Exoplanets and Astrotheology

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SWEDENBORG AND THE PLURALITY OF WORLDS: ASTROTHEOLOGY IN THE EIGHTEENTH CENTURY

by David Dunér

Abstract. The possible existence of extraterrestrial life led in the eighteenth century to a heated debate on the unique status of the human being and of Christianity. One of those who discussed the new scientific worldview and its implications for theology was the Swedish natural philosopher and theologian Emanuel Swedenborg. This article discusses Swedenborg's astrotheological transformation, his use of theological arguments in his early cosmology, and his cosmogony that later on ended up in his use of contemporary natural philosophy in his theology, especially concerning the question of the plurality of worlds. I will first sketch the astrotheology found in his natural philosophical works, and then turn to the astrotheology of his later spiritual teachings. In Swedenborg's works we find teleological arguments and a stress on the universality of the divine creation and Christianity, as well as anthropomorphic descriptions of extraterrestrial life. By reconciling contemporary astronomical ideas, among others the concept of the plurality of worlds, with Christian dogmas, Swedenborg refuted deistic conclusions that Jesus was merely a mortal, while at the same time keeping his belief in the modern astronomical worldview.

Keywords: astrotheology; eighteenth century; extraterrestrial life debate; history of astrobiology; history of astronomy; physicotheology; plurality of worlds; Emanuel Swedenborg; teleology

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Astrotheology and the Plurality of Worlds

The extraterrestrial life debate, or the plurality of worlds debate, intensified in the seventeenth and eighteenth centuries (Dick 1982, 1996; Guthke 1983; Crowe 1986, 2008; Brake 2006; Dunér 2012, 2013a, 2013e; see also Michael Crowe's article in this section [2016]). With the new heliocentric system, Earth had become a planet like the others and no longer the center of the universe. With the invention of the telescope, topographical features on the moon were revealed similar to those on Earth. Added to these explanations and observations, the discoveries of new worlds overseas led to cultural encounters with foreign ways of life. The possible existence of life unrelated to our own Earthly, European culture, led also to a heated debate on the unique status of the human being and of Christianity. When rejecting Christianity was not an option, philosophers and theologians had to either deny the existence of other worlds or reconcile the idea with Christian dogmas (Dick 2009, 175 f.). One of those who discussed the new scientific worldview and its implications for theology was the Swedish natural philosopher and theologian Emanuel Swedenborg. In his works, as I will show in this article, there is a transition of ideas from natural philosophy to theology, arriving at an eighteenth-century astrotheology, informed by contemporary natural philosophy, that tried to solve those questions raised by the extraterrestrial life debate.

The theological and existential implications of the new astronomical worldview are well-known. When Nicolaus Copernicus showed in 1543, in his *De revolutionibus orbium coelestium*, that Earth did not need to be considered the center of the universe any longer, the human being, during this transition from a geocentric to a heliocentric worldview, also lost the central position in the divine creation. The planets became Earths. When Galilei (1610) aimed his telescope at the moon in 1609 and found it a rough globe resembling our own planet's topography of mountains and plains, then Earth lost its unique status as the only habitable planet in our solar system. If we find other worlds with similar topographical features as Earth, why could not these planets also harbor life? Earth seemed not to have any unique characteristics that we cannot find elsewhere in the universe. Our planet became a planet amongst others. These astronomical observations, along with geographical discoveries of foreign countries and nations on Earth, gave material for a genre of space travel stories that blended scientific knowledge with a fictional grip that stretched the imagination to the extreme. It was very much a utopian, satirical genre. The moon travels were a way of telling about other possible ways of living, a critique of the mundane, political world in which we live. The stories of travels to other worlds by Francis Godwin, John Wilkins, Athanasius Kircher, Savinien de Cyrano de Bergerac, Samuel Brown, Ludvig Holberg, and François-Marie Arouet (better known as Voltaire) are examples. But there were also others

who claimed that they, literally, had been there themselves. One of those space travellers was Swedenborg.

In the extraterrestrial life debate of the seventeenth and eighteenth centuries, our closest celestial body, the moon, was the prime candidate for life on other worlds. However, a number of natural philosophers and scholars also speculated about life on other planets, both within our solar system and beyond its frontiers, for example on Venus (Dunér 2013e) and Jupiter. One of the most famous and popular accounts defending the plurality of worlds, also read by Swedenborg, is Bernard Le Bovier de Fontenelle's book *Entretiens sur la pluralité des mondes* (1686), which consists of six evening discussions on the plurality of worlds between a philosopher and an aristocratic lady in the gardens of a country chateau. Perhaps, wonders the philosopher, there are astronomers on Jupiter; and perhaps we cause them to engage in scientific quarrels, so that some Jovian philosophers must defend themselves when they put forward the ludicrous opinion that we exist. Their telescopes are directed towards us, as ours are towards them; "that mutual curiosity, with which the inhabitants of these Planets consider each other, and demand the one of the other, *What world is that? What people inhabit it?*" (Fontenelle 1686; 1702 trans, 93). Another prominent natural philosopher, Christiaan Huygens, expresses in *Cosmotheoros* (1698) his thoughts about extraterrestrial life, and believed that life on other planets is similar to what we find on Earth. He notes that liquid water is necessary for life, and he thought he saw darker and lighter spots on the surfaces of Mars and Jupiter, which must be understood as water and ice. Beyond our solar system there are stars of the same sort as our Sun—and why, he asks, would not they, in turn, have their own planets and moons? Huygens's extraterrestrials are in many ways just like Earthlings, they have mathematics, astronomy and music, similar intellect and moral conceptions.

Some natural philosophers even speculated about the intelligence of these extraterrestrials. The philosopher Immanuel Kant—who had, as we will see, a complicated relation to Swedenborg's spiritual teachings—wrote in *Allgemeine Naturgeschichte und Theorie des Himmels* (1755) that the intelligence of the extraterrestrials becomes "more excellent and perfect in proportion to the distances of their habitats from the sun." The Mercurians and Venusians are according to Kant less intelligent than Earthlings who are exactly in the middle. The Jovians and Saturnians are superior beings. Kant wrote: "From one side we saw thinking creatures among whom a man from Greenland or a Hottentot would be a Newton, and on the other side some others would admire him as [if he were] an ape" (Kant 1755, 189 f.; Crowe 1986, 52 f.). Interestingly, here Kant actually discusses how the body functions of humans are a result of their location in the solar system, and also how this location and their bodies affect their minds and their ability to think.

There was also a lively extraterrestrial life debate in Swedenborg's native country. In the 1740s, two dissertations were defended in Uppsala with the astronomy professor Anders Celsius chairing the proceedings, of which one refuted the idea of a habitable moon, while the other defended the idea of the plurality of worlds (Celsius 1740; 1743). Of more relevance for Swedenborg was an account of moon travel written by the inventor Christopher Polhem (1954) with whom Swedenborg collaborated closely for a couple of years. Polhem's *Nyia tiender uthur månan* ("News from the Moon") from the 1710s tells about a Sami who travels to the moon (Dunér 2013b). A Sami had been engaged by some learned men in Uppsala to use wings to fly in the air, but after several unsuccessful flight attempts, another Sami, who was a magician, suggested another way of travelling to the moon. With the help of his magic drum, he could travel there. After spending seven months on the moon, while learning the language of the Lunarians, he returned to Earth and told about everything he had seen and heard on the moon.

