

## Introduction

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Fontenelle's *Entretiens sur la pluralité des mondes* or *Conversations on the Plurality of Worlds* became an instant best-seller three hundred years ago. But the author, introducing these ideas for the first time to a broad public, courted danger when he wrote his pioneering work in 1686. Less than a century earlier, in 1600, Giordano Bruno had been burned at the stake for, among other offenses, desecriling the Earth by suggesting the possibility of multiple inhabited worlds in the universe. Only fifty years before Fontenelle wrote, Galileo had lost his freedom and had been placed under permanent house arrest for writing on daring astronomical theories. So while much of Fontenelle sounds matter-of-fact to us—his talk of a boundless universe, his speculations on intelligent extraterrestrial and extragalactic life, his discussion of space travel—we have to remember that publishing his book three centuries ago was very risky business. The ideas he was bandying about were bold, controversial, even forbidden. As they had been scarcely known to the average reader before he explained and disseminated them, these astonishing ideas suddenly became the rage. Since its first appearance in French, there have been approximately one hundred editions of the *Entretiens*. It has been translated into English, Danish, Dutch, German, Greek, Italian, Polish, Russian, Spanish, and Swedish. Thus there is a very real sense in which Fontenelle's work

spread the word, encouraged the curiosity, and created the international audience that this subject still enjoys today.

But why were these cosmological ideas once dangerous? To be properly persuaded that writers expounded on this subject at immense personal cost, or at least at great risk, we have to familiarize ourselves with the scientific theories and climate of Fontenelle's day. Then we will be better able to understand how the notions in his book threatened received wisdom on the subject.

The prevailing view of the universe, since the days of Aristotle and Ptolemy, was that Earth stood at the center of a relatively small, bounded, finite world, with the Moon, the Sun, and all the other planets and stars spinning about it. The sublunar region, composed of the four "elements," earth, air, fire and water, obeyed one set of physical laws, while the Moon, Sun, and planets, made of a different, immutable material and embedded in crystalline spheres, proceeded in combinations of circular motion, obeying a different physics. This gave humankind a very special position, as the noblest creatures in the central spot, around which the celestial bodies and the very heavens revolved. During the Middle Ages, this pagan view of the universe had needed to be reconciled with the teachings of the Church, a job accomplished by the great intellectual synthesis called Scholasticism, and especially by the writings of Thomas Aquinas. Once Aristotle's cosmology had thus been rendered acceptable, the Church endorsed this picture wholeheartedly, as it made Earth the apple of God's eye, a fitting stage on which the human drama of salvation could be played out. From the astronomical point of view this cosmology had its problems; observations of the skies revealed anomalies—we know now that they are due to Earth's motion—which did not fit neatly into the scheme. For example, the planets, watched from Earth, seemed to slow down, stop, and even go backward, a difficult thing to explain if nature moved in putatively orderly circles. But the appeal of this view of the world had become so great on theological and philosophical grounds that for centuries such objections were overruled, and were even mathematically accommodated in increasingly complex diagrams of the heavens constructed to "save the phenomena."

In 1543, Nicholas Copernicus published his *On the Revolutions of the Heavenly Spheres*, a huge, ponderous Latin tome that exploded the Ptolemaic world view, suggesting instead a heliocentric or Sun-

centered universe, with the Moon still revolving about Earth, but Earth, like all the other planets, now spinning around the central Sun. Copernicus's ideas, displacing and demoting the Earth as they did, were radically new and different, and eventually caused a tremendous crisis, though this inevitable reaction was delayed for a while. Copernicus himself was on his deathbed when the work was published. A Lutheran clergyman, Osiander, had written a disclaimer in the book, to the effect that it was merely a computational scheme intended to remedy observational anomalies and not a true representation of the universe or of the actual paths of the planets. Also the work was long, forbidding, full of mathematical equations, and written in the scholarly tongue of Latin so that only those trained in the Church or university could read it. Those who did read it were thrown into turmoil, because the notion of a moving Earth seemed to contradict passages in the Bible. This led to questions about the interpretation of Scripture, whether it should be taken literally or understood metaphorically, and who had the authority to determine its real and allegorical meanings. Some Protestants attempted to make the new astronomy compatible with their reading of biblical texts. Counter-Reformation Catholics, after the Council of Trent, and especially the increasingly influential Jesuits, were opposed to Copernicanism and upheld the literalism of Holy Writ.

Copernicus's ideas, however, were soon to set in motion a chain reaction of revolutionary astronomical research that could not be stopped however hard Christian authorities tried. A Danish astronomer named Tycho Brahe, while not persuaded by Copernicus's arguments, nonetheless realized that ancient astronomical tables were inadequate to resolve the dispute, and set up his own island observatory, monitored round the clock by his students, who provided new, accurate information on celestial movements. Tycho studied comets, which appeared to cross through the crystalline spheres and thus cast doubt on their existence, and observed a supernova, the creation of a new star, another impossible phenomenon in the immutable heavens of Aristotle. Unable to accept either Ptolemy or Copernicus, Tycho came up with his own compromise system. Meanwhile young Johannes Kepler, attracted by Tycho's new astronomical data, had come to work with him. In his study of the planet Mars, Kepler arrived at a staggering conclusion: the orbits of planets could not be reduced to a combination of circles, as had been believed since the ancient Greeks, but were ellipti-

cal. Kepler's new laws of planetary motion were buried deep in long rambling writings, and although somewhat known, they would later be appreciated and made familiar by Isaac Newton, whose work they inspired.

