krupp, 1984; Miller, 1997; Williamson, 1987). In some origin myths, humans did not come directly from the sky, but the creator gods who made humans have celestial roots, as in Inca mythology, in which Viracocha descended to earth and created plants, animals, and men and built the city of Tiahuanaco. In other origin myths, the gods literally are the sky, as in Egyptian mythology, in which the sky is formed from the body of Nut, or dominion over the sky is reserved for the most important gods, as in Greek mythology, in which Zeus was god of the sky. Additionally, even when humans do not descend directly from the sky or from celestial elements or gods, the right to rule over humanity often comes from celestial realms, as in Chinese mythology, in which the "Mandate of

Heaven" is given to the Emperor. Given the belief that humans directly or indirectly originated from the sky, the celestial realm would have had an important role in shaping human nature.

Not only are the origins of humanity sometimes attributed to the stars or to the sky, but some cultures also believe that when a person dies he or she ascends to the stars or even becomes a star or other celestial object. For example, the stars of the Pleiades are seen as dancers, brothers, and fighting women in various Native American cultures, nymphs in Greek mythology, and the wives of the seven rishis in Hindu mythology. Several Native American and other shamanic traditions believe the Milky Way is the bridge between the land of the living and the domain of the dead, and in Pawnee mythology, the one who receives the spirit of the dead is a star at the north end of the Milky Way. In Egyptian mythology, the pharaoh ascended to the celestial realm and became a star. The idea of ascension is especially well illustrated in the *Paradiso* of Dante's *Divine Comedy*: The heavens form the outermost of several concentric spheres enclosing Earth (as specified by the Ptolemaic model dominant at the time of Dante), and the process of approaching God in the outermost sphere involved ascension and passage through the intervening spheres. Finally, a hallmark of the Christian faith is the belief that Jesus Christ ascended to heaven after his resurrection, and the Islamic faith proclaims that Mohammed ascended to heaven during a dream.

When we consider the idea of ascension, the "heavens" in a religious sense are usually co-extensive with the "heavens" in a physical sense (at least from a physical viewpoint on Earth). Why might this pairing of the physical sky with a metaphysical realm occur? One possibility involves the relative permanence of elements in the sky: Within the span of a single human lifetime, the relative positions and seasonal patterns of the stars do not change by any perceptible amount (changes due to precession of Earth's axes or to stellar drift unfold on time scales far longer than a human life), and so the relative positions and seasonal patterns of many stars have a phenomenological permanence. Once early humans became aware of their own mortality, they could have associated changes involved with

life and death with other changes in their terrestrial environment, and then drawn the conclusion that immortality required a permanent or unchanging environment. For humans searching for a realm of relative permanence, the celestial realms (especially the circumpolar regions in which the stars never set) would have seemed an ideal setting. Indeed, many prescientific cultures believed circumpolar stars were immortal and that after death a soul that migrated to the polar region of sky would become similarly immortal (for discussion, see Krupp, 1984).

Cosmology

Human origin and ascension mythologies often involved a cosmological component, that is, in addition to addressing the origin of humankind, such mythologies also addressed the origin of the universe. Many cultures believed in a cyclic cosmology in which the universe was periodically destroyed and created anew. For example, in Mayan mythology, the end of a great cycle involves the destruction of the current universe and the creation of a new universe, and in Hindu mythology, the universe exists when Brahma is awake and is destroyed or reabsorbed into Brahma when Brahma sleeps. In contemporary Western culture, reigning scientific models of cosmology are based on the idea of a “Big Bang” in which the current universe was created in the explosion of a primordial particle, the effects of which are still observed today in the red-shifting of light from distant stars (indicating a continued expansion of the universe driven by the force of the initial explosion) and in the presence of cosmic background radiation. Whether the ultimate fate of the Big Bang universe is to continue expanding forever or to eventually stop expanding and perhaps fall back on itself (in a more cyclic cosmology in which the universe is periodically destroyed and created anew) hinges upon the density of the universe and the cosmological constant (for discussion, see Ferris, 1998).

What relevance might the Big Bang or other cosmological theories have for a consideration of human nature? The cosmology of a culture would influence beliefs regarding any meaning or purpose of the universe or of humanity that is held by

that culture. In many mythological cosmologies, a powerful being created the universe, and human nature was often defined by the relationship between that powerful being and humans. For example, in the Judeo-Christian tradition, the imperfect nature of humans as unavoidable sinners springs from the relationship between the Judeo-Christian God and humans. Unlike many prior cosmologies, the Big Bang cosmology does not address any meaning or purpose of the universe or of humanity, and this parallels (and might have given impetus to) contemporary existential views of human nature that suggest the existence of humanity in general or of a given individual in particular does not have an intrinsic meaning or purpose. Furthermore, the Big Bang cosmology separates the creation of the universe from the creation of Earth and the creation of humans by several billion years. This separation of cosmic history and human history in part reflects a demythologizing by science of celestial realms and of biological realms, and changing views about cosmology might then be linked with changing views about human nature.