Natural philosophy and theology were intertwined in the seventeenth- and eighteenth-century plurality of worlds debate. God's providence upheld the laws of nature, and the wonderful ingenuity and diversity in nature indicated that there is a clever divine watchmaker behind the creation. But the very possibility of life on other planets raised a number of theological problems. Is humankind unique in the universe? Are aliens like us, or of higher or lower intelligence and morality? And how does the idea of habitable worlds fit into God's plan with his creation? The idea that there could be life on other planets became more accepted by philosophers and theologians. In the Middle Ages, because of the dominance of Aristotelian philosophy, it had been impossible; such ideas became now not just a possibility, but a probability, due to the new cosmology, new observations and interpretations. If this idea raised serious objections in the early seventeenth century because it seemed to be contrary to Christian truths, it could in the eighteenth century rather support the belief in an omnipotent creator. Common arguments against the existence of other worlds had been that it would lead to a questioning of the uniqueness of the human being and its central position in God's creation. And what would happen with Christ's death on the cross? Did our Jesus die also for the sins of the extraterrestrials, or are there a countless number of Jesuses out there in space who died on their crosses? And had all these inhabited worlds their Adams, their apples of Eves, their snakes? Or did Jesus the redeemer hop, as Thomas Paine asked, from one world to another in an endless succession of death? (Paine 1794; Dick 2009, 176; see Michael Crowe's article in this section [2016]).

In the eighteenth century, however, many natural philosophers and theologians came to defend a physico-theological view that the wonderful and astonishing order and efficiency we can see in nature, the countless life forms we can find on Earth, show that there must be an omnipotent and

infinitely wise Creator. According to the physico-theologists, there were good arguments that life must exist on other planets. The all-powerful Creator must have filled the entire universe with life, and he could not have left all stars and planets as an immense empty, barren desert. One of the most famous promoters of such a physico-theological interpretation was the English theologian William Derham, who in his book on astrotheology from 1713 (translated into Swedish in 1735) argued that the stars and planets indicated the existence of an ingenious creator. The stunning mechanics of the starry sky tells us about a divine watchmaker who had created everything according to a certain pre-established plan. Derham believed that moon was inhabited, and there were many inhabited solar systems and planets besides our own. Our Earth is just a point compared to the entire universe. And for this little point we fight with fire and sword. By citing Seneca, Derham (1715, 235; Seneca, *Naturales quaestiones*, 1, praef. 8, 11) points out how ridiculous this is, when "above there are vast spaces, to whose possession the Mind is admitted."

Probably one of the most original and curious contributions to the debate concerning the plurality of worlds in the eighteenth century was a work that, without the slightest irony, provided a sincere account of its author's encounters with extraterrestrials. In 1758a, the Swedish spiritual visionary Emanuel Swedenborg published a book that described his encounters with extraterrestrial spirits, which he entitled *De telluribus in mundo nostro solari* (Goerwitz 1985; Acton 1996; Bedford 2006). Swedenborg did not only say that extraterrestrial life might exist, or that his travels among inhabited worlds were like being in the grip of a utopian novel; he in fact claimed that he had met these extraterrestrial beings and talked to them in person. In this article, I will show that Swedenborg's belief in extraterrestrial life, however seemingly strange, rests on his work as a natural philosopher and various scientific beliefs that were circulating during his time. I will, to begin with, sketch his astrotheology that could be found in his natural philosophical works, where he puts forward a number of ideas—such as the astrodynamics of the solar system, the micro-macrocosmic analogy, and the creation of the natural world—and his endeavor to reconcile the words of the Bible with contemporary natural philosophical theories, that are important for understanding his later theological treatment of the question of the plurality of worlds in *De telluribus*. We will follow Swedenborg's astrotheological transformation chronologically, but first I need to introduce the main figure of this article and put his works and teachings in a biographical and intellectual context.

Swedenborg—Natural Philosopher and Theologian

Emanuel Swedenborg (1688–1772) was a Swedish natural philosopher and assessor of mines, who later became an original Bible exegete, spirit-seer,

and theologian. As a natural philosopher with Cartesian and Wolffian inclinations, he wrote a number of books on mathematics, matter theory, metallurgy, astronomy, anatomy, and physiology (Crasta 1999; Jonsson 1999; Dunér 2013c, 2013d; Schaffer 2014). In the mid-1740s he underwent a religious conversion. He found his natural philosophical aspirations as insufficient, partially failed, and fruitless. He abandoned his scientific work and went on travelling in his dreams to a totally different world, to a spiritual, immaterial world. He claimed that he had discovered the correspondence between the natural and spiritual meaning in the Bible, or as he said, he had received the key to the inner message of the Bible. His novel interpretation of the Bible rests on his correspondence doctrine, that is, that every physical thing corresponds to an intellectual or moral sense as well as a theological or divine truth. For example, the creation story is not really about the creation of the Earth but of man's own rebirth and maturation, where the six days of creation correspond to six spiritual states.

Swedenborg received the knowledge of these correspondences, as he says, under the guidance of the Lord, through his travels in the spiritual world and his conversations with spirits and angels. With his internal vision, he could see into the afterlife. During sleep, but also during dormant states in the middle of the day, he travelled in his dreams to the world of spirits and angels. The spiritual world is a kind of gathering place for the souls of the dead, from where they then, after a time, travel on to either heaven or hell. But Swedenborg's heaven and hell are not places, but spiritual states. The universe as a whole appears like a gigantic man, where the little man is a miniature of The Greatest Man, *Maximus Homo*. Each body part of the human body corresponds with similar parts of the greatest man, but also to various spiritual meanings. His first major theological work was a commentary on Genesis and Exodus, *Arcana Coelestia* (1749–1756) in eight volumes. This work, which reveals the heavenly secrets hidden in the word of the Bible, summarizes the major elements of his theological thinking. All his theological works—a total of eighteen were published during his life—were written in Latin and printed in Amsterdam and London. In the summer of 1758 he published no less than five books, including the work of the Earths in our solar system, *De telluribus in mundo nostri solari* (1758b), where he tells us about his conversations with spirits from the other planets in our solar system, but also in other planetary systems in the universe.

Swedenborg's clairvoyant abilities made him famous in eighteenth-century Europe. Immanuel Kant mentions a story when Swedenborg saw in his inner mind a fire taking place far away in Stockholm. Kant wrote even a whole book about Swedenborg, *Träume eines Geistersehers* (1766), where he heads out into a bitter tirade against the spirit seer's dreams and describes him as a swindler and liar, and that everything he wrote had its origin in the pure fantasy of a sick mind. Subsequent research, however, has

tried to show that Kant's view of Swedenborg was more complicated, that Swedenborg in fact had an impact on Kant's critical turn (Florschütz 1992; Stengel 2008). Swedenborg's teachings were controversial in Germany. The theologian Johann August Ernesti attacked Swedenborg's spiritual interpretation of the Bible, while the theologian and philosopher Friedrich Christoph Oetinger, in turn, defended him (Hanegraaff 2007). Oetinger also published Swedenborg's *De telluribus* in German in 1770, 1771, and 1776, *Von den Erdcörpern der Planeten und des gestirnten Himmels Einwohnern* (Stengel 2011, 422 f.). In his *Beurtheilungen* (1771, 50), Oetinger concluded that Swedenborg's speculations concerning extraterrestrials, with no doubt, had taken up ideas from Huygens's *Cosmotheoros*.

Swedenborg's contrast-rich life, a life that took him from natural philosophy to theology, from rationalism to mysticism, from mathematics to spirit-seeing, has puzzled many scholars (Benz 1948; Toksvig 1948; Sigstedt 1952; Bergmann and Zwink 1988; Brock 1988; Larsen 1988; Lawrence 1995; Wilkinson 1996; Hallengren 1998; Bergquist 2005; Stengel 2011; Grandin 2013). From being a natural philosopher of the mechanistic school, he turned to what may be perceived as the antithesis of rational, natural science: a deeply religious worldview with the idea of an immaterial spiritual world, where everything tends towards the spiritual and the divine. Friedrich von Schelling wrote that in Swedenborg's teachings "the loveliest comfort, the most devout poetry, the most brilliant depth of thought carry on a strange and wonderful war with abstract dogmatism and poor mathematics" (Horn [1954] 1997, 32). Despite Swedenborg's seemingly contradictory course of life, recent research has shown a clear relationship between the former natural philosopher Swedenborg and the latter theologian Swedenborg (Lamm [1915] 2000; Jonsson 1999; Dunér 2013c).