Now the ideas of Copernicus, Tycho, and Kepler, though extremely important, remained virtually unknown to the literate public until Galileo's telescopic discoveries of 1609, published in his *Sidereal Messenger* of 1610. The telescope had recently been invented in Holland, and was being advertised and used primarily as a navigational and military tool, but Galileo turned it toward the heavens, and what he saw there altered the course of the history of science forever. He discovered, for the first time, clear observational evidence for Copernicus's system. He saw that the Moon was like a "dead Earth," not the pristine ethereal body of Aristotle's scheme. He saw sunspots, which also contradicted the immutability of the heavens. He saw that Jupiter had moons, thus exemplifying a solar system in miniature. He saw the phases of Venus, changes in its shape which would have been impossible in the geocentric system where, stuck between the Sun and Earth, Venus should always appear a crescent. He saw that the so-called "fixed stars," supposedly the tight outer boundary of the world, were hardly magnified at all, and must, therefore, be immeasurably more distant than had previously been believed. He saw no evidence whatever of any crystalline spheres holding up the planets.

Galileo spent the next two decades biding his time about most of this, continuing to work but publishing little. In 1616 the Catholic Church made an official condemnation of Copernicanism as false and needing to be expurgated (the euphemistic word was "corrected"), and Galileo thought discretion the better part of valor. But when a friend of his, Cardinal Barberini, became Pope Urban VIII, he mistakenly believed he could finally speak freely of the new astronomy. In 1632, he wrote about it in the form of a conversation and in the vernacular Italian in his delightful *Dialogue Concerning the Two Chief World Systems*. (This was doubtless an inspiration for Fontenelle, who wrote his work in dialogue form and in French.) Galileo's famous trial and condemnation at the hands of the Catholic Inquisition, the result of his miscalculated daring, is a dramatic story of a world-historical confrontation that merits close attention, although it cannot be covered here. Suffice it to say that it gained unprecedented attention, both good

and bad, for the new astronomy, which was finally recognized and experienced as the great shock to human complacency and pride that it was—a shock as monumental in its day as those delivered by Darwin and Freud centuries later. Together these three revolutions, in cosmology, in biology, and in psychology, shattered forever all comfortable and facile assumptions about the purpose of human existence.

Galileo's sentencing for "teaching, holding, and defending" Copernicanism, and his famous or infamous recantation, understandably inhibited others who were considering publishing on the subjects of physics and astronomy, or, as they were called at the time, "natural philosophy." One such person was René Descartes, a Catholic Frenchman whose work was in some ways much more innovative and menacing to ancient and Christian authority than Galileo's. Descartes's *Discourse on Method*, which he finally published in 1637, is of revolutionary significance for the history and philosophy of science, as is his even longer-delayed *Principles of Philosophy* (1644). Together they challenged all received opinion, championed the methodical doubting of everything previously believed, and put forth the first complete physical system of the universe since Aristotle. As Descartes's influence on Fontenelle would be enormous, we should look a bit more closely at his ideas.

Descartes believed that to achieve certainty, the human mind must first unload itself of all tradition, of all preconceived ideas, and put them through rigorous testing and the closest scrutiny. This thoroughgoing willingness to doubt distinguished Descartes as one of the world's most daring thinkers, and Fontenelle admired his independence, his courage in the face of vested authority, his irreverence toward the intellectual heritage. He liked his method, his habit of mind, his philosophical orientation far more than his results, for the universal system Descartes arrived at seemed to Fontenelle provisional, subject itself to the same questioning and criticism. Therefore Fontenelle rejected Descartes's ontological proof of God's existence, his doctrine that a few ideas were innate and thus exempt from doubt, most of his metaphysics, and his mind/body dualism. Fontenelle was in fact more like Descartes's contemporary, Francis Bacon, whose scientific method was empirical, subjecting all reason to experimental verification by the senses. But one aspect of Descartes's physics appealed to Fontenelle tremendously, and he was to remain faithful to this theory during his entire long life, de-

spite its being almost immediately discredited by Newton. This was Descartes's theory of vortices, or whirlpools of particles, always in motion, always in contact with each other. In this totally mechanical view of the universe there were no voids, no empty spaces. Instead, atoms of matter continually hit each other, setting up chain reactions of swirling movement that caught up big and small bodies alike, and that spun each planet in its vortex. This theory—unlike Aristotle's, which treated terrestrial and celestial movement separately—assumed the essential similarity of laws of motion for the entire universe, for minute objects as well as for celestial bodies, as they were all in contact through their touching, mutually propelling vortices. Fontenelle found this theory elegant, based as it was on the conviction that nature was uniform and mechanically simple. The theory also seemed to explain what kept the planets in orbit, now that Tycho's observations had "shattered" the crystalline spheres. Descartes's view seemed to Fontenelle far more logical and satisfying than Newton's rival notion of "attraction." Newton's theory of action-at-a-distance, of bodies influencing each other through forces operating across empty space, smacked of the occult, of the strange, mysterious superstitions Fontenelle was determined to combat. It was Descartes's theory of vortices, as we will see, that formed the basic physical explanation of planetary movement in the *Entretiens*, as did Descartes's related beliefs that the universe had no limit, that it was probably not created solely for humankind, that the Earth was materially like the Moon and other planets, and that the stars were made of the same stuff as our Sun.

Now while Fontenelle's *Entretiens* became far better known than any other book for the layperson on the subject of the plurality of worlds, there had been others. Kepler, in his *Somnium* (1634) or astronomical dream, had toyed with the notion of other planets being like Earth, but his was still a very anthropocentric view, in which our Sun was the brightest, our planet the best, our species the noblest. Galileo, who never mentioned his unfortunate countryman, Giordano Bruno, seems nevertheless to have been sobered by the latter's martyrdom, and was uncharacteristically quiet on the possibility of inhabited worlds, saying nothing explicit about the obvious implications of his discoveries for extraterrestrial life. But a young Protestant clergyman in England, John Wilkins, wrote his *Discovery of a World on the Moon* in 1638, in which

he argued that the possibility of lunar inhabitants contradicted neither reason nor faith. The work was translated into French and published in Fontenelle's hometown of Rouen in 1655, where it quite probably became known to him as he was growing up. Wilkins's argument that pluralism was not blasphemous, however, probably did relatively little to reassure writers in non-Protestant countries of the safety of the subject. Still, there were free-thinkers even in Catholic France, *libertins* determined to play with these ideas in fanciful disguise. Pierre Borel in 1657 published his *Discours nouveau prouvant la pluralité des mondes*. Cyrano de Bergerac, whose literary merits were made legendary in Rostand's romantic play, gave free reign in 1657 and 1662 to his scientific and technological imagination as he explored hypothetical worlds on the Moon and Sun. The most daring, however, was yet to come. None of these authors had argued for a plurality of solar systems as Fontenelle was soon to do, developing to its logical conclusion Descartes's notion that each of the stars is a sun like ours.