Removing humanity from the center

In Western culture prior to the Copernican revolution, the Earth was considered to be the center of the universe. In the initial Aristotelian and subsequent Ptolemaic models of the universe, the Earth was surrounded by a series of larger concentric crystalline spheres that contained the sun, moon, planets, and stars. For nearly two thousand years the Earth-centered Ptolemaic model provided a way in which to understand the celestial realm. However, observations of the night sky were not always in agreement with the Ptolemaic model. One problem was the occasional and unpredictable appearance of comets, meteors, and other objects within the celestial realm. A more troublesome problem was the appearance of retrograde motion of some planets. Also, because the Ptolemaic model was incorrect, discrepancies between predictions of the model and observations of the celestial realm inevitably arose. Epicycles (i.e., small circular movements imposed upon the larger motions of the orbits) were added to the Ptolemaic model as a way to accommodate the discrepancies. Eventually, the pattern of epicy-

cle adjustments became exceedingly complex, and the evidence against the Ptolemaic model became so overwhelming, that the Earth-centered Ptolemaic view was replaced by the sun-centered Copernican view.

Although observations of the celestial realm were not the only spurs to the development of Western science, they contributed in significant ways. When Galileo aimed his telescope at Jupiter, he saw evidence that Jupiter was orbited by its own system of satellites, but this finding conflicted with religious views of that time which specified that the Earth was the center of the universe. Subsequent observations by Brahe, and Kepler's use of those observations in uncovering the laws of planetary motion, revealed that the orbits of the planets corresponded to ellipses rather than to the perfect circles suggested by the notion of crystalline spheres, and this further conflicted with religious views. Newton's discovery that the same law of gravity that governed motions of objects on Earth also governed motions of objects in the sky questioned the prevailing separation of the laws of Earth and the laws of heaven. Copernicus removed the privileged place of Earth, and coupled with Darwin's subsequent removal of the privileged place of humanity, effectively changed Western culture's view of human nature from humans as a special and unique creation to humans as an ever less important and insignificant part of the cosmos.

The removal of humanity from the center of the physical universe that occurred with scientific development is mirrored by the removal of the individual from the center of his or her social universe that occurs with cognitive and social development. One of the notable characteristics of young children is a high level of egocentrism, that is, an inability to detach from their own viewpoint and take the perspective of another. Eventually, a child matures and learns that other people may have different views, thoughts, perspectives, and feelings (see Royzman, Cassidy, & Baron, 2003). The anthropocentrism that placed Earth at the center of the physical universe parallels the egocentrism that placed the child at the center of his or her social universe. As astronomy matured as a science, humanity realized it was not at the center of the physical universe, and

as individual humans mature, they realize they are not at the center of their social universe. A general principle in the life sciences is that ontology recapitulates phylogeny (i.e., the growth of the individual retraces the growth of the species), but in this case phylogeny (as in the growth of astronomical science) also recapitulates ontogeny (the growth of the individual human); the decline in egocentrism with maturation of the individual has been paralleled by a decline in anthropocentrism with maturation of astronomical science.

The anthropic cosmological principle

Even though Western science removed humanity from the center of the universe, remnants of an anthropocentrism in which humanity plays an important role in the universe may be seen in the anthropic cosmological principle (Barrow & Tipler, 1986). In its strong form, the anthropic cosmological principle suggests the universe must have those properties that allow intelligent life to come into being. In one view, this is trivial, because if the universe had different properties, we would not be here to observe the universe, and the fact that we are here suggests the universe is not otherwise. However, in another view, the anthropic cosmological principle is profound, because if other universes were possible, then why does our universe exhibit the particular properties that it does? Only one implication will be noted here: the anthropic cosmological principle suggests a role for humans in the universe, and in a strong form, suggests that human nature is an important determining factor of the properties of the universe. Although such an implication is consistent with an interpretation of quantum physics in which observers "collapse the waveform" and observation by a conscious human defines which reality out of an infinite number of simultaneously present possibilities is manifested, such an interpretation is controversial. It is not clear how idealism at the level of the quantum relates to realism at the levels of humans, planets, stars, and galaxies.

