Soft Moon: Exploring Matter and Mutability in Narratives and Histories of the Earth-Moon System

Jane Grant

Soft Moon

Soft Moon [1] (Figs 1–6 and Color Plate A) is a computer-generated film I made with Kim, a London-based Research and Design studio, in 2010 that explores the reciprocal attraction of two planetary spheres: the Earth and its Moon. The work is drawn from George Darwin’s Fission Theory, from Henri Bergson’s significant work Matter and Memory [2] and writer and journalist Italo Calvino’s short story also titled “The Soft Moon” [3]. Bergson writes: “All division of matter into independent bodies with absolutely determined outlines is an artificial division” [4]. The ideas in these works are intriguing: in my film there are shown two seemingly independent bodies in space. In effect their autonomy is ambiguous, as the surface of each sphere mutates in a mutual exchange of matter, emphasizing that mass is a density of matter rather than a sovereign state.

The film Soft Moon depicts the intensities of exchanges between things, makes visible the unseen: the tiny particles of lost matter, the un-digitized dust not entered into astrophysical models. The surfaces of these worlds, ruptured by their encroaching proximity, become strange and uncanny, deformed by the intensities of the exchanges caused by the attraction of the two celestial bodies. In my series of accompanying drawings and in the film itself, tendrils of fluid matter and dust are depicted rupturing the boundaries of the surface of each world, splitting apart the internal gravitational structure.

In making the film, we employed computer modeling to simulate attraction and repulsion, to construct a visualization of the physical forces between things and to rupture the boundaries of the individual worlds, rendering each world’s surface a threshold rather than Bergson’s “independent body with absolutely determined outlines” [5]. The sound in the film is made up of layers of rich bass drones, deep and cracking, implying immensity and vast spaces and objects such that one feels the film in the space before seeing it. The film is projected on a large scale, enveloping the viewer’s gaze. The work is slowed to an extreme degree, predominantly focusing in on, and extending the moments just before, collision or capture. Here we are suspended between events, between each world. This focusing in or magnification brings about an ambiguity regarding scale; at times there is a corporal, cellular aspect to the film. This shift of perspective, from the immense to the infinitesimal, reminds us of the unifying nature that the extension of our vision has had on our perception of matter, the vastness of space being reflected in the miniature immensity of the intricacies of living things. This extension is also reflected in the drawings, which are made from graphite powder and pencil and depict the reciprocal action that each world has on the other in greater detail. The drawings, of course, are static—dust and tendrils of terrestrial and lunar matter being pulled toward each other in mutual exchange, each world in an arrested state of its formation.

Accretion and Exchange

The development of Soft Moon was informed by theories concerning the history of ideas regarding the formation of the Earth-Moon system, including astrophysics, science fiction and philosophy. The film is one of a body of completed and ongoing works relating to science fiction, including my work Leaving Earth (2010) (Article Frontispiece), which explores longing and the distance of the Earth from other worlds. Calvino wrote four short stories about the Moon, each prefaced by a specific scientific hypothesis. “The Mushroom Moon” [6] begins with astronomer and mathematician Sir George Darwin’s Fission Theory, in which the Moon was born of the Earth, when a vast solar storm caused a large mass of the rotationally unstable Earth to detach itself and to be flung out into space, forming the Moon. In “Daughters of the Moon” [7], Calvino introduces theories regarding the Moon’s surface wherein the lunar regolith is reduced to dust through violent meteor bombardment. “The Distance of the Moon” [8] again opens with George Darwin, this time addressing tidal forces and the relationship of the distance of the Earth to the Moon. In “The Soft Moon” [9] Calvino opens with Capture Theory, which proposes that the Moon was once a planet that was captured by the Earth’s gravity, causing it to derail from its trajectory:

The Moon moved closer and closer, contracting its orbit around us. At a certain moment the reciprocal attraction began to alter the surface of the two celestial bodies, raising very high waves from which fragments were detached and sent spinning in space, between Earth and Moon, especially fragments of lunar matter which finally fell upon Earth. Later, through the influence of our tides, the Moon was impelled to move away again until it reached its present orbit. But a part of the lunar mass, perhaps half of it, had remained on Earth, forming the continents [10].
One of the most enduring images conjured in “The Soft Moon” is that of accretion—the exchange of matter between the two spheres. In the story, the Moon draws so close to the Earth that the effects of gravity cause an exchange of matter between the two bodies. As the Moon draws closer, protuberances of lunar matter begin to form, soft tendrils of substance fall onto the Earth and, as the orbit becomes closer still, the matter of the surface of the Earth—tiny shards of glass and fragments of steel—fall to the Moon. In the narrative, this happens on a populated Earth, where the narrator, “Qfwfq,” observes and comments on the effect of the exchange upon him. Qfwfq talks of his disquiet regarding the substitution of the cool, sharp, hard objects of the Earth for the inferior and primordial substance of the moon, the organic lunar substance parasitically absorbing the surface of the Earth. After a significant exchange of terrestrial and lunar matter has taken place, and the surface of each world is irrevocably altered, the Moon continues to widen its orbit away from the Earth and eventually leaves, disappearing altogether and taking with it much of the Earth’s surface.