By the time Fontenelle took up this subject, then, the ground had already been broken somewhat, and new astronomical theories were becoming the subject of both debate and entertainment. Still, Copernican cosmology was not universally accepted by any means and was still grossly misunderstood, as evidenced by the reaction to the fiery comet of 1680, much larger and more dramatic than that of 1682 (later to be named after Edmund Halley, the first astronomer to realize its periodicity and to predict its return). This celestial visitor of 1680 caused considerable panic. It was seen by many as an ominous portent of impending doom and the reaction to it was only slightly calmed by the sophisticated astronomical reading matter available. Fontenelle, no doubt surprised and amused by the irony that a comet could still cause extreme anxiety even when the scientific theories on such subjects were supposedly in vogue, wrote a comedy, *La comète* (1681), in which he tried to explain away all worries about it; he tried, according to the French formula, to both "amuse and instruct." Newspapers advertised that now going to the theatre could cure the fear of comets. With this play, Fontenelle first embraced the subject of cosmology and showed his taste and talent for the graceful exposition of scientific material. Although the *Entretiens*, which features a long section on comets, did not appear until five years later, it is plausible that during that time the

author began seriously to contemplate and construct the role he would play in winning general acceptance for the new cosmology and dispelling superstitions and outdated ideas

Before going more deeply into the *Entretiens*, Fontenelle's most celebrated, successful, and popular work, it will be helpful to explore a bit more closely his life and some of his other writings against the background of the France of Louis XIV, the so-called *Grand Siècle*.

Fontenelle was born in 1657 in Rouen, a city in provincial Normandy, an area with considerable Protestant roots. This, despite his education at the hands of the Jesuits, would make him an active seeker of religious toleration. His father, a lawyer, wished his son to follow in his profession, but after pleading—and losing—one case, Fontenelle abandoned the law to pursue studies in philosophy and literature. He was a voracious reader and by age fifteen had competed successfully for several literary prizes. His maternal uncles were the famous Corneille brothers. As a teenager he made frequent trips to visit them in Paris, where they introduced him to the world of the theatre, in which Pierre Corneille was widely regarded as the greatest writer of tragedies since Aeschylus, and to the world of the new periodical press, where Thomas Corneille was active on the editorial board of one of the first Parisian newspapers, the *Mercurie galant*. This was primarily a literary paper filled with *pièces fugitives* (short prose and poetry), book reviews, and theatre criticism. It targeted an elite, cultured audience. Not surprisingly, Fontenelle's first literary ventures were in the fields of drama and journalism. Though he was not wildly successful in those areas—he even learned the bitter message of the power of the press when his plays were panned in a rival newspaper!—he was becoming known in fashionable Parisian cultural circles as an intelligent *galant*, a young man of learning, wit, and charm. Through his uncles he came to know well many writers, both male and female. He was a particular favorite among the *précieuses*, the hostesses of the salons, informal gatherings in private homes presided over by influential women who could make or break careers, and around whom savants and men of letters flocked. Here Fontenelle mingled with the intellectual stars of the capital, watching, hearing and absorbing, gently challenging, polishing, and refining the discussions. His company was sought after, and numerous salon hostesses, fiercely competitive as a rule, acquiesced to sharing this



popular man of the world and putting up with his divided loyalties. It is, I believe, highly significant that in addition to his friendships with female writers, he received this kind of welcome and valorization in the salon, a forum created by women. It was through this female-sponsored institution that he was able to glean a sense of what was intellectually à la mode, a sense of his own strengths as a conversationalist, listener, observer, and interpreter. Not accidentally, he made a woman the eager, enthusiastic, and gracious student in his *Entretiens*. Why should he not acknowledge his debt and immortalize his gratitude to the women who helped shape his career.

The 1680s were very productive years for Fontenelle, who was helped at all times by his female supporters and by the highly effective publicity instrument that was the *Mercure galant*. This paper was read increasingly by women, and in taking them seriously it did much to create a new market, later to be targeted by an explicitly feminine press. We have already seen that Fontenelle wrote *La comète* in 1681. Other plays followed. In 1683 he wrote *Nouveaux dialogues des morts*, in which were brought together for conversation mythological figures, important thinkers, and political actors from different ages. For reasons which should by now be clear, many of the characters were women—poets, goddesses, queens. Already in this early work Fontenelle attacked dogmatic philosophical systems and spoke of the difficulty of discovering truth; he projected a healthy preservative form of skepticism and attacked gullibility in all its forms. Here Fontenelle's fancy, as he put it, was that living people say plenty of useless things, but the dead have more experience, leisure, and time to think, and can perhaps illuminate certain issues for us.

In 1685 Pierre Bayle, the Huguenot journalist who fled France for Rotterdam and published in exile his *Nouvelles de la république des lettres*, printed Fontenelle's *Mémoire sur le nombre neuf*, showing that even in his twenties he was already taking an interest in mathematics as part of his province. In 1686, along with the *Entretiens*, the *Histoire des oracles* and the *Relation curieuse de l'île de Bornéo* were written. The second was a thinly disguised protest against Louis XIV's revocation of the Edict of Nantes which withdrew toleration of Protestants in France, forcing them to flee in enormous numbers, and which would result later in France's political isolation and economic decline. The *Histoire des oracles* was an extraordinary work, almost a comparative history of religions,

in which Fontenelle collected different myths and legends and analyzed them to show various stages in the development of humanity's understanding of nature. He argued that people had, since earliest times, been capable of reason, but that they needed to be set free from their belief in marvels and magic, disengaged from traditional superstitions and false teachings. Of course Fontenelle's mockery of supernatural explanations, his critical approach to oracles and prophecies, cast doubt upon Christian miracles as well. That he was not punished for the controversial opinions expressed in these works can largely be explained by his mastery of a tone of *insouciance* which lent a flip, evasive quality to his writings. Though he propagated extremely unorthodox views, he was never heavy-handed or dogmatic.