The Cosmic Cycle

In order to explain how Swedenborg as theologian and spiritual seer could assume the existence of intelligent life on other planets, we need to trace these ideas back to his natural philosophical works. His conception of spirits from other worlds is dependent on his natural philosophical theories developed during the 1710s to the 1730s. In his very first works on astrodynamics in the late 1710s, we find a dependence on classical ideas about the divine circle, and the heliocentric worldview explained in Cartesian terms. One could especially note his endeavor to reconcile the statements of the Bible with the contemporary heliocentric worldview.

Stars, suns, planets and moons are recurring themes in Swedenborg's natural philosophy, poetics, and theology, stretching from a small poem of the year 1700 to his latest travels in the universe of the spiritual world.

Swedenborg's astronomical studies of the celestial movements are connected to the seasons, times and ages, navigation on the seas, and the creation of the solar system. It is a universe of spiral motions, whirls, and micro-macrocosmic correspondences (Dunér 2002). Time is a cosmic cycle, through the orbit of the Earth around the Sun, with the seasons repeated in a circle, or the peregrinations of the heavenly bodies, the annual tasks in the fields, the ebb and flow of the sea, the course of rain and rivers, the stages of life and regeneration. The preacher in Ecclesiastes starts with the vanity of the eternal, meaningless cycle, as generations come and go, the Sun rises and sets, the wind goes towards the south and turns to the north. All rivers run into the sea, yet the sea never becomes full. There is nothing new under the Sun.

There is a longing for immobility in the classical worldview with its spherical celestial bodies in circular movements. Swedenborg develops it into a world of spiral bubbles in spiral motion and whirling spheres, constantly in movement. Swedenborg followed René Descartes in the tracks of his vortical theory. Aristotelian natural philosophy had been forced to concede, with its circles and its crystalline, concentric spheres representing an immutable, eternal celestial order, in contrast to the notion of rectilinear movement upwards or downwards that dominated under the moon, on the imperfect, mutable Earth, as it was put forward in the physics of Aristotle (*Physikēs* [1980], 8.8.261b27–262a12; *Peri ouranou* [1986], 1.2.268b15–26). Swedenborg adopted Cartesian vortices, a whirling movement that applies both above and below the moon, to the biggest and the smallest alike. But he does not let go of the idea of a perfect order established by an infinite geometrician. The world is a reflection of perfect figures. The doctrine of the perfection of the circle lived on as an important basis of his thought, immortalized as a spiral.

The whole of Swedenborg's mechanistic natural philosophy actually seeks to provide purely mechanical explanations such as pressure and motion in a continuum. Occult forces working at a distance, thus also Isaac Newton's theory of gravity, had no explanatory value. What heaven has to say is merely that God is an omnipotent and omniscient Creator. Swedenborg had distanced himself from the kind of interpretations embraced by his father, the Bishop Jesper Swedberg, who read more concrete messages into the sudden celestial phenomena. Swedberg wrote to the priest he had sent to the Christina congregation in Pennsylvania, Andreas Hesselius, to tell of "the dreadful and terrible *celestial sign*" that had been seen on the night of March 6, 1716. Hesselius replied that this "would be like *the gleaming of swords with their points facing down*, and many quickly moving and unusual flashes. May God let it not mean something evil!" (Swedberg 1941, 345; [1732] 1985, 85 f.; Schück 1918, 111). Swedenborg did not believe in augury; stars and comets are not portents of coming

misfortunes but, as we will see next, astronomy has an explanatory value for interpreting some problematic statements of the Old Testament.

The Age of the Antediluvians

Everything is perishable, nothing lasts forever. "Since this is the case with Earthly things, one can well conclude as to things superterrestrial, and that even there everything progresses toward a goal and a [state of] rest," wrote Swedenborg in 1717 in *En ny theorie om jordens afstannande* ("A New Theory about the Retardation of the Earth") (1717; *Opera* III [1907–1911], 271; *Collectanea physica-mathematica*, no. 34; *Photolith* I [1869–1870], 28–65; trans., 43). In this manuscript he puts forward a number of reasons for his opinion that the Earth has been moving increasingly slowly since the beginning. Ether causes a resistance in the Earth's orbit, and air in the motion around the axis, which makes the years and the days longer and longer. He bases this on an analogical thinking: there are similarities between the mechanics of the universe and the tools of man. The Earth rolls and spins on her axis or her central pole, as when one takes a ball and throws it into the water, when a point on a wheel rotates around its axis or the spindle on a spinning wheel. Another reason why the movement around the axis must have been faster in the past can be detected in the roundness of the Earth. The irregularities have been rubbed off and subsided in spherical form. "If one takes a lump of clay and rolls it around its axis in water, it is formed into an oval" (*Opera* III [1907–1911], 272 f.; trans., 45). For Swedenborg, then, in contrast to a Newtonian explanation, the Earth is oval owing to the resistance of the medium.

There is also written evidence, according to Swedenborg, for the theory that the world is slowing down, as when the Bible and classical poets talk of an eternal spring in primeval times. When the year and the days were shorter, the antediluvians, those who lived before the Deluge, could reach an age of 700–800 years. So Methusalah's 969 years actually correspond to only 121⅛ of our years. Perhaps with the support of Johan Peringskiöld's genealogical tables in King Charles XII's Swedish Bible, Swedenborg calculated that in the time from Adam to the Deluge, the age of the antediluvians had decreased by 100 years in 1,656 years. If the Earth had not been flooded, it would now have had an age of 18,212 years.

Around 1718–1719 he wrote two other versions about the motion and position of the Earth. In the first version, in manuscript, *En ny mening om jordens och planeternas gång och stånd eller några bewis at jorden löper alt sachtare och sachtare: at winter och sommar, dagar och dygn til tiden blifwa lengre och lengre in til werldsens sista tid* (1718), he puts forward "a new opinion about the motion and position of the Earth and the planets or some proof that the Earth is moving more and more slowly: that winter

and summer, days and nights are becoming longer and longer until the end of the world." The increasing distance of the Earth from the Sun has made it poorer and less fertile. But this has not been noticed, and no wonder, for "we have not been aware that our Earth rotates like a ball each day: indeed our vision often deceives us in small matters; one does not notice that the ship is moving forward or backward." If one sails around the Earth one does not know that one has travelled in a circle, if one does not return to the same place again or finds that one has lost a day. "Behold, thus are we deceived by the light of our own senses, and are blind with them, and believe an untruth to be true" (Swedenborg, *Opera* III [1907–1911], 285, cf. 303). We therefore cannot trust our senses. It requires reason and geometry for Swedenborg to make us truly able to see.

Swedenborg published his theory in 1719 in *Om jordenes och planeternas gång och stånd* ("On Motion and Position of the Earth and the Planets"). A theory about the origin of the Earth from chaos ought to follow geometry and be compared with the opinions of Descartes and Newton. But that would be beyond the scope of the present work, he says. Instead he puts forward a number of reasons for the deceasing speed of the Earth based on arguments in a Rudbeckian tradition in which, according to the Swedish physician and historian Olof Rudbeck the Elder, ancient myths have something to say, notably that the lost Atlantis actually refers to Sweden in old times. Rudbeck can explain, he writes, why Canaan and the golden land can be compared "with our mountains and iron-cliffs, its bright and delightful summer with our chilly and cloudy winter" (Swedenborg, *Opera* III [1907–1911], 301). God's word, Ovid, and other pagan poets such as Homer, the "True Grandfather of Poets," and Plato's Atlantis tell us that the Earth once had "a glorious air, a constant spring, a golden age, an Eden and Paradise, an Earth inhabited by *Atlas*" (Swedenborg, *Opera* III [1907–1911], 306, cf. 287; Homer 1995, *The Odyssey* I, 7.112–132). There was a heaven here on Earth. Life flourished in the eternal spring.