We are star-stuff

The removal of humanity from the center of the universe does not mean humans do not have pro-

found connections with the celestial realm; indeed, recent discoveries suggest that humans are connected to the universe in fundamental and intimate ways. Spectrographic studies suggest that even the most distant of stars, dust clouds, and nebulae are comprised of familiar chemical elements found on Earth. Indeed, many elements found on Earth (e.g., carbon, gold, iron) were forged long ago within the furnaces of ancient stars, and were then distributed throughout the cosmos in supernovae explosions. Our physical bodies contain molecules from ancient suns, and as Sagan (1985, p. 256) eloquently pointed out, “we are made of star-stuff.” Interstellar space is filled with organic molecules, and some astronomers suggested such molecules seeded or fertilized life on our own planet. At least some of the water in Earth’s oceans is thought to have originated in comets that struck our planet in its infancy. The origins of humanity, both mythological and chemical, may have lain in the stars and other elements of the celestial realm; human nature, as well as the nature of all life on Earth, is inextricably linked to the celestial realm. Although Kant’s philosophical analyses suggested to him that human minds contained an a priori understanding of space, recent findings and theories in astronomy suggest that mind, life, and the universe may be even more tightly coupled than Kant claimed, and related in ways Kant never imagined.

Human nature and extraterrestrial intelligence

If the atoms and molecules of our bodies and of our planet were forged in distant stars, and if life on Earth arose from the operation of physical and chemical processes that operate in the same way across the breadth of the observable universe, then it is possible that life might also have arisen elsewhere. Life on Earth evolved a species capable of human-level intelligence and civilization, and so it is possible that life on some extraterrestrial planet could have similarly evolved a species to an equivalent (or perhaps greater) level of intelligence and civilization. In recent decades the search for extraterrestrial intelligence (SETI) has searched the skies for signs of such extraterrestrial civiliza-

tions, but thus far the way in which humanity has approached issues regarding extraterrestrial life and the search for extraterrestrial life provides more insight into human nature than into whether or not extraterrestrial civilizations exist.

Conceptions of extraterrestrials

Extraterrestrials are often portrayed in the popular media as bipedal organisms similar to humans. Although some of this is probably due to budgetary and time constraints of television and movie production, it might also reflect how humans think about extraterrestrial beings. When asked to sketch a “space alien,” most people rearrange or modify elements they are already familiar with (e.g., add an eye, antennae, ridges on the forehead, etc.), and such sketches usually contain a recognizable head, arms, torso, eyes, ears, etc. similar to those of the human form (Ward, 1991). However, the human form is the result of millions of events over millions of years of evolution, and humans could appear radically different if evolutionary history on Earth had unfolded differently. On probabilistic grounds, an intelligent species that evolved elsewhere would appear very different from humans (Dobzhansky, 1972; but see Swords, 1995), and yet we imagine intelligent extraterrestrial beings to be rather humanlike. An extraterrestrial very similar in appearance to humans might also seem more comprehensible (i.e., more likely to have similar mental and emotional experiences) and less threatening or frightening than would an extraterrestrial very different in appearance from humans. In general, humans are remarkably anthropocentric in their notions of how extraterrestrials could appear or think (Baird, 1987).

What we perceive and what we imagine

Our physical senses perceive only a small portion of the potentially available information. For example, our eyes perceive as visible light electromagnetic radiation between approximately 380-760 nanometers in wavelength. This is a very small portion of the electromagnetic spectrum, and we might be sensitive to these specific wavelengths only because they are the wavelengths of solar radiation that are most effective in penetrating Earth’s

atmosphere. Thus, the nature of human visual experience was determined by the constraints of the planet upon which humans evolved. The universe might appear very different to intelligent beings that evolved in a different environment and whose “visual” experience encompassed a different set of wavelengths. Indeed, one of the surprises of contemporary astronomy is how different the universe can appear if “viewed” using different wavelengths. For example, radio waves penetrate the dust cloud between Earth and the galactic core, but visible light does not; thus, the Milky Way galaxy “looks” very different in radio astronomy and in visible light astronomy. Even within terrestrial environments, there are other animals with very different sensory systems (for a survey, see Hughes, 1999), and so how much more different might the sensory systems of an extraterrestrial species that evolved in a very different environment be?