Fontenelle's *Digression sur les anciens et les modernes* was published two years after the *Entretiens* in 1688. The Quarrel of the Ancients and the Moderns pitted traditionalists who approved of absolute monarchy and thought the Golden Age was in the past—the dramatist Racine, Boileau, La Bruyère, La Fontaine—against such “beaux esprits” as Fontenelle and other admirers of Corneille, Charles Perrault, and the *Mercurie galant* staff, who were open to novelty, who believed that political power should serve the whole nation, and who cherished their independence. In taking the side of the Moderns, Fontenelle explained that while ancient literature might be as great as ours, the sciences surely had advanced steadily since days of old, and dramatically in recent years. With a perspective and vision quite astonishing for one so close, Fontenelle even identified the Scientific Revolution (though he did not label it as such), the immense leap taken in understanding the natural world since the mid-sixteenth century. Science, he argued, emancipated humanity from ignorance and prejudice, made us less the slaves of our passions. The scientist's allegiance to knowledge was far more admirable than the politician's pursuit of power. Though folly and vanity might persist through all ages, the worthy study of nature would only enhance the human experience. Fontenelle hoped such advance might continue, unfettered by wars, indifferent governments, religious prejudice, or fanaticism.

The year 1691 saw Fontenelle's reception at the Académie Française, an honor most writers considered the pinnacle of their careers. But this author, who seemed almost to sense that he had more than another half century of intellectual activity in front of him, set his sights ahead and

began now actively to cultivate the Académie des Sciences, many of whose members were already friends and acquaintances. In 1697 he was named its perpetual secretary, taking over this function from the aged Du Hamel, a fellow Normand who had dutifully been writing the history of the Academy in Latin. This work was uninspired and inaccessible to most readers. It was undoubtedly the huge success of Fontenelle's *Entretiens*, his ability to create an appetite for science, that brought him to mind for the secretary's post, which the Academy hoped he would exploit as their propagandist. He did not disappoint them. He immediately recognized that the doings of the Academy and of its many distinguished members would have to be written about in French to reach a wide public and to create in the outside world the proper appreciation for this institution. He also began the tradition of *éloges*, brief biographies of each recently deceased academician, filled with subtle psychological observations, clear and elegant explanations and evaluations of each man's work, and an overarching image of scientists as a kind of secular sainthood in disinterested pursuit of knowledge. Scientists showed a seriousness of purpose, a respect for discipline, a determination to find answers, which were their own reward. In the *éloges*, which had shed the playful tone of the *Entretiens* but were still eminently readable, the investigation of nature was described by Fontenelle as a solemn duty, but also an immense pleasure. The contemplation of nature's wonders elevated the soul. Fontenelle realized that though scientific research could yield fruit as well as light—it could have considerable practical utility—it would be stifled by too much emphasis on applications, and therefore pure investigations must always continue to be encouraged. He saw his *éloges* not only as a way to excite the public about unsung scientific heroes but also as a reminder to scientists that a bright though untrained audience awaited news of their work and should be treated with respect. The *éloges* covered everything from architectural engineering through biology and astronomy to political arithmetic. Indeed, Fontenelle in his *éloges* remained ever fresh, always awed by the wonder of unraveling nature's riddles, and continually able to communicate that sense of exhilaration. Daring scientists, his audience learned, trespassed where no human had gone before. In discussing the astronomer Cassini, for example, who like Galileo went blind toward the end of his life, Fontenelle mused that “these two great men made so many discoveries in the sky that

they resemble Tiresias, who lost his sight for having seen some secrets of the gods.”

Fontenelle lived one month short of one hundred years and continued to write *éloges* and other works almost until his death in 1757. He died without suffering, telling his doctor at the end that he felt simply “a difficulty in being” [une difficulté d’être]. He achieved and maintained celebrity status, and knew most of the influential people of his time. Yet he always cherished his independence. His friendship with the Régent, Philippe d’Orléans, who ruled during Louis XV’s minority and who actually gave Fontenelle an apartment in the beautiful Palais Royal, never in any way compromised his free spirit. He knew how to cultivate his reputation, how to gain prestige and influence, in short how to survive in France. Though he expressed views every bit as bold as Pierre Bayle’s, he was not exiled because he developed gentler strategies to fight the fight safely from inside. Fontenelle liked calm and comfort and disliked aggressive polemics or anything upsetting. Though his curiosity spanned all fields and kept him in a state of perpetual intellectual thirst, he relished the serenity and satisfaction of learned contemplation, the thinking through and figuring out of the many problems he posed to himself, first in the privacy of his own mind, then for his adoring public. Nor did it hurt that he was fast friends with the Marquis d’Argenson, keeper of the seals and chief of police, who more than once saved Fontenelle from persecution and prosecution for his bold, unorthodox ideas. Many an author in this period was harassed, imprisoned, or forced to flee France with authorities in hot pursuit. Many had their books censored, publicly condemned and burned. During periods of witch-hunting, when the government issued *lettres de cachet* for the arrest (without trial or recourse) of subversive authors, Fontenelle enjoyed a kind of unofficial immunity thanks to d’Argenson. Fontenelle’s inimitable style, his ability to treat all his subjects so pleasingly, so easily, so elegantly, almost affectionately, and to put forward his views, however iconoclastic, as proposals, conjectures, suggestions—this too helped him stay safe, active, and able to continue publishing. As Montesquieu once said admiringly of Fontenelle, one can say many important and serious things while joking.

