# The Machine Awakens: The Science and Politics of the Fantastic Automaton

# John Tresch

Abstract Automatons of the eighteenth century testified to a faith in the rationality of a clockwork universe. During the early nineteenth century, in the Restoration and July Monarchy, images of self-moving machines were newly associated with the physics of ethers, conversions, steam and electricity, as well as with animal magnetism; they also frequently had magical and religious associations. This new generation of fantastic automatons can be seen as a reaction to the demiurgic power of mechanized industry and as a focal point for rethinking the past while facing an uncertain future. Images of animated matter and self-moving machines reveal the close partnership between romanticism and mechanization. Beyond highlighting the connections among the sciences of fluids, conversions and transmutations, fantastic literature, the emergence of mass entertainment, and early socialism, images of fantastic automatons reveal the supernatural undercurrents of the early industrial age.

It is fire which brings metamorphosis; It makes all things obey, It gives a soul to rude bodies; From the mud, at its magic touch, Water rises up with an energetic thrust And moves a forest of steel.

Victor de Laprade, Le nouvel âge

## A Mystery of Love Rests in Metal

Machines in the eighteenth century were often seen to embody the promises of reason and enlightenment. This was strikingly the case with automatons: devices that moved on their own in imitation of natural objects and processes. The most celebrated among them were orreries (models of the solar system), clocks, and mechanical animals and humans. Jacques de Vaucanson, who introduced programmable looms into the silk trade in Lyons and helped found Paris's Centre National des Arts et Métiers, designed and built automatic flute

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players, drummers, and a duck that flapped its wings and appeared to digest pieces of grain; the Swiss Jacquet-Droz family built a boy who wrote in a fine hand with quill and ink, as well as a woman who played a harpsichord and moved with gestures expressing delicate feelings. Earlier self-moving machines, going back to the Middle Ages and the Renaissance, had been connected with magic and secret arts; yet the charming automatons of the Enlightenment—like the tools and manufacturing processes on the plates of the *Encyclopédie*—were frequently presented as emblems of rationality, technical skill, and the power of humans to understand and master nature.<sup>1</sup>

In the first half of the nineteenth century, automatons took on stranger, more somber shadings. This shift was most pronounced in fantastic literature-a romantic genre baptized in France in 1829 by Jean-Jacques Ampère (the literary critic and son of André-Marie Ampère, the founder of electrodynamics) in a discussion of the tales of E. T. A. Hoffmann. Sigmund Freud later analyzed Hoffmann's "The Sandman," the story of a bewitching automaton, as an instance of das Unheimliche or "the uncanny"-the eerie feeling produced when an alien object is recognized as familiar and possessed of a primal emotional charge. For Tzetvan Todorov, whose key examples came from Hoffmann's French imitators, the fantastic was defined by the "hesitation experienced by a person who knows only the laws of nature, confronting an apparently supernatural event."<sup>2</sup> Both of these aspects of the fantastic-a disquieting affective relation with nonhuman objects and the hesitation between natural and supernatural explanationswere common experiences in the first half of the nineteenth century in France. Beyond its psychoanalytic and literary meanings, fantastic imagery of automatons may be read as an inscription of the metaphysical, scientific, and political uncertainties of the early industrial age.

The illustrator J. J. Grandville's popular book *Another World* (*Un autre monde*) used the visual tropes of the fantastic to present, in a hys-

<sup>1</sup> Simon Schaffer, "Enlightened Automata," in *The Sciences in Enlightened Europe*, ed. William Clark, Jan Golinski, and Simon Schaffer (Chicago, 1999), 126–65; Jessica Riskin, "The Defecating Duck; or, The Ambiguous Origins of Artificial Life," *Critical Inquiry* 20 (2003): 599–633; Adelheid Voskuhl, "Producing Objects, Producing Texts: Accounts of Android Automata in Late Eighteenth-Century Europe," *Studies in History and Philosophy of Science* 38 (2007): 422–44; Joan Landes, "The Anatomy of Artificial Life: An Eighteenth-Century Perspective," in *Genesis Redux: Essays in the History and Philosophy of Artificial Life*, ed. Jessica Riskin (Chicago, 2007), 96–118. For a *longue durée* perspective, see other chapters in that volume, as well as Otto Mayr, *Authority, Liberty, and Automatic Machinery in Early Modern Europe* (Baltimore, MD, 1986); and Minsoo Kang, *Sublime Dreams of Living Machines: The Automaton in the European Imagination* (Cambridge, MA, 2010).