It seems that Capture Theory was first posited by Descartes in the 17th century [11], and although his idea was not fully formed, it suggests his growing realization that our solar system, galaxy and universe were not always in a seemingly stable state. Descartes’s idea suggests a wealth of possibilities and in doing so emphasizes the improbability of the formation of our home, the Earth, and its uniqueness in the vastness of space. The Earth’s formation and the complexity of its subsequent evolution were of course dependent on the Moon, and by introducing such a tenuous beginning, Descartes highlights the fragility of our place in the universe.

**FISSION: ONE WORLD INTO TWO**

In *The Tides and Kindred Phenomena* [12], George Darwin developed his theory of the formation of the Earth and Moon. Fission Theory, the most widely accepted account of the formation of the Earth-Moon system in the decades of the late 19th and early 20th centuries, proposed that the Moon was formed from a rotationally unstable Earth. The problem with Darwin’s idea was that, if the mass of the Moon is added back to the Earth, the resulting body is not unstable; therefore Darwin conjectured upon the influence of the “Sun’s tidal action to trigger fission by building up resonant vibrations” [13]. By introducing the Sun into the equation, Darwin advanced one of the oldest problems in physics; that of the mutual gravitational interaction of three bodies, in this case celestial. Darwin was one of the first to use mathematics to attempt to understand the dynamics of the Sun-Earth-Moon system, further developing Isaac Newton’s opening work on this classic Three Body Problem [14]. While Fission is no longer considered a valid theory of the origin of the Earth and Moon, Darwin’s contribution to the numerical construction of the Three Body Problem was immense and his research fundamental for scientists working on the problem at the time, including the mathematician Henri Poincaré [15]. The pivotal conditions of our now temporally resolved three body problem (involving our Sun-Earth-Moon system and the delicacy of the dynamic that allows one of these masses, the Moon, to rotate in relation to the Earth while the Earth is in rotation relative to the Sun) are a physical testament of the exquisitely stable equilibrium in the formation of our habitat.

In Calvino’s “The Mushroom Moon,” the Earth is covered with a shallow layer of fresh water above a layer of granite. The surface of the Earth is unvarying, and there is nothing for its inhabitants to do other than catch fish from small boats and dispute one another’s watery territory. As predicted in the story, a mass of the Earth’s granite, pulled by a huge solar storm, is drawn away by the Sun as if it were a fluid, so powerful is the attraction.

The granite mass attracted by the Sun was uprooting itself from the basalt base to which it had until then been anchored. A huge boulder of enormous dimensions—the upper part eroded and porous, but underneath still soaking as with the mucus of the Earth’s innards, riddled with mineral fluids and lava, and barnacled with colonies of worms—hovered in the air, light as a leaf. The waters of the globe cascaded into the huge crack left agape, thus letting islands and peninsulas and plateaux emerge in the distance [16].

The vast cavity left behind is filled with the surrounding water, becoming what is now the Pacific Ocean, leaving the remaining solid ground uncovered. This transformation of the surface into both land and water allows complexity to flourish, and a rapid and potent evolution takes place.

The unease with which Qfwfq narrates the events in each of these stories is explicit; in the corporeality and mutability of these spheres, we are reminded that the Earth and its Moon are dynamic enti-
ties capable of mutation and accretion; they are wet, viscous, monstrous and abject. Unable to influence these celestial events, the narrator highlights their eeriness and the hopelessness of human influence or intervention. As the matter of these worlds fuses or pulls apart, it becomes apparent that human reason and scientific and philosophical understanding are futile or inconsequential in the immensity of what is taking place. In Powers of Horror, Julia Kristeva writes about the abject as something other than rational thought, “an exorbitant outside or inside, ejected beyond the scope of the possible, the tolerable, the thinkable” [17]. The birth of “The Mushroom Moon” is abject. It is excessive, a terrible threshold, an uncontaminable fusion that is beyond thought and beyond our conception of the behavior of matter.