It is always said that Fontenelle was a great popularizer of science, a superb mediator, but this must be understood correctly. While granting his matchless talent as a communicator and interpreter, the modern

reader must not conceive Fontenelle as a bridge between two cultures, one scientific and the other humanistic. Nor should we fall into the trap of picturing experts producing knowledge and Fontenelle diluting it for popular consumption. Rather, the author of the *Entretiens* gives us an invaluable insight into the early modern world, when science was still in its adolescence, still searching for its purpose and its self-image, still seeking a public to understand it, make it welcome, foster and even guide it. C. P. Snow's "two cultures" had not yet polarized the terrain of ideas. Scientists were not yet professional specialists in the sense they are today, separated from the layperson by sophisticated technical jargon. The *Entretiens* provides important clues, and we must be sensitive to them. It would be unfortunate to miss the openness of the exchange taking place in Fontenelle's dialogue, the reciprocity of the talk, the flow of the give and take, the common meanings of the language. We have here a delightfully balanced piece of writing, full of analogies that blend with grace the literary and scientific, romantic and serious, playful and profound. The *Entretiens* was written at a time when the pursuit of knowledge still enjoyed great unity, and fields had not yet separated to lose touch with each other. Fontenelle's talents spanned ideas in all their manifestations. He could listen to questions from and share his responses with a wide, varied audience. The notions he sought to communicate were difficult, but it was axiomatic that they were accessible to anyone who bothered to follow along. Of course, in these dialogues, a teacher speaks to a student, yet he needs the student as much as the student needs him. Acceptance, a friendly atmosphere, and society's value and esteem were necessary not only for science's reception and healthy propagation but also for its self-definition. Fontenelle wrote a conversation, not a lecture, in which both interlocutors partook of a common culture, a broad, all-encompassing curiosity that made just about any topic fair game.

Indeed, as we have seen, in a writing career that lasted nearly a century, Fontenelle did touch upon nearly every topic. In his breadth he may have been the last Renaissance man, but he was also the first of the *philosophes* ushering in the new age of the Enlightenment. He represents a transition, a link, between an age steeped in faith, tradition, and reverence to past authority, and an age characterized by a secular spirit, independence, and openness to the future. Fontenelle was no facile optimist, but his conviction that the accumulation of knowledge had

enhanced and enriched humanity inspired the eighteenth-century belief in progress as expressed in the great *Encyclopédie* and as epitomized in the writings of Condorcet.

With this background we are ready to look more closely at the *Entretiens* itself, one of the most important works of its time and a beloved, immortal classic. It is a literary masterpiece. Fontenelle's training, we must not forget, was in philosophy and belles-lettres. Though profoundly influenced by and attracted to the new science, he could trace his skepticism back even further to humanistic roots, to the writings of Lucretius, Machiavelli, and Montaigne. Thanks to such authors he realized early the relativity of knowledge, the possibility and richness of numerous points of view on any given issue, and the importance of high style, clarity, precision, rhetorical grace, and narrative strategies in getting a multiplicity of ideas and meanings across. In his *Preface*, Fontenelle explicitly stressed his debt to literature by likening this work to a romance or novel, in particular to the popular *La Princesse de Clèves* by his friend Mme de Lafayette. Anyone who could figure out a plot and keep characters straight could as easily follow him on his extraordinary cosmic voyage. His genius for inventing apt similes and analogies (rolling balls, sailing ships, mulberry leaves), for explaining natural philosophy in terms of everyday thoughts and experiences, for recognizing and welcoming even the fictional dimension of all scientific speculation, allowed him to ease his reader into difficult, sophisticated material. The finesse and dexterity of his writing thus served a democratizing function among the literate. While we must not get carried away imagining everyone reading this book—literacy rates were low in seventeenth-century France and the vast majority of the population could not read—still Fontenelle spread the habit of scientific thought and methodical doubt to the entire *reading* public. As the Duc de Nivernais said, Fontenelle had the power and skill “to make reason a common thing, to introduce and establish it in all genres and in all minds.”

Fontenelle could engender excitement effortlessly, it seemed. His topic, of course, had a thrilling, timeless fascination. The author was only twenty-nine when the *Entretiens* appeared, and it had a youthful, spontaneous, even reckless quality about it that immediately created a sensation. Spinning a tale of infinite space, wondrous and strange in-

habitants on other planets, in other galaxies, and even on comets, could hardly fail to captivate. The press, especially the loyal *Mercurie galant*, cooperated by giving an advance notice of the work that made it sound exceptionally inviting and provocative. The friendly, flirtatious atmosphere of Fontenelle's dialogue made it more naturally conversational. This chat between a philosopher and a Marquise, as they strolled in a beautiful garden looking at the night sky, was even more attractive to the reader than the comparatively formal dialogues of Plato and Galileo, though these too had been very engaging. But Fontenelle had struck on an extremely inventive pedagogical technique, coaxing the reader to participate by identifying either with the smart though untrained student or her knowledgeable, versatile teacher.

The structure of the work merits some comment, for it belies the apparent effortless of the exposition. Fontenelle tells us in his *Preface* that he will never be dry, but that he will digress and embellish more at the beginning to break the reader in. He pulls off the work with great élan and panache, but he has done his homework, and has given long hard thought to how best to present his material. The work is divided into five parts, or "evenings," during which the couple behold the skies. The first part sets forth the system of Copernicus as that most likely to be correct, but not without exploring the older alternative views. The second and third discuss the Moon and the possibility of travel to it, an area already explored as we saw in several earlier imaginary lunar voyages by Wilkins, Borel, and Cyrano. Thus the first three "evenings" broach subjects that might be somewhat familiar to readers in the know already. Only then, after easing the reader into it, does Fontenelle allow himself to cover totally new ground. The fourth part deals with Descartes's difficult physics of vortices as an explanation for all planetary motion. And the fifth takes the radical plunge into discussing the fixed stars as suns, around which an infinity of habitable planets probably revolve. The Milky Way is described as a "cluster of worlds." Suddenly the universe becomes infinite, teeming with bizarre but intelligent life everywhere. And the reader, lulled by the gradual seduction of earlier, more familiar suggestions, does not really experience this news as a shock. Fontenelle had said early on in the *Entretiens* that truth should be pleasing. He had a sense of the aesthetics, the beauty of simple conclusions, and here he succeeded in putting forth astonishing ideas as if they were entirely natural. The author was a mas-

ter of gamesmanship. Philosophy, he said, was based on curiosity and poor eyesight. We want to know more than we can see. So together, we do some educated guesswork based on judicious observation and clear thinking, and if we are careful, respecting both the economy and the fertility of nature—that she is uniform in her laws but varied in her manifestations—then we will ultimately arrive at conjectures that ring true.