Methusalah's abnormal age is due to the fact that the Earth used to move faster. He lived as long we do now, but he experienced more summers and winters. With the decreasing speed of the Earth's orbital rotation, the generations after us will regard 20 or 30 years as a high age. Swedenborg is thinking in a variant of the old idea of *mundus senescens*, the ageing Earth. Our globe would age and die like a human being (Dunér 2015). In the past there was a golden age, according to the myth related by Ovid (*Metamorphoseon* 1984, 1.89–150) and Hesiod (*Erga kai emerai*; 2006, trans., 117–120), but now we have descended into a poor age of copper, iron, and clay. Invoking the support of Rudbeck's *Atlantica* (1679–1702), as well as Samuel Pufendorf, he seeks to show that Sweden was once a marvelously abundant land, like a Canaan, Savoy, or Italy, like a Florence or Mantua (Swedenborg, *Opera* III [1907–1911], 312, cf. 293). Swedenborg's theory is also able to explain why the great island of America

is inhabited. During the eternal spring, when the air was still and mild, as in the month of April in today's Sweden, the first inhabitants walked across Lapland and Greenland to America. Then winter spread itself over the world. Physical experiments could demonstrate that the thesis was correct, as when one rotates a thermometer slowly over a fire, the alcohol rises, but with greater speed to a smaller peak (cf. Swedenborg, *De cultu* [1745], n. 17, note i; *Principia* [1734], 447; trans., II, 359 f.). Another experiment can be performed with the vibrations of the pendulum. Just as an ordinary cart wheel makes as many revolutions during a mile regardless of whether one is travelling fast or slow, there are always 365 days in a terrestrial year irrespective of the speed of the Earth's orbital rotation. In the printed version there were no illustrations to explain the experiments, but in a copy once owned by Swedenborg's cousin Johan Moræus and then by his son-in-law Carl Linnaeus, Swedenborg's own drawings are appended (Linnaeus's copy of Swedenborg's *Om jordenes och planeternas gång och stånd*, pp. 24/25, in Linnean Society, London). In his childhood Linnaeus had been amazed that the early ancestors lived to such an age, but Swedenborg's theory explained everything to him (Linnaeus 1958, *Diæta naturalis*, 17).

What the Bible says about the signs that will precede the last days is compatible with the retardation of the Earth, with reference to the description of the destruction of Jerusalem in Luke 21:25: "And there shall be signs in the sun, and in the moon, and in the stars; and upon the Earth distress of nations, with perplexity; the sea and the waves roaring." The Earth will be destroyed, Swedenborg warns, the human race will dry up, barrenness and famine will spread. There will be signs visible in Sun and moon, in air and sea, "*dreadful eclipses shall come*, causing the peoples anxiety and fright," stars shall fall down, "The sea and the wave shall roar" with storms and rain (*Opera* III [1907–1911], 319, cf. 296). This could be interpreted as showing that Swedenborg at this time read the Bible literally, not embracing a doctrine of correspondences with levels of meaning, and that he believed the creation, the age of the antediluvians, Noah's flood, and doomsday to be real events. He transfers the particular history in the Bible to a universal history. To understand the hidden mechanism of the solar system he uses physical and biblical examples.

Of special significance for Swedenborg's cosmogony and geogony was Thomas Burnet's theory of the mundane egg in *Telluris theoria sacra* (Burnet 1694), which was in his library (*Opera* III [1907–1911], 297, 319 f.; Jonsson 1999, 27). In a notebook started in the 1710s he made annotations about Burnet's cosmogonic world egg alongside data from David Gregory's astronomy about the distance of the planets from the Sun, and something about Johannes Kepler's theory and the hypotheses of Epicurus, Descartes, and Leibniz (Swedenborg, *Anatomica et physiologica*, 165–186; Burnet 1694, II, ch. X, 137–140; Burnet 1697, II, ch. VIII, 184 f.;

Gregory 1726). The surface of the Earth, according to Burnet, was perfectly smooth, regular, and uniform before the deluge, without mountains or oceans. The Earth arose from chaos, a fluid mass in which everything was mingled in confusion. Heavier matter sank towards the middle, while lighter matter swam up. The oilier and lighter substances were separated from the heavier ones, floating on the surface, like cream and milk, oil and water (Burnet 1694, I, ch. V, 21; 1697, I, ch. V, 38). Chaos and the idea of the cosmos are based on the conceptual pair of cognitive dialectics, that cosmos presupposes chaos, that order presupposes disorder. The order that we have must come from disorder.

Swedenborg's theory of the slowing Earth is linked not only to Burnet, but also to Polhem and Newton's *Principia*. What is most obvious, however, is that he proceeds from the Cartesian vortices. Since all particles in Descartes' vortex theory seek to move in straight lines, this means that the stronger or heavier particles will describe the largest circles. There is thus a centrifugal force, as mathematically studied by Huygens. According to Descartes, an orbit arises through a balance between the planet's centrifugal tendency and an opposite pressure from matter in the vortex. Centrifugal and centripetal forces can thus explain planetary orbits. In other words, the spiral path of the Earth is due to its centrifugal force being greater than the opposite force of the ether. The idea of the retarding motion of the Earth, with a spiral path proceeding from the Sun, was something that Swedenborg had read and transcribed several times from Polhem. One of Polhem's favorite examples, which he varied countless times in order to illustrate the centripetal and centrifugal forces of the planets in the solar vortex, is an experiment with a sphere that is rotated under water (*Dædalus Hyperboreus* I, 7; Polhem 1941–1946, 8–11, 13, 24, 90, 118 f.). Polhem may have derived the inspiration for this experiment from his teacher Rudbeck the Elder, who had just devised a model to describe the movement of the heavenly bodies by revolving a globe in water (Spole 1686).

In November 1719 Swedenborg heard rumors in the capital that the Earth had come 25,000 Swedish miles (about 166,000 English miles) closer to the Sun (Swedenborg, *Opera* I [1907–1911], 290 f.; *Letters* I [1948–1955], 214 f.). He was amazed that such a jump could take place in just a year or two, and he seriously doubted the statement. He told his brother-in-law, the university librarian Eric Benzelius the Younger, he thought it was unreasonable. Moreover, the claim was in opposition to his own theories. This gave him occasion to comment on the motion and position of the Earth. The stronger the movement and rotation in the solar vortex, the further the planets are thrown out from the center, but a weaker movement causes them to be drawn inwards. "And it is well known in what proportion the *vis centrifuga*, in traveling outward and inward, increases according to the speed. Of this, Isaac Newton treats in his *Principia*." Swedenborg read Newton with Cartesian eyes, reading vortices into the

theory of gravitation. He had probably read a section in Newton's *Principia* (1687, II, sect. IV, prop. XV, theorem XII) about the circular motion of bodies in resistant media, where Newton demonstrated that if the force of gravitation varies in inverse proportion to the cube of the distance, instead of to the square, then the planets would not follow an elliptical orbit, but would be hurled away out from the Sun in a logarithmic spiral course.

There is no risk yet that the Earth will be swallowed up by the Sun, Swedenborg assures us: "If the sun grows larger and larger before our eyes, then first would be the time to entertain fear because of it, and to commend oneself to God's hands" (Swedenborg, *Opera* I [1907–1911], 293; *Letters* I [1948–1955], 220). Benzelius also wondered about another thing he had read, namely, a statement that the abode of the damned is in the Sun (Benzelius had been reading *Neue Zeitungen von gelehrten Sachen*, 2 August 1719; *Letters* I [1948–1955], 218 f.). "I think just the opposite," Swedenborg replied. The Sun is, if anything, the abode of the blessed. For it is at the center of our planetary system, in which all vortical movements have their origin. It has the most splendid light and magnificence, whereas darkness and terrors are furthest away from it. The Sun consists of the most subtle particles,

> almost devoid of composition, and so put off the denomination of matter, and also of form, weight, and many other properties possessed by compound particles. And it would also seem likely that in this finest, must be the finest essences. A God, an angel, a thing which, moreover, has nothing *materiale* in its being. (Swedenborg 1907–1911, 294)

Swedenborg is led towards the idea of God and the Sun being brought together in his assurance "God has his seat in the sun" (Swedenborg, *Opera* I [1907–1911], 294; *Letters* I [1948–1955], 220 f.).