Philosophers have argued that humans might not be able to imagine what the subjective experience of an organism with a vastly different sensory system would be like. In the most famous example, Nagel (1974) argued that because humans did not navigate by radar or have sensory receptors that responded to spatial information in echoic reflections, humans could not understand the experience of what it was like to be a bat (although humans could certainly describe the functioning of bat radar at an abstract or verbal level). Similarly, it could be argued that if the perceptual experience of an extraterrestrial was radically different from the perceptual experience of a human (and such differences might be implied by differences in the anatomy and physiology of the sensory receptors of extraterrestrials and of humans), then humans could not understand the subjective experience of what it would be like to be that extraterrestrial. Although an inability to understand subjective experience does not preclude an abstract or verbal description, explanation, or prediction, it may limit understanding (Hubbard, 1996). If humans could not imagine what it is like to be an extraterrestrial that has very different subjective experiences, then how could humans understand extraterrestrial nature and understand how extraterrestrial nature might relate to human nature?

Human nature and extraterrestrial nature

Although humans might eventually gain some scientific or descriptive knowledge of the body structures of an extraterrestrial, could such knowledge help humans to understand the subjective experience of that extraterrestrial? This question is reminiscent of a long-standing issue within philosophy regarding the relationship between mental (i.e., subjective) experience and the physical body and referred to as the *mind-body problem* (for reviews, see Churchland, 1988; Warner & Szubka, 1994). The ultimate resolution of the mind-body problem will profoundly influence our understanding not just of human nature, but also of extraterrestrials and the relationship between human nature and extraterrestrial nature. Although the standard reading of Kant’s question with which this article opened focused on the *physics of bodies* in the celestial realm, a broader reading which includes the relationship between humans and extraterrestrials focuses on the *psychology of beings* in the celestial realm. How can we know with any certainty that the beliefs, desires, and mental states experienced by humans here will be similar to the beliefs, desires, and mental states experienced by extraterrestrials out there? Would an extraterrestrial have the same subjective experiences and mental states as a human? Perhaps ironically, consideration of extraterrestrial nature may shed light on one of the most debated issues regarding human nature, the mind-body problem.

Only the two most relevant potential resolutions of the mind-body problem will be considered here. In *identity theory*, subjective experiences are simply the functioning of physiology (e.g., pain is the firing of C-fibers). The only way an extraterrestrial could have the same subjective experiences as a human would be if that extraterrestrial was made of the same materials (e.g., carbon, water) in the same concentrations as are humans. To the extent that an extraterrestrial was made of different materials or of the same materials in different concentrations, its subjective experience would be different from that of a human, and humans would be less likely to understand the mental states of that extraterrestrial. In *functionalism*, relationships between mental states, sensory inputs, and motor outputs are more relevant

than are the specific materials in which those relationships are instantiated (e.g., pain is a pattern of activity within a network of processors). To the extent that an extraterrestrial exhibited relationships between mental states, sensory inputs, and motor outputs similar to those of a human, its subjective experience would be similar to that of a human, and humans would be more likely to understand the mental states of that extraterrestrial. Interestingly, philosophers who support functionalism and oppose identity theory invoke the possibility of humanlike mental states in a nonneural-based or noncarbon-based extraterrestrial as a demonstration of the alleged falsity of identity theory (e.g., Lewis, 1980; Putnam, 1975).

Receiving a message

Understanding the mental states and subjective experiences of extraterrestrials is relevant to detecting, deciphering, and interpreting any message from an extraterrestrial civilization. Given current scientific understanding and technical ability, the fastest and the cheapest method for communicating across interstellar distances is to transmit a signal using electromagnetic radiation (e.g., radio waves), and it is generally assumed that any extraterrestrial civilization near our level of scientific understanding and technological ability would be similarly limited. If an extraterrestrial civilization wanted their radio signal to be detected by another civilization, which frequency would they use? The frequencies typically chosen in SETI are within the “microwave window” containing radio emission lines of hydrogen and the hydroxyl radical (which are components of water). However, the choice of these frequencies may reflect the importance of water to humanity and the idiosyncrasies of Earth’s atmosphere rather than any characteristics or criteria important to an extraterrestrial civilization (see Klein, 1990). Because humans consider those frequencies as the logical choice, it is assumed that an extraterrestrial civilization would consider those frequencies as the logical choice as well.

If a message from an extraterrestrial civilization is received, humanity would face the daunting task of trying to decipher or interpret that message. Humans conceptualize and categorize the world in

highly specific ways (e.g., Rosch & Lloyd, 1978) dependent upon their experience and their biology, and across human cultures there are wide variations in category structures (e.g., Lakoff, 1987, discusses an Australian aboriginal language in which a single category contains the elements of women, fire, and dangerous things). How large might differences between the category structures of humans and the category structures of an extraterrestrial species that evolved under vastly different environments and circumstances be? Our conceptual and category structures have served humanity reasonably well, but it is not obvious that those structures are the only (or even the best) ones that could have been evolved. Would an intelligent and technological species that evolved elsewhere have similar categories and concepts? If not, would there still be sufficient overlap with human categories and concepts to allow comprehensible communication between humanity and that species to occur? Without a sufficient similarity in conceptual and category structures, deciphering or interpreting any message would be extremely difficult (see Baird, 1987).