In his novel Solaris [18], science-fiction writer Stanislaw Lem creates a hostile and inexplicable universe outside the limits of human intellect and consciousness. The planet Solaris orbits a binary star, and its viscous surface is distended and compressed due to its continuous modification by fluctuations in relation to the gravitational pull of the two suns. This surface matter takes the form of memories, desires and subconscious thoughts elicited from the human scientists sent out to study the planet. These physical manifestations are seen as an attempt to mirror human consciousness, to initiate communication with humankind. However, it is not successful: These potential exchanges between the “vast thinking ocean” and the protagonists are futile, the gulf so huge that both the scientists and the planet remain unfathomable to each other. In these stories, both Lem and Calvino express anxiety regarding the mutability of matter, a disquiet so profound that it borders on repulsion.

In “The Mushroom Moon,” what repels the narrator is the knowledge of the physicality shared with this “mucus”—the soaking, heaving innards of the matter of the Earth. But this propinquity is double edged; the viscous matter disgusts but is the crux of all subsequent evolution. In Solaris it is the otherness of the distended matter, the discrete or immense physical manifestations and tendrils of continuously mutating structures, that causes disquiet. In both cases there is a visceral corporeality that is both of the body and other, a liminal shift of the minute or vast intensities between things, whether bodies or objects [19].

These bodies emerge as a consequence of some other force—not chaos but “an incandescent, unbearable limit between inside and outside” [20]. In escaping the confinement of its own internal structure, matter exceeds its materiality, transgresses its form and structure. It is potent, an action and no longer just a substance. Here matter is in the process of becoming, a concentration of forming and reforming “passages of intensities” [21] that overspill the static.

These newer, stranger worlds, constructed by extending the laws of astrophysical theories, allow the reader to see something recognizable of our world in these mutating landscapes. In these stories we have the uncanny, a series of celestial doppelgangers presenting the possibilities of what the Earth might have become. In placing beings and their narratives in these peculiar worlds, Calvino and Lem are able to speculate on the interface between substance and thought. Science fiction allows us to sculpt and extend the laws of physics, to use scientific analogies in which we can play out narratives on vast or minute time scales that are normally unfathomable. It allows us to speculate on the relationship of imagination and matter, on the thresholds of physical laws in contrast to the limits of our human selves. In using other worlds to outline the extremes of physical laws, we emphasize our anthropomorphic and rudimentary measure of the physical universe.

The distance of the Moon from the Earth is remarkable, as it is both proximate and remote, affording us an intimate relationship with our satellite coupled with longing; our desire to know more of the Moon and its relation to the Earth. The distribution of terrestrial matter within the Moon emphasizes this closeness in that, looking at the Moon, we recognize that something is lost. This longing is beautifully discussed at the end of “The Mushroom Moon,” due to the division of one world into two through fission. Qwdfq belongs neither to the Earth nor to the Moon; he is a creature of both and lost somewhere between the two. Now bound to the Earth, Qwdfq longs to join the cool, hard, barren surface of the Moon, to escape from the now teeming, intoxicating matter of the Earth covered in thick forests and neon signs, no longer the watery planet preceding fission.

**DISTANCE AND PROXIMITY: THE ORIGINS OF THE MOON**

In looking at our Moon as we see it from Earth, it appears unchanging, a perfect sphere, the lunar maria and the larger craters visible and invariant. The surface of the Moon seems to be a record of its own coming into being. With little atmosphere or geological fluctuation to speak of, the Moon is a testimony to its

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*Fig. 2. Still from Soft Moon, 2010. (© Jane Grant, Kin)*
bombardment and an atomic repository of the solar wind. In contrast, the Earth is always in flux, its permeable mantle and changeable atmosphere obfuscating or destroying many of these objects from other worlds. The early Earth’s chemical structures, hidden in ejected rocks from the Late Heavy Bombardment, may be buried just a few meters deep under the lunar regolith. At that time, the Moon’s orbit around the Earth was closer, allowing ejected material from the Earth to be flung onto the surface of the Moon. In this sense, we might see the Moon as a museum, safeguarding the early matter of our planet.

From time to time I look up at the Moon and think of all the desert, the cold and the void up there which weighs down on the other side of the scales and sustain this poor pomp of ours. I know that I am in debt to the Moon for everything I have on Earth, indebted to what is not here for everything that is [22].