Swedenborg could thus explain gravitation in mechanical terms, as did Polhem and other philosophers trained in Cartesian natural philosophy, as being dependent on the pressure of the atmosphere or the "ether." In *Miscellanea observata* (1722) Swedenborg expresses this equilibrium in terms of heavier bodies falling downwards and lighter ones rising. This Cartesian understanding of gravity becomes odd when he concludes his reasoning by referring to an authority—Newton, the "star of the learned world" (Swedenborg, *Miscellanea* [1722], 160; trans., 100). Swedenborg did not read Newton's Newton, but rather Newton with a Cartesian preunderstanding. One contemporary reviewer points out that Swedenborg must be a very special admirer of Newton, since it cannot be unknown to him how little value Newton attached to concocted physical theories based solely on the discoverer's own fantasies (*Historie der Gelehrsamkeit unserer Zeiten* 1722, 315–327; trans., *The New Philosophy* 2003, 565). It is not permissible for a natural philosopher merely to create things from his own brain.

Life in the Sidereal Heaven

So far, we can conclude that Swedenborg put a rather strong effort during the 1710s on trying to reconcile the teachings of the Bible with the observations and theories of contemporary natural philosophy. Turning to his major work from 1734, I will focus on three propositions concerning the cosmology and cosmogony of the universe, which later will turn up as fundamental for his astrotheology and theological treatment of the question of inhabited planets elsewhere in the universe, that is, (1) the plurality of worlds; (2) the micro-macrocosmic analogy; and (3) the evolution of the solar system.

In Swedenborg's work on the principles of natural things, *Principia rerum naturalium* (1734), he put forward an all-encompassing theory of the universe, how the world developed from the first mathematical points, through increasingly complex combinations of active and finite particles and elementary particles of higher and higher order, to the creation of the solar system—from the spiral motions of the microcosmic matter to the vortices of the macrocosm. If the least thing, he says, is perfectly geometrical, this also applies to the greatest. In the mechanical order of the world, man is between the smallest and the largest, for his senses register things that are equally far from nature's two extremes (Swedenborg, *Principia* [1734], 375 f.; trans. II, 229 f.). Man is amazed both by what he sees and by what he does not see. Wherever he turns his eyes he is struck with wonder, one extreme surprise above his senses, the other under him. Since nature remains the same in the greatest and the least, from what we see and feel we can arrive through reason and analysis at a knowledge of what we neither see nor feel.

The magnet and its sphere are an image of heaven, a world system in miniature. In the magnetic sphere there are spiral gyrations or vortices, and in the same way there are also spiral gyrations and vortices in the sidereal heavens. Around the Earth there is a whirl in spiral motion, where the Earth is like a core, a child in the arms of its nurse. The spiral motion forms an ecliptic and poles with conical apertures through which elements can flow in and out, like a current from south pole to north pole in spirals. "Let the mind thus soar into the vast regions of the universe . . . , enjoy the wonders of the heavens above." The whole visible firmament is a single huge sphere. Beyond our solar system, the countless stars form vortices as our own Sun does. But, Swedenborg adds, the firmament that we see is perhaps only one of an uncountable number of spheres or sidereal heavens in the finite universe, and between these universes there may be connections as between two magnetic spheres; "and that the whole visible sidereal heaven is perhaps but a point in respect to the universe." There are probably countless immense spheres or heavens like ours. But all these spheres together are not even a point in comparison with the infinite,

just as our visible firmament is merely a point in comparison with the finite universe. We ask ourselves then: What is man?

> Proud Vain-glorious mortal, why so inflated with self-importance? Why deem all the rest of creation beneath thee? Diminutive worm! What makes thee so big, so puffed out with pride, when thou beholdest a creation so multitudinous—so stupendous around thee? Look downward upon thyself, thou puny manikin! behold and see how small a speck thou art in the system of heaven and Earth; and in thy contemplations remember this, that if thou wouldest be great, thy greatness must consist in this—in learning to adore Him who is Himself the Greatest and the Infinite. (*Principia* [1734], 311, 376 f., 380; trans., II, 145, 231, 234, 238)

After this physico-theological exclamation Swedenborg turns to the diversities of worlds: "How many myriads of heavens may there not be! How many myriads of mundane systems!" Astronomers are totally misled in their calculations of the number of the planets. In an argument of plenitude, he comes to the conclusion that life might exist out there, resembling our contemporary arguments of probability. The Earths in the universe may have animal kingdoms like ours, but need not be inhabited by exactly the same kind of living creatures. The perfection of the world consists in its very variation, its mutability, and the ability to give rise to increasingly complex things. Descend into Tartarus and Pluto's regions (in other words, mines or caves) and you will not find one thing like any other. "Look abroad on the vegetable kingdom; how varied is it! how pleasing, how delightful because of this variation!" Swedenborg (*Principia* [1734], 381–383; trans., II, 240–243) exclaims. Walk through groves and woods and see how everything is pregnant. If anything were missing, the world would not be as perfect, a piece would be missing in the order, a link in the chain. The perfection of the world is in proportion to larger alternations, changes, and temporary properties that collaborate in shaping it. The world is more perfect and beautiful in its composite, connected things than in its simple, separate parts, and in greater and freer motion than in a more limited motion. Perfection, Swedenborg had noted from Christian von Wolff's *Ontologia* (1730) around 1733–1734, is unity in variation, or the diversity of the fluctuation of differences in unity (Swedenborg, *Varia philosophica*, 325; Wolff 1730, § 503).

In every world system, however, the principles of geometry and mechanics remain the same. The dissimilarities or variations consist merely of differences in series, degrees, proportions, and figures. But the mechanics can actually differ in different worlds, since the external circumstances diverge, with different proportions, events, and degrees. Swedenborg actually acknowledges that varying physical environments affect the bodily nature of living creatures. If air and ether, or something similar, were to be found there, they would not display the same tremulations, and one would therefore see and hear differently. Our sensory organs, which are

adapted to our world, would perhaps not even be able to receive these undulations. Machines in a different world would be constructed according to other rules and be applied according to other mechanical forces. The very symbol of inventiveness and the combination of mechanics and mathematics, the ingenious Archimedes who said that he could displace the world, would realize its limitations. Archimedes' name had a special symbolic value. In the scientific journal *Dædalus Hyperboreus* (Swedenborg 1716-1718, I, intro., cf. II, 25; VI, 1), which Swedenborg edited, he assigned to Polhem this epithet when he called him "our Swedish Archimedes." If the ancient Archimedes were moved to a different world, he would lower his voice at the realization that his genius and skill would be valueless, as if vanished, in a world with proportions and figures totally different from what we find on our globe. The Infinite, God, can vary creation in infinitely many ways, and consequently He can also vary geometry and mechanics to infinity (Swedenborg, *Principia* [1734], 384 f.; trans., II, 246 f.).

Macrocosm and Microcosm

In Swedenborg's *Principia* (1734), we find an analogical-metaphorical thinking, for example, between the Earth and the magnet, between the vortices of the solar system and the spiral motions of mathematical points. This metaphorical thinking constitutes his later developed theory of correspondences, a theory that is fundamental for the theology of the *De telluribus* (1758b).

In the analogy between the Earth and the magnet, Swedenborg was inspired by William Gilbert's *De magnete* (1600), which he had used frequently in his manuscript with the same name (Swedenborg, *Principia* [1734], 376; trans., II, 231). Gilbert regards the Earth as a large magnet, or conversely the magnet as a small Earth. On the sure foundation of geometry, Gilbert (1600; trans., xlviii) says, the ingenious mind can rise above the ether. Since the sphere is the most perfect form, the shape of our own globe, it is also the best form for experiments. Magnetic demonstrations should therefore be performed with a globular magnet. To this round stone Gilbert (1600; trans., 23 f., 66 f., 330–332) gives the name "Microgē" or "Terella," that is, Earthkin, a little Earth. Gilbert's is a typically analogical mode of thought, alternately understanding the Earth and the magnet in terms of analogies. The magnet has the same properties as the globe, such as attraction, polarity, and orbiting. The circular motion of the magnet shows that the whole of our Earth is also moving in a daily circular motion. All the movements of the magnet are in harmony with and controlled by geometry and the shape of the Earth. Gilbert takes this analogical thinking to extremes when he assumes that the whole world, the globes, all the stars are alive, animate. Why should not the stars have souls, if worms,

ants, roaches, plants, and morels have? Thales, of whom Aristotle speaks, says that the magnet is alive as a part of the living mother Earth and her beloved offspring (Gilbert 1600; trans., 309–312). Earlier in *De magnete* (1722–1729; trans., 237), Swedenborg too had described the magnet as being animate according to Thales, but in a passage taken from Pliny.