<sup>2</sup> Pierre-Georges Castex, Le conte fantastique en France de Nodier à Maupassant (Paris, 1951); Joan Kessler, ed. and trans., Demons of the Night: Tales of the Fantastic, Madness, and the Supernatural from Nineteenth-Century France (Chicago, 1995); Sigmund Freud, "The Uncanny," in The Uncanny, trans. David McLintock (New York, 2003); Tzvetan Todorov, The Fantastic: A Structural Approach to a Literary Genre, trans. Richard Howard (Ithaca, NY, 1975), 25. terically distorted form, the debates, tensions, and potentials of its own world.<sup>3</sup> The book's fractured narrative followed the attempts of a trio of journalists, self-named "neo-Gods," to create a new religion that would unite the kingdoms of nature, realize a perfect system of government, and earn a tidy profit. One of their first schemes was a symphony performed entirely by machine. An image of this "Steam Concert" shows frenetic musicians with faces made of steam whose appendages resemble the pistons of engines, keeping precariously in time by following a pressure indicator (fig. 1). This chaotic scene-echoed by the "apocalyptic ballet" performed by shape-shifting objects in a later section-is a grotesque mockery of the decorous and harmonious demeanor of Enlightenment-era automatons. Grandville's chimeras, and above all his automatons, embodied the cosmic hopes and anxieties of late romanticism, the metamorphoses brought by mass-scale industry and the unorthodox religious themes that shaped the social philosophies of the 1840s.

The shift in representations of machine-humans that we can see in Another World-from the eighteenth century's delicate reassurances of rational mastery to the early nineteenth century's sublime, even apocalyptic metamorphoses-was geared to broader transformations. New manufacturing techniques multiplied the nation's productive capacities, especially in print and textiles; railroads, steamboats, and telegraphs sent people, goods, and words across vast distances; telescopes, daguerreotypes, and other scientific instruments revealed secrets of nature. Regimes rose and fell: Napoléon's Empire gave way to the Bourbon Restoration, the revolution of 1830, and the July Monarchy of Louis-Philippe, whose deafness to the demands of the unrepresented majority led to the worker's revolution of 1848. As Karl Marx and Friedrich Engels declared in 1848, "All that is solid melts into air": in their prophecy we should hear the acknowledgment not only of the destructive zeal of the bourgeoisie and of the nascent worker's movement but also that of the energy conversions that powered new industry.<sup>4</sup>

This was also the age of romanticism, whose imaginative leaps, frenzied contrasts, and alleged wariness toward mechanism we might see at work in the "Steam Concert." Yet while opposition to mechanism was undeniably a common romantic theme, the variability of fantastic images of machine-humans lets us bring out an intriguing counter-

<sup>&</sup>lt;sup>3</sup> J. J. Grandville, Un autre monde: Transformations, visions, incarnations, ascensions, locomotions, explorations, pérégrinations, excursions, stations. . . . (Paris, 1844).

<sup>&</sup>lt;sup>4</sup> Karl Marx and Friedrich Engels, "The Manifesto of the Communist Party," in *The Marx-Engels Reader*, ed. Richard Tucker (New York, 1978), 469–500. For a beautiful discussion of relations among technological modernization, artistic modernism, and creativity, very close to the concerns of this article, see Marshall Berman, *All That Is Solid Melts into Air* (New York, 1983).



Figure 1 "Concert à la vapeur." Grandville, Un autre monde, 17

melody. Many postrevolutionary authors sought to correct what they saw as the soulless mechanism of the eighteenth century, yet without rejecting mechanical science or technology outright. Instead, romanticism's