The Moon, our nearest neighbor, is the only other world we have inhabited, albeit temporarily, and in emphasizing the closeness of the physicality of both spheres, we highlight the intimacy of this relationship. As our Moon continues to widen its orbit, pushed by tidal forces, its gradual drift away from the Earth emphasizes our loneliness in the universe and the vastness of space.

The succession of theories and ideas regarding the formation of the Earth and its Moon are multifarious, influenced by politics, philosophy, spiritual beliefs and, of course, the development of scientific instruments. At one time, the Moon and Sun were considered deities, celestial beings made of light and something quite other than the matter of the Earth. The astronomer and philosopher Anaxagoras of Clazomenae (c. 500–c. 428 BCE) proposed instead that the Sun, Moon and stars were made of some sort of “incandescent stone” [23], being physical material rather than divine, intangible gods. Anaxagoras believed that the matter of the Universe—the stars and planets visible to him—was formed from fragments of the Earth thrown into space, thereby forming the planets and stars that he believed circled the Earth [24]. It was also supposed that the Moon was populated, and that these human inhabitants, in looking out into space, would see that the Earth, with its spots, would also present to them such a map upon a nearly black Sky by day, with a surface fourteen times greater than that which the full Moon presents to us, and always in the same position. But the constantly varying clouds and obscurities of our atmosphere would could [sic] fuse the outlines of the continents [25].

Another theory was that the Moon was a vast celestial mirror, reflecting an image of the Earth back to all those gazing upon the lunar surface [26]. Again, in Asia Minor [27], a theory emerged that the Moon is a reflection of the Earth, and that “what we see in the moon is ourselves; it is the map of the Earth” [28].

On an Earth unable to look back on itself, the mirroring of our planet is very significant in that it serves as a space in which to see at a distance our home as a whole, to identify it and in turn glimpse ourselves in the immensity of the universe. In considering this mirror image or “map of the Earth” as allegorical, as a record of the distention and separation of the matter of the Earth through fission, we might imagine the entrails of the Earth, “the mucus of the Earth’s innards, riddled with mineral fluids and lava” [29], forming a petrified indentation resulting in the surface of the Moon. The Moon, in pulling away from the Earth, incurs scars—the lunar maria and the Pacific Basin—physical testaments to fission.

In “The Distance of the Moon,” Calvino writes of a time when the Moon was very close, expounding upon the proximity of its orbit around the Earth. There were many other theories regarding the marks on the surface of the moon [30]. Another belief that many philosophers shared was that the shadows of dense, unseen, opaque bodies floating in space between the Sun and the Moon were cast upon its surface. Others believed that there was “some intervening substance in space itself, whether between the Moon and the Earth or the Moon and the Sun. Such a substance might include a certain ‘moistness’ or a series of ‘vapours’ drawn up from the surface of the Earth” [30]. Here, only the effects of these mysterious celestial bodies or mists were seen. At a time before the technology of the telescope afforded astronomers extended vision, details of the Moon, the planets in our solar system and the spaces in between could only be inferred or imagined. Invisible objects, gases and fluid matter conjured from the improbable casting of shadows on the surface of the Moon remind us, from the perspective of our dazzling world of scientific discovery where shadows are eliminated, of what it is not to see.

Once the telescope was invented and was turned toward our Moon and as optics improved, the Moon drew incrementally closer to the Earth, became of the Earth at a slight remove, the vast distances of the universe framing the in-
timacy and the proximity of both worlds. As technologies advance and our understanding of the chemical and material structure of our universe deepens, the Moon returns to us, if not bodily, then in its origin and sharing of matter.

The Eighth Continent is an epithet used to describe the Moon that was once part of the Earth. Giant Impact, the current and most likely theory of the formation of the Earth-Moon system, proposes that an impactor around the size of Mars crashed into the newly formed Earth, flinging a large amount of matter into space; this matter then coalesced, forming our Moon. As the Eighth Continent, the Moon becomes part of the Earth, in our possession, but at a remove. Politically, in naming it, we are able to negate distance and difference, to regard its materials as ours to use, its surface ours to inhabit.

**Matter and Mutability**

Spheres result from the distribution of matter in an isotropic gravitational field, the lowest energy state in a gravitational system. The distributed matter within any astronomical object is bound together under its own gravity. In looking at the Moon and the planets in our solar system, we see these worlds as formed, solid, impenetrable, perfect and apart. Each world is delicately connected to the others and held in place by the gravitational attraction of each planet with the Sun and in smaller ways with each other.