Swedenborg's comparison between the magnetic sphere and the sidereal heaven rests on the analogy between microcosm and macrocosm. It is not always possible to refer to any particular source or a necessary dependence on a reading of other thinkers, such as Aristotle, Paracelsus, or someone else; Swedenborg is, to a great extent, proceeding from the human ability to think in metaphors. With metaphorical thinking I mean in line with contemporary cognitive semantics, as represented by George Lakoff, Mark Johnson, and others (Lakoff & Johnson 1980; Lakoff 1990; Lakoff & Johnson 1999; Lakoff & Núñez 2000). Our basic concepts do not function beyond our everyday experiences. To conceptualize non-everyday phenomena or abstract thoughts requires conceptual metaphors. Metaphor can then mean understanding and experiencing something with the aid of something else, or that a structure in one domain is transferred to another, from a source (the sensorimotor domain) to a target (subjective experience) which simultaneously preserves the deductive structure. In philosophical analysis and scientific theory formation, metaphors play an important part. Philosophical and scientific texts are more or less, as in the case of Swedenborg, strewn with conceptual metaphors, analogies, metonymies, similes, and comparisons (Crombie 1994; Spranzi 2004; Dunér 2013c). Scientific reasoning, in other words, uses metaphors to a great extent as conceptual tools or as theoretical models of the external world.

The idea of microcosm and macrocosm could be understood as metaphorical thinking, as a notion of infinite analogies, metaphors, correspondences between different levels in existence. The classical expression of this agreement between large and small, above and below, could be found by Swedenborg in a book that he owned, *Die gantz neue eröffnete Pforte zu dem chymischen Kleinod* (Anon. 1728, 17). It is the Emerald Tablet of Hermes Trismegistus: "that which is below is as that which is above, and that which is above is as that which is below." The micro-macrocosmic idea is a metaphor that constantly produces and generates new metaphors, for example, gold below corresponds to the Sun above, and the Sun corresponds to God the Father, and so on to new metaphors. As in heaven, so on Earth. However, "the world machine" became the central metaphor in the natural philosophy of the seventeenth and eighteenth centuries, a basic metaphor that generated new metaphors, particularly spatial, visual, and orientational ones, finding similarities between the artificial mechanics of humans and the natural mechanics of God.

The Creation of the Solar System

Another difficulty for astrotheology is how to explain and reconcile the Mosaic creation myth with modern natural philosophy. In the beginning was chaos. Light and dark, hard and soft were buried together in a raw, disordered mass. From this chaotic mass, Swedenborg explains in *Principia* (1734, 388–390; trans., II, 254–257), everything issued like a child from the womb. Thought chooses the least difficult path, as a wanderer in the darkness gropes his way in the direction with the fewest obstacles, and follows the path without seeing it. He touches different objects without knowing what they are, and finally reaches his destination without knowing how he got there. In the same way the ancient philosophers succeeded in reaching the rational stance on chaos. Aristophanes (*Ornithes* 1989, 691–695) wrote about chaos and the black-winged night laying a wind-egg; Ovid (*Metamorphoseon* 1984, 1.5–9) spoke of a confused, formless chaos without life, without sea, without Earth or sky. Moses agreed: "And the Earth was without form and void; and darkness was upon the face of the deep. And the spirit of God moved upon the face of the waters" (Genesis 1:2). I was there, says "Wisdom" in the book of Proverbs 8:27, when God set a compass upon the face of the depth.

In our nearest macrocosmic vortex, the solar system, the Sun is the world egg, the seed from which the planets are born. This recalls Burnet's theory of the world egg, but it could also be understood as a general metaphorical thought that could be found in various ancient creation myths. The egg stands for something living, for vitality, a symbolic beginning, something that develops from a point to full-grown body. It is a seed, an onion, a point. Creation takes a different course for Swedenborg. The planets are not extinguished stars, sucked into the vortex of the Sun, as in Descartes. Instead the Sun gives birth to its satellites, bringing them forth in a successively arising whirling movement. Swedenborg's nebular hypothesis, as it has been claimed, thus anticipates the theory put forward more than two decades later by Kant and Pierre-Simon de Laplace. But it could be questioned, since Swedenborg did not rest his explanation on Newtonian physics, as Kant and Laplace did. According to Swedenborg, the Sun rests in the center, surrounded by particles in a vortical movement (Figure 1). On the inside of the vortex the elementary particles are compressed to finites of the fourth order. They increase in number and form a crust around the Sun, which shuts out the sunlight. This crustaceous matter rotates around the Sun, and because of the centrifugal force it moves further and further away from the Sun. The vortices of space are like those in our own visible world, as when water whirls around a center and continues to do so even after the first impulse has ended. The crust continues its movement around the Sun, not unlike effluvia circulating around a magnet. The huge crust and the enclosed Sun are like an elementary particle with an active core and

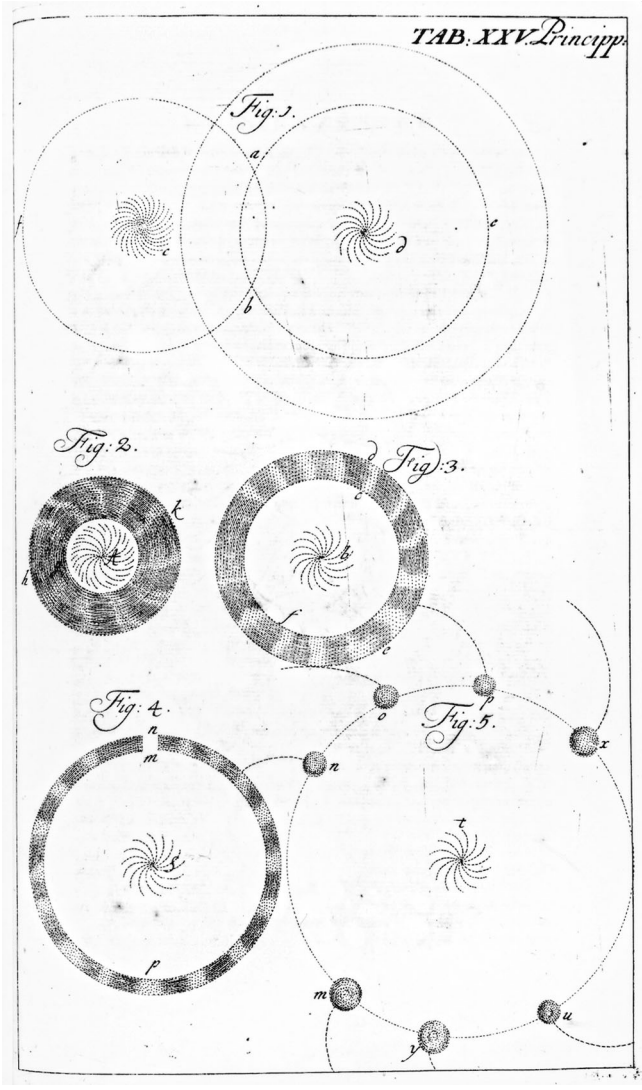

Figure 1. The vortex of the Sun. The Sun, *A*, with a surrounding crust, *kh*, of fourth finites (2). The crust, *cdef*, expands (3). The crust expands further more and burst at *mn* (4). Seven spherical bodies, *mnopruy*, are thrown out in spirals from the solar vortex, *t* (5). Swedenborg, *Principia rerum naturalium* (1734).

finite particles around it, like images of each other. In its outward journey, in larger and larger circles, as a geometrical consequence the crust becomes thinner and thinner and finally bursts. The debris left by the explosion falls in a belt that revolves around the Sun in increasingly large circles, until it

thins out and finally explodes once again. The blasted mass of matter sticks together and forms round globes or spheres of matter of the fourth finites, that is to say, the planets and satellites of the solar vortex.