Not only structurally, but in more subtle ways, Fontenelle lures his reader into a frame of mind ready to brave the new world he is presenting. At the outset the philosopher flatters and teases the Marquise, and it is she who repeatedly urges him to drop all the frills and explain the facts. He is not so easily persuaded to abandon the colorful moral digressions, and introduces the notion that the Earth is not central with a homily on human vanity. Cloaking his discussion in flowery terms, he explains that Copernicus wrested Earth from her proud posturing, hurtled her into the skies, and, as punishment for her conceit at thinking she was the purpose for which all nature was created, gave her many movements and much extra work to do. Some recent feminist scholars have seen a misogynistic strain in this treatment of Mother Earth, and perhaps the Marquise herself senses it. As she continues to protest the philosopher's innuendoes and off-color jokes, he slips in the notion that nature is quite indifferent to humanity, that we must realize ours is only one of many perspectives, that we must be willing to play with them all rather than remain fixated on our own importance. The philosopher, who had earlier commented on his pupil's ability to "arrange things in her mind, without confusion," compliments her at the end of this first session on her "lively and prompt discernment." By the second night he realizes a review is unnecessary, that his student is ready to go on to new material. She catches on so fast, in fact, that he says he would not wish to be reproached for belaboring points. Thus he encourages the reader to keep up a healthy pace and see, as does his pupil, that there is really "no mystery" to his explanations, though foolish superstitions still persist among those who do not bother to think. Nevertheless at the end of the second evening, he has pressed things too far. The Marquise uses her healthy skepticism on his argument, and things do not end as placidly, perhaps a reminder to readers and teachers alike that learning is not a linear progression, that the rhythms of the mind's readiness and resistance need to be respected.



By the third evening, he retracts his bold assertion that the Moon is inhabited, but twenty-four hours have passed and by now the Marquise has had time to think about the possibility, and has grown accustomed to the idea. She even likes it. She says now that she finds it difficult, almost impossible, to suspend judgment on something like that, to be aloof or indifferent to these wonders her teacher describes, thus showing how impressionable students are, how eager, whatever the subject, to have solutions to believe in. Together they muse on what the world would look like from the Moon, and this whets her appetite to “travel” on. She wants to render their speculations visually concrete, to draw pictures of the various inhabitants of other worlds. On the fourth evening, however, she complains about the frustrating limits of her own imagination. Even in dreams she can only come up with variations on human themes, and seems incapable of conjuring up totally different forms of life. In this fourth part the philosopher makes the incredibly bold remark that the planets are where they are because of “chance alone” [le seul hasard de la situation] at the beginning of the world. Earth *could* have been a moon of Jupiter if chance had caught us in its vortex. Does this perhaps hint at there being no creator, or at least no grand design? Elsewhere the philosopher had said that inhabitants of other planets were not sons of Adam, implying that they were not part of the Christian drama of fall and redemption. It is interesting to contemplate just how much Fontenelle’s own views are represented by the philosopher, and just how far he meant readers to go with this suggestion of ultimate skepticism. At least one of his translators, while not labeling him an atheist, was convinced he was a “pagan.”

The Marquise now expresses pleasure at the idea that Jupiter’s astronomers might be eager to learn about us. This possibility of mutual curiosity fascinates her. To counter the philosopher’s half-hearted, scattered, yet persistent suggestion that indifference, play, and chance might be the ways of nature, the Marquise now argues, as they discuss the rings of Saturn and the great reflected light these rings must surely provide, that nature is a caring, almost maternal guardian who keeps the needs of her creatures in mind. The discussion of the characteristics of the inhabitants of Earth, undertaken now from a comparative cosmic perspective, is an amusing but sobering social satire.

By the fifth evening, when the philosopher presses on to discuss the myriad stars as suns, the Marquise has a fleeting moment of alarm. The

enormity of the universe suddenly frightens and humbles her, as it reduces humanity almost to insignificance. But she recovers quickly, and thrills to the possibility that the inhabitants of comets, which slice through different vortices, would get to see the planets around many different suns and thus have an especially rich and varied experience. Toward the end the Marquise mourns the fact that, according to her teacher, some suns go out. This notion of the expiration or extinguishing of heavenly lights upsets her, but the philosopher takes the opportunity to introduce the changeability of the universe, the idea that things come and go, live and die, that new worlds are being created as others fade away, that the cosmic voyager must travel in time as well as space to truly understand.