Responding to a message

If humanity responded to a message from an extraterrestrial source, what should we say? Actually, humanity has inadvertently already been saying a great deal to potential extraterrestrial listeners, as our radio and television broadcasts radiate outward from Earth. An extraterrestrial civilization with a sufficiently sensitive receiver could even now be watching original broadcasts of the 1936 Olympic Games, *I Love Lucy*, or the original *Star Trek*, among the millions of other programs that have been broadcast. Such “leakage” signals are presumably quite different from a message explicitly designed for the purpose of communicating with an extraterrestrial civilization. The first attempts to explicitly design messages for contact with an extraterrestrial civilization involved plaques attached to the Pioneer and Voyager spacecraft launched in the 1970s and the radio message transmitted from Arecibo toward the M13 globular cluster in 1974. These messages included information about who we are and where we are (e.g., pictures of a man and woman, a map of our solar system, etc.), and

it is assumed that any extraterrestrial civilization sophisticated enough to receive the message would also understand our pictorial conventions and be able to determine how to access the message (e.g., would understand how to use the stylus and the record album attached to the Voyager probes).

Assuming difficulties with deciphering and interpreting messages can be solved, and this is by no means assured, the vastness of interstellar distances would result in any sustained dialogue based on radio (or other electromagnetic) communication taking centuries to unfold. We should therefore choose our topics of conversation wisely. Scientists involved with SETI see science as important, and so usually suggest scientific information should be the first kind of information exchanged between humans and an extraterrestrial civilization. Although an exchange of scientific information might be useful in establishing a common ground for further communication, we might ultimately learn more from a dialog with an extraterrestrial civilization if the dialog focused on differences between our civilizations. It may be in the social sciences and the “humanities” that the greatest differences between humans and extraterrestrials occur, and from discussion of which we could learn the most. After all, humanity is the only clear example of a technological and language-using civilization we have, but it is difficult to understand general principles with a sample size of one. If we asked the right questions, contact with an extraterrestrial civilization could significantly deepen our understanding of human nature, about who and what we are.

Conclusions

Kant asked “how is it that in this space, here, we can make judgments that we know with apodictic certainty will be valid in space, there?” but rather than appealing to a separate a priori knowledge as suggested by Kant, perhaps we simply respond on the basis of the predispositions and biases of human nature. If so, then judgments of a distant space such as the celestial realm might reveal some of the predispositions and biases of human nature. Many human cultures divided the multitude of stars in the night sky into a small number of constellations,

and this reflects a tendency to impose structure and organization on otherwise random stimuli. Many human cultures attributed a variety of properties, behaviors, and abilities to objects in the celestial realm, and this reflects a tendency to impose meaning and attributions on otherwise ambiguous stimuli. Many human cultures exploited the perceived regularity and order of the celestial realms in the development of a more accurate calendar, long-range navigation, agriculture, and possibly astrology, and this reflects a need for predictability. The tendencies to impose structure, organization, meaning, and the need for predictability, may all reflect fundamental aspects of human nature. Also, the celestial realms provide a rich source of metaphor for many human cultures, and this may reflect a general metaphorical nature or structure of thought.

Early human cultures viewed the celestial realm in mythic terms, and mythologies regarding human origin and destination after death often involved descent from or ascent to a celestial realm. The celestial realm has long been conceived of as a place of power and as the dwelling place of gods and immortals, and even today those who visit that realm gain in power, knowledge, and stature. The demythologizing of the celestial realm by developments in astronomy and cosmology greatly influenced views of human nature and of the place of humanity in the universe, but views regarding the possible nature of beings who originate in or come from the celestial realm may still reflect mythic or archetypal elements of human nature as well as a general anthropocentrism. In general, how we explain celestial phenomena in the absence of direct feedback, and how we conceive of extraterrestrial intelligence prior to encountering a message or representative from an extraterrestrial civilization, might tell us more about human nature than about celestial phenomenon or where or how to look for extraterrestrials. Although discussion of Kant’s question usually focuses on physical laws, implications of Kant’s question for psychological laws may ultimately be more important. In looking at the celestial realm, we see more than distant points of light. In gazing at the most distant reaches of space, we encounter the most intimate parts of our human nature.

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