The planets move away in spirals from the Sun until they achieve balance with the solar vortex and enter their final circular orbit. For a long time the Sun was covered by darkness, heaven was in the shade, obscured by pitch-black clouds with the rays imprisoned behind the crust. Each planet is like a large finite particle with the same movements. They differ only in degrees and dimensions. The parts resemble the whole and the whole the parts. On a large scale one can see what happens on a small scale, in the visible part of the material world what happens in the invisible part, in the whole machine what happens in the model. If nature "is invisible you seek her in the visible world, she will never disappoint you, but there present herself as visible before you. Thus will she never elude the eye, nor hide herself within mysterious shrines, but ever be most intimately present, and perpetually about and around both yourself and your senses" (Swedenborg, *Principia* [1734], 397, 403, 412; trans., II, 273 f., 285, 301).

The Earth lies naked, uniform, in an azure, sky-blue tone. No air, no rosy light of dawn, no dew or clouds exist through which Iris with her saffron wings can show her multicolored rainbows, no forests, no green, violet, red shades over the fields, no shimmer of metals—not a living creature. Swedenborg's natural philosophy is combined with mythology. The god Jupiter is the ether and Juno the air. Nature is reborn from herself as the phoenix rising from the ashes. Nature takes place in an eternal circle. From death comes life, from the funeral pyre comes resurrection. The Earth itself also forms a vortex like a big magnet, wholly in harmony with the large solar vortex. Under the spiral journey it was at first naked, but was then covered with ether, then air, and finally water. A crust formed over the watery surface of the Earth. It was an eternal spring. Years and days were shorter when the Earth was closer to the Sun and rotating at a greater speed. The inhabitants of Mercury and Venus likewise counted more summers and years than we do. And if the antediluvians were to appear to us they would be astounded at our short springs and long autumns and winters (Swedenborg, *Principia* [1734], 410 f., 423, 440, 445, 447; trans., II, 300, 321, 347, 355, 358 f.).

The Worlds in Space

These natural philosophical assumptions and theories mentioned above must be kept in mind in order to fully understand the scientific-philosophical basis for his theological assertion of inhabited planets elsewhere in the universe. After the publication of *Principia* (Swedenborg 1734) astronomy never became for Swedenborg the subject of closer theoretical study, but he would many times return to the vast universe, to the

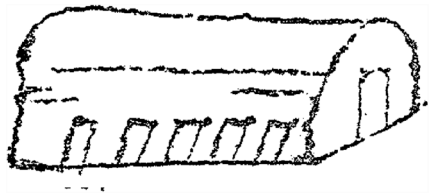

Figure 2. A dwelling on a planet in another solar system. Swedenborg, *The Spiritual Diary* (1843–1846, 355; see also 223).

indefinite space, to the creation of our world, to the inhabited planets of our solar system and beyond. The same year he published *Principia*, he also published a work on the infinite, *De infinito* (1734). Here he talks about a finite universe that it has limits, is immensely vast, but not infinite—only God could be infinite. In his poetic drama of creation in the hexaemeron tradition, *De cultu et amore Dei* (1745), Swedenborg recapitulates the cosmogony from *Principia*, how the Sun gives birth to the planets and how they move from the Sun in spirals (Jonsson 2004).

In his explorations of the spiritual world Swedenborg also discovered inhabited planets in our solar system and beyond. He travelled in his dreams to the planets of the spiritual world through varying inner mental states, which appeared to him like journeys in space. The inhabited planets of the spiritual world "are not spatially remote as in the natural world, but only appear to be so, depending on the state of life of their spirits and inhabitants. By state of life I mean the state of their affections as regards love and faith" (*De telluribus* [1758b], n. 135). The encounters with these extraterrestrial spirits first appear in his *Diarum spirituale*, the Spiritual Diary (also called Spiritual Experiences [1843–1846]; see e.g., n. 460, 519), from the late 1740s (Figure 2). These extraterrestrial encounters changed his theological writing. After two weeks of conversation with spirits of Jupiter, in January 1748 he began referring to God, not as previously "God Messiah," but as "the Lord" (Bedford 2006, 334). The travel notes were then included in his Heavenly Secrets, *Arcana Coelestia*, in the volumes published in 1753, 1754, and 1756. He collected finally all notes in 1758b to a book on the Earths in our solar system and beyond, *De telluribus in mundo nostro solari*. Even in Swedenborg's book on heaven and hell, *De coelo et ejus mirabilibus, et de inferno* (1758a), from the same year, the idea of the plurality of worlds appears.

In *Arcana Coelestia* (n. 9237) Swedenborg makes a grand claim, an anthropomorphic and teleological argument of inhabited worlds: "Where a terrestrial body exists, so does the human being; for the human being is the end for the sake of which a terrestrial body exists, and the Supreme Being has created nothing without that end in view." In *De telluribus* [1758b], he advanced his theological arguments for the existence of extraterrestrials,

in conversations with spirits, that there is more than one world in the universe, based on the fact that the starry sky is so immense and contains countless stars, each one a sun with its own planetary system. But the planets and stars have a more important purpose than merely to rotate and to shine. The planets visible to our eyes, he says, can be plainly recognized as worlds, bodies made of Earthly matter that reflect sunlight, mottled with dark patches like land masses on Earth, revolving around the Sun, and rotating about their axes like our Earth. "Can anyone knowing this and able to think rationally still claim that these are empty masses?" (*De telluribus* [1758b], n. 3). All this immense structure serves the ultimate purpose of creation, that is, "the establishment of a heavenly kingdom in which the Deity can dwell with angels and human beings" (n. 4).

The human race, Swedenborg says, "does not come from only one world, but from countless worlds" (*De telluribus* [1758b], n. 2). There is a certain anthropomorphism in his astrotheology. The extraterrestrials are no doubt humans, even though they can differ in proportion, anatomy, and mentality. He combines the idea of a plurality of worlds with his doctrine of the Grand Man, that is, the whole heaven is in the form of a single human being. The Mercurians have a great memory of abstract ideas, and surpass others in knowledge both in matters within the solar system and in the starry sky beyond it (n. 11, 14). They are travellers through the universe and know about systems and worlds outside our solar system. They said to Swedenborg "that the universe contains very many worlds inhabited by human beings," and went on saying that "they knew of the existence of more than several hundred thousand worlds in the universe" (n. 26). Some spirits of Mercury came to visit a certain spirit from Earth, famous for his learning, namely the philosopher Christian von Wolff. But they were not impressed. His speaking did not raise above sense-impressions of the natural man, and he just thought about his own reputation. Swedenborg also heard a conversation between two spirits; one of them was Aristotle. To his surprise Aristotle approached his right ear and spoke there, hoarsely, but sensibly. They discussed the science of analysis, and Swedenborg said of him "that a small boy could say more philosophically, analytically and logically in half an hour than Aristotle had been able to say in a book" (n. 38). Swedenborg had probably Aristotle's *Prior* and *Posterior Analytics* in mind.

The spirits of Jupiter were much wiser than those of our world. They said that Earthlings talk too much and think to little. And when Swedenborg wanted to tell them that we, in our world, have wars, plundering and murders, "they turned their backs, and refused to listen" (*De telluribus* [1758b], n. 49). To them Earthlings were external men. The Martians, according to Swedenborg, are instead among the best of our solar system, like celestial men. The spirits of Saturn live in a world with nocturnal illumination coming from the great ring and the satellites of their planet,

but they do not see it as a ring, only as a whiteness in the sky. They do not bother much about food and clothing, because they all know that they will live on after death. For the same reason "they do not bury the bodies of the dead, but throw them out, covering them with branches from the trees of the forest" (n. 103). Those Venusians living on the side facing our Earth are fierce, almost like wild animals, and take great pleasure in stealing, and particularly in eating what they had stolen (n. 108). They are giants—people of our world only come up to their navel—and stupid, do not ask what heaven is or everlasting life, just care about their lands and their flock. The inhabitants of the moon are small as boys, in the height of a boy of seven, but with stronger bodies.