In depicting the mutual effect that each bodily mass has on the other, Calvino’s short story and the film *Soft Moon* accentuate the relationship of affect to accretion; the exchange of lunar and terrestrial material becomes a physical manifestation of thought, a dialogue between two or more bodies. Bergson, in linking matter to thought, likens extended matter to a form of consciousness, wherein everything is in a state of perfect equilibrium, balancing and stabilizing movement. Bergson speaks of matter as an immense body in which all elements act reciprocally on one another, all parts linked together in an “uninterrupted continuity” [31], the outlines or surfaces of objects a limit of perception and not the “porous and indefinite” intensity of atoms; “solidity is far from being an absolutely defined state of matter” [32].

Between the supposed molecules of bodies the forces of attraction and repulsion are at work. The influence of gravitation extends throughout interplanetary space. Something, then, exists between the atoms. It will be said that this something is no longer matter, but force. And we shall be asked to picture to ourselves, stretched between the atoms, threads which will be made more and more tenuous, until they are invisible and even, we are told, immaterial [33].

In positing a tangible relationship between consciousness and matter, we are presented with a vivid pictorial analogy of the forces between things, externalizing thought in such a way that it may be seen as plastic, functioning semi-independently of its mass, and in a similar way, in Lem’s *Solaris*, the mind appears to function semi-independently from the physical matter of the brain. The idea thus offers the science-fiction writer a visualization of the reciprocity of materials on scales that could not occur in our worlds.

There are body tides on the Moon [34] caused by the periodic closeness of its elliptical orbit around the Earth, and while these tides are small in amplitude, they afford us a less-inert picture of our satellite. In this way the Moon becomes something at once giving, in flux, resonating and affected. The matter of the Moon, in episodically straining to fuse with the matter of the Earth, draws toward the Earth’s surface by more than 10 cm and then recedes, temporarily slipping back into its own spherical form.

We live in a time of mass and of matter, the conglomeration of the material of the universe into discrete stars, planets, gases and nebulae being a temporary condition. The Stelliferous Era, the age of the stars, presents a seeming equilibrium of celestial cohesion. Of course it is not—nothing in the universe is static; everything is in a state of dynamic mutability. This age of matter and of light is only a small fraction of the life of the universe. Eventually all of the stars of the Stelliferous Era will either disappear or collapse in on themselves, becoming black dwarfs, hypothetically the most densely packed objects ever formed in the cosmos. These stellar remnants will also eventually evaporate and with them the last matter of the universe, which will be dispersed in the form of radiation. Eventually, once the last atom of matter has disappeared, all that will remain are particles of light and black holes scattered across the universe [35].

Thus will begin the Dark Era, when there will be “no more stellar bodies, only an inventory of leftover particles, positrons, electrons, neutrinos and lots of long-wavelength photons” [36]. We are of the Stelliferous Era, and it is unfathomable to contemplate a cosmos that is dark and empty of mass and matter.

The eye falls upon light, the hand on matter. It seems that our tangible understandings of matter and time are largely related to our corporeal selves, to our senses. Most of what does happen, however, takes place on entirely different time scales or too far away to be seen unaided by our tools of observation, outside of our comprehension, invisible and abstract, “operat(ing) on principles too
different from anything that influenced our evolution” [37]. While we can model and measure rates of change and mutability through calculation and abstraction, our conception of cosmological and geological time is still difficult to grasp, to fold into the human sensormum, to relate to ourselves, to our duration. As the universe slowly expands, the invisible, incremental pulling apart of matter continues on such a scale that it becomes unfathomable, abstract in relation to our sense of time.

When science fiction works, it allows a narrative to fix itself to these very complex and often abstract ideas, ideas too strange to present themselves in our present world.

“Look stuff is coming down!” and I raised my arm to point out a suspension of thick drops of creamy pap in the air. But at the same moment a vibration came from the Earth, a tinking; and through the sky, in the direction opposite to the falling clumps of planetary secretion, a very minute flight of solid fragments rose, the scales of the Earth’s armour which was being shattered: unbreakable glass and plates of steel and sheaths of non-conducting material, drawn up by the Moon’s attraction as in an eddy of grains of sand [38].

References and Notes

Uedited references as provided by the author.


27. Asia Minor is a historical geographic term describing the westernmost extension of Asia, including a large part of Turkey.


35. “Destiny,” Wonders of the Universe, BBC 2 (06.03.2011).


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