The edition of the *Entretiens* translated here is Fontenelle's first, that of 1686. One year later the work was placed on the Catholic index of prohibited books, but this did not deter the author from publishing a new edition with a sixth "evening" added. This was basically a summary of the major points he had already made in the work, but one which brought to bear more forceful evidence and abandoned the argument for chance. He stressed the similarity in physical composition of the Earth and planets, strengthening the likelihood that the planets are inhabited. He underscored the difficulty in figuring out why the other planets were created, if not to house living creatures. In connection with this, he stressed the principle of plenitude, made popular by Leibniz, that nature is fecund, magnificent and full, that none of it goes to waste, or is created in vain. This perspective was probably further inspired by the discoveries Leeuwenhoek made with his microscope in the 1670s of tiny worlds filled with infinitesimal "animalcules" never before seen. Great orbs, like minute drops of water, must indeed be populated too. Just because the naked eye failed to detect things did not mean they did not exist, and Fontenelle argued that the limitation of our senses should not paralyze our scientific imagination. He put forth an interesting new argument, no doubt influenced by Bayle's critical writings on history, that historical facts were no more certain than cosmological ones. Our conviction, for example, that Alexander the Great existed, is based on no firmer evidence than these astronomical verities. There were, then, he summed up, many sound reasons for believing his conjectures, and hardly any for rejecting them. Perhaps he felt that the ending of the fifth evening, by leaving things up in the air

and giving the Marquise the choice of ignoring all she had learned, had made the new system seem optional to the reader as well. The Marquise had even commented that he would never a martyr make, playing as he did with ideas but failing to commit himself to one side or the other. While acknowledging once again that it was neither chic nor safe to insist on something, Fontenelle came back in this last added evening to urge more persuasively the view to which he subscribed. And the Marquise ended by demanding she be treated henceforth not as a novice but as a *docteur*, or learned person.

Fontenelle continued over many decades to update and correct new editions of the *Entretiens*, most notably in 1708 and 1742, based on the newest astronomical data provided by his colleagues and friends in the Academy of Sciences. In this sense he kept the work alive, preserving the spontaneity and exuberance of its first appearance on the literary scene, recapturing its freshness. He changed the size of Venus several times in response to new observations, incorporated Kepler's theory of elliptical orbits which Newton had meanwhile made better known, and even altered literary and political references to keep the work current and timely. During his lifetime his ever-renewed *Entretiens* inspired a new genre, the hundreds of utopian novels and imaginary voyages that proliferated throughout Europe but especially in France during the eighteenth century. These pioneering works of science fiction, with their visions of alternative societies and futures, experienced a tremendous vogue.

What sort of audience did Fontenelle have in mind? To what socio-cultural milieu did he address this work, and what motivated him? One of his biographers has suggested that he had a fine nose for what was fashionable, and knew the *Entretiens* would be a financial success that would catapult him to fame and fortune. Others have found more lofty motives in Fontenelle's determination to appeal to a wider reading public as arbiter of thought in order to share his relativistic world view. But while he meant to enlighten the literate elite, he was no democrat, and had no interest in converting the masses. The study of nature was healthy, even necessary, for the leisured classes; they should all be "spectators of the world." This would not result in worship or love for a creator—Fontenelle did not think that necessary—but rather in respect and admiration for the wonder of it all, and in a healthy perspective balanced somewhere between humility and pride. For the lower classes,

however, he seemed to hold little hope. Fontenelle had no tolerance for people “too tender in religious matters.” He maintained an audaciously anti-clerical stance in all his writings and did not address the “ignorant masses” whom he felt would never transcend their historical limitations. The *Histoire des oracles* had portrayed prophets as masters of trickery and priests as deceitful, power-hungry frauds who prey on the gullibility of their flock to achieve power. The duped, it seemed, were as much to blame as the charlatans. In the *Entretiens* Fontenelle made unflattering remarks even about popes. He toyed with the possible role of chance in the world. His skepticism, his general unbelieving attitude, made religion of any kind relatively unimportant for him, and distanced him from those dependent on faith, as were most commoners. It was folly, he tried to show in the *Entretiens*, to believe that the universe was a private affair between humanity and God. He served up to his sophisticated or at least culturally aware readers, as delicately and gently as possible, the fact of their relative cosmic insignificance. Presenting them—and us—with this unsettling paradox, he assumed, would encourage active, intelligent debate among those who could exercise their reason in order to discover truth. Fontenelle spoke only to a public he considered worthy of him.

That women were included in Fontenelle’s invitation to ponder and resolve the meaning of existence was extraordinary for his day. This, as much as anything else, makes the *Entretiens* an exceptional and enduring work. Misogyny was rampant in seventeenth-century France—in most of Europe for that matter—and while the *question de la femme* had begun to be actively debated, with a few partisans of women even arguing provocatively for their superiority, the majority of writers treated the female as a subhuman species. The development of the salons and the growing influence of women as readers and as theatre-goers seemed menacing to men who sought to maintain their hegemony as arbiters of cultural taste. Attempts on the part of women to educate themselves were experienced by most male intellectuals as a threat to their jurisdiction over the province of scholarship; such women were mercilessly ridiculed. Molière’s famous comedy, *Les femmes savantes*, mocked the *précieuses* for seeking to better their understanding, for involving themselves in anything other than trivial, mindless pursuits. This play, in which women were damned if they did think and damned if they did not, appeared only fourteen years before Fon-

tenelle's *Entretiens*, and represented quite accurately the prevailing view of intellectually ambitious women at that time.

Fontenelle, though he never wrote explicitly feminist tracts, simply gave women the benefit of the doubt. They deserved his attention. He casually, calmly addressed his remarks to them, as if to say come, follow, all this knowledge can be yours with the same kind of effort that allows you to understand literature. His Marquise is worth considering in some detail. She is charming, sensitive, humorous, quick, though totally unschooled. He uses her in a unique way in the dialogue, not as a person with views opposed to his own—as was the case with Plato and Galileo, and as again would be the case with Diderot a century later—but as a mind ready to be filled, yet quickly developing the capacity to question and criticize, to evaluate and challenge in its own right. Hers is a mind unspoiled by false teaching, and thus all the more promising for proper cultivation. She has an identity; we learn of her social class, her looks, her garden. By the end we can almost predict her reactions. She chooses to spend her time learning astronomy rather than dancing, hunting, or gaming, as do most of her social rank. She gets impatient with the philosopher's gallantries, and in the course of her instruction seems to grow in self-esteem. More than the various tracts on the education of girls, Fontenelle's Marquise did much to justify equal instruction for both sexes. Though the telescope and microscope had by this time become fashionable toys for ladies, this woman seeks to understand the whole cosmic system and craves learning of a deeper sort. Despite her lack of training, she catches on fast. What seems at first like flirtatious naiveté on her part almost immediately develops into genuine curiosity.