That Swedenborg believes in the existence of humanoid lifeforms on the other planets in our solar system is not so surprising if one considers what many other contemporary natural philosophers assumed, such as Fontenelle, Huygens, and Kant. There was some scientific evidence that could support a belief in extraterrestrial life, even though there also was, as Michael Crowe shows in detail in his article in this section (2016), scientific evidence that made it unlikely. Swedenborg did not bother about Newton's inverse square law for gravitation, and henceforth presumed the existence of humanoid lifeforms of comparatively similar size on planets of very different mass, such as Mercury and Jupiter. Perhaps more interesting is that he also avows that there are habitable planets orbiting other stars in our universe.

Swedenborg also tells about his conversations with spirits from five different extra-solar planets. It is well known in the learned world, he says, that each star is a sun, and therefore it follows that they, like our Sun, have their planets. However, these "are invisible to our eyes because of their immense distance, and because they shine only with light reflected from their own star, which again cannot reach us here" (*De telluribus* [1758b], n. 126). And these planets are peopled with humans, which is the purpose of God's creation of the universe. Swedenborg then calculates the total number of human beings or spirits in the universe. If there were a million worlds in the universe, and three hundred million human beings in each world, and two hundred generations in six thousand years, and each human being or spirit were given a space of three cubic meters, then when all this was added together, they would still not occupy a thousandth part of the volume of this world, but perhaps the volume of one of the satellites of Jupiter or Saturn. These calculations predate those of the Scottish church minister and science teacher Thomas Dick, who in 1848 tried to estimate the number of inhabitants on the planets of our solar system by comparing their magnitude with the population of our globe (Dick 1848, 135 f.; see Michael Crowe's article in this section [2016]). If the planets were populated as densely as England, at a rate of 280 inhabitants to a square mile, we find that Venus would have 53.5 billion people, and Jupiter, the

most populated planet, would have 6,967 billion; in total with all the planets, satellites, asteroids and the rings of Saturn, there would be 21,894 billion people in our solar system. Anyhow, according to Swedenborg, a belief shared by the angels, the human race is of a small size compared with the infinite size of the Creator. There would still be room enough for humans to live forever without filling up the uninhabited regions. The heaven surrounding our world is so small in comparison that "it would not equal one hundred millionth part of the uninhabited space" (n. 168).

After travelling through a great gap Swedenborg came to the first world in the starry sky, and his sight was opened and he could see that world itself:

> There were many meadows to be seen, and woods with leafy trees, as well as sheep with woolly fleeces. Later I saw a few of the inhabitants; they were of the lower classes, dressed in very much the same kind of costume as peasants in Europe. I also saw a gentleman with his lady; she had a fine figure and behaved becomingly. So did the man; but I was surprised to see he had a lordly, almost haughty, walk. The lady, however, walked humbly. The angels told me that this is the custom in that world, and that such men are loved because they are none the less good. I was further told that they are not allowed to have more than one wife, because this is against their laws. (*De telluribus* [1758b], n. 134).

The travel to the second planet in the starry sky took two days. That world contained meadows, flower gardens, and woods full of fruit-bearing trees, lakes with fish, blue-colored birds with golden feathers, and small animals with raised backs like camels in our world. The inhabitants did not live in houses, but instead making roofs among the leaves in the woodlands to shelter from rain and the heat of the Sun (*De telluribus* [1758b], n. 144). To spirits of a third extra-solar planet he told that the writings could be printed, so that whole groups of people could read and understand them. And they became very surprised "to hear of the existence of such a technique, which is wholly unknown elsewhere" (n. 155). On another extra-solar planet, the fourth, a small planet with a circumference of 3,320 miles and with a year consisting of 200 days and a day of 15 hours, he saw fields turning white with a ripe crop resembling Chinese rice, grassy plains with flowers, trees with fruits like pomegranates, and shrubs which bore berries from which they prepared wine (n. 166 f.). The inhabitants of the fifth extra-solar planet lived in low wooden constructions, walked about naked, and did not feel ashamed of their nakedness (n. 176). Because their year was equivalent to just 75 days of our Earth they lived in a perpetual spring and summertime where the fields blossom and the trees bear fruit all the year round. This seems to be in line with what Swedenborg previously had concluded in his studies of the retardations of Earth in the 1710s.

Swedenborg explains why the Lord chose to be born on our Earth and not on another planet (*De telluribus* [1758b], n. 113–122). The most important cause was for the sake of the Word, which could be written and circulated in our world, and thus could be preserved for all posterity, because the art of writing has existed on Earth since ancient times, first on tablets, then on parchment and paper, and finally disseminated in print. On Earth the Word could be circulated because terrestrial humans are in contact and able to travel around to every part of the globe. As Crowe (1986, 199 f.) has noticed, Swedenborg gives here Christ's communicative function primacy over his redemptive role. On our Earth, Swedenborg explained to spirits from an extra-solar planet in the starry sky, there are remarkable sciences and arts that are unparalleled anywhere else in the universe,

> such as astronomy, geometry, mechanics, physics, chemistry, medicine, optics, philosophy. I went on to mention techniques unknown elsewhere, such as ship-building, the casting of metals, writing on paper, the diffusion of writings by printing, thus allowing communication with other people in the world, and the preservation for posterity of written material for thousands of years. I told them that this had happened with the Word given by the Lord, so that there was a revelation permanently operating in our world. (*De telluribus* [1758b], n. 136).

With the aid of printing, people can pass on and store their thoughts and inventions for thousands of years, to future generations, to new creatures on Earth. Among the immense numbers of stars and planets in the vast universe there is only one globe where the art of writing is known. Only there can sciences, mathematics, and philosophy be found. Earth is the most advanced technological civilization in the universe, with stunning communicative skills unknown elsewhere. That is why Jesus chose to be born on Earth.

Conclusion: An Astrotheology of Plurality of Worlds

As a natural philosopher, Swedenborg pondered the history and evolution of the solar system from an entirely mechanistic standpoint. However, he also tried to reconcile these astrodynamic theories with what were considered biblical truths, or rather, he utilized certain statements in the Old Testament in order to give support to his rationalistic, mechanistic theories of nature. In his early astrodynamic attempts concerning the retardation of the Earth, he asserted that these theories, besides being in line with contemporary Cartesian natural philosophy, also could explain the extraordinary life span of the antediluvians. In his prime work on the principles of natural things, the *Principia* of 1734, he put forward a nebular hypothesis of the evolution of our solar system. God became the prime mover. In the creation of the world, God implanted motion in the mathematical point, or more

exactly an effort, *conatus*, at motion (*Principia* [1734], 33; trans., I, 57). All that comes after—matter, the solar system, the stars and planets—follow the inevitable geometrical, mechanical laws of nature. And he finds it very likely that this immense universe could contain numerous other habitable worlds.

Basically, we find the same arguments for plurality of worlds in Swedenborg's theological writings: the argument from plenitude, that God cannot have left the stars and planets barren and lifeless; that there is a certain teleology imbedded in nature, a purpose to fill the universe with life; and a physico-theology acclaiming the admirable works of the Creator. His firm scientific standpoint, in line with the natural philosophy of his time, challenged, however, some Christian dogmas. Swedenborg tried to reconcile them. He defended the idea of a prime mover, an infinite being that transcends the finite world of matter, and asserted that there is only one Christ, a redeemer who chose to be born on our Earth. In his *De telluribus*, we find teleological arguments, a stress on the universality of the divine creation and Christianity, the universality of God's presence and purpose, as well as anthropomorphic descriptions of extraterrestrial life. God's salvation is not Earth-specific; the Lord is the Redeemer of the entire universe. By reconciling the natural philosophy of his time, including the concept of the plurality of worlds, with Christian dogmas, Swedenborg avoided deistic conclusions that Jesus was merely a mortal, but at the same time he could keep his belief in that modern astronomical worldview he seems never to have abandoned.

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