Not surprisingly, one of the earliest English translations of the *Entretiens* was done by a woman, Aphra Behn, already famous in her own right as a dramatist, poet, and novelist, the first woman in England to earn a living by her pen. Using the title *A Discovery of New Worlds*, her translation came out in 1688, just two years after the first appearance of the *Entretiens* in France. She explained that she had wanted to write her own work on astronomy, but that, having neither the health nor the leisure to do so, she instead decided to translate a new book that seemed to her quite fine. She commented on Fontenelle's skill in arguing his points, and praised his examples and comparisons as "ex-

traordinary,” “just,” “natural,” and “lofty.” Interestingly, she had some objections to the Marquise, whom she found unrealistic, saying things at times silly, at times so profound that only the great sages would understand her. Behn’s inability to identify with the aristocratic Marquise in her *château* may have resulted from her being a middle-class, city-dwelling woman exercising a profession. Or perhaps she considered science somehow still a male province. Behn, for all her accomplishments and reputation, at times adopted a diffident stance, explaining for example that she too agreed with the Copernican system, “as far as a woman’s reasoning can go.” Was she somehow unready for, or suspicious of, Fontenelle’s tacit assumption that a “woman’s reasoning” was no different than a man’s? This ambivalence on Behn’s part—her obvious attraction to this book for its inclusion of women but her hesitance over her sex’s trespassing too boldly into the sciences—should remind us not to see the seventeenth century through the prism of modern feminism, but instead to be attuned to the nuances of women’s first halting attempts to emerge from centuries of intellectual subordination. Modesty was a necessary strategy for the few female writers of the day. Behn knew that women who wrote pleasingly and agreeably and maintained a deferential attitude would have far more male listeners than their coarse, strident colleagues. There was, in this period, considerable hypocrisy in both directions, critics trying to be indulgent and courteous, and women playing their game. Thus Behn, in the “Dedictory Epistle” to her translation, asked for special consideration. “If [the translation] is not done with that exactness it merits, I hope your lordship will pardon it in a woman, who is not supposed to be well-versed in the Terms of Philosophy, being but a beginner in the science.” Behn went on in her preface to comment that Fontenelle “ascribes all to Nature, and says not a word of God Almighty from the Beginning to the End; so that one would almost take him to be a Pagan.” But she then agreed that religion has no place in such a work anyway and ventured to list many inaccuracies and inconsistencies in Scripture. “The design of the Bible was not to instruct in Astronomy, Geometry, or Chronology, but in the Law of God.” Anything that sounds scientific in Scripture is allegorical, and can be distorted to “fit the common acceptance or appearances of things to the vulgar.” Thus Behn, because her disclaimers liberated her, dealt boldly with the issues raised by Fontenelle’s work, even ventured some literary criticism and biblical

hermeneutics, and somehow managed to make the whole package acceptable. She was cunning, and her tactics reveal much about the codes deployed by women who wished to get into print.

In England, at least as much as in France, Fontenelle's *Conversations* became a classic for women readers, and his Marquise a model for the "scientific lady." Magazines, books, and lecture series began to be aimed at women. Entrepreneurs were quick to exploit the new female market as buyers of scientific instruments and newspapers. John Dunton's twice-weekly *Athenian Mercury* and its sister publication, *The Ladies Mercury*, addressed primarily to the woman reader, treated scientific material, although still sometimes in a satirical vein, throughout the early 1690s. Soon, though, things got more serious. Papers edited by Richard Steele and Joseph Addison aimed at "the improvement of ladies." The *Guardian*, in 1713, portrayed a memorable scene of a mother and her daughters reading Fontenelle aloud to each other as they made jam. The *Spectator*, another paper, summed up Fontenelle's ideas and encouraged women to learn about nature. Algarotti's *Il newtonianismo per le dame* or *Newton for the Ladies*, dedicated to Fontenelle, spread the taste for scientific research to Italian women. In general throughout Europe in the eighteenth century, women began to involve themselves increasingly in scientific investigation. Where Fontenelle's Marquise had been essentially passive, a beginner, a listener, the scientific ladies of the following century actually did laboratory work, went out observing and collecting, dissected cadavers, got grubby. Some of them even became teachers and editors, taking a more aggressive approach as propagators, not mere recipients, of scientific wisdom. Eliza Haywood and Charlotte Lennox became journalists in England, editors respectively of the *Female Spectator* and the *Lady's Museum*, instructing their subscribers on their original microscopic researches, seeking "artfully to cajole fair readers into seriousness." The Italian Laura Bassi got a doctorate and teaching post in physics at the University of Bologna. In France, Bassi's praises were sung in the first newspaper "par et pour les femmes" the *Journal des Dames*. Another paper edited by a woman, the *Nouveau Magasin Français*, was full of articles on the scientific work of the Academy of Rouen. The Marquise du Châtelet, Voltaire's long-time companion, did numerous physical experiments and was the first person of either sex to translate Newton into French. Today, at the end of the twentieth century, though we no longer feel the patronizing need

to compose separate science texts for female readers, women are still vastly underrepresented in the sciences, mathematics, technology, and medicine. That they have developed into a strong and growing presence in these fields, however, and have the self-respect and courage to strive for equality here as in other domains, may perhaps in some measure be traced back to the quiet but steady vote of confidence given them by Fontenelle.

The *Entretiens*, then, is a work that resonates with meanings for our own time on many levels; some have been suggested here, many others wait in the pages that follow to strike different chords in each of us. But more precious even than its enduring relevance is the window it provides into an earlier age, that of seventeenth-century French culture. This work represents the convergence of numerous social assumptions, stylistic strategies, and intellectual preoccupations of another historical period, and studying it closely allows us to time-travel backward into that world. Fontenelle, who journeyed so gracefully through space and other ages, would wish us *bon voyage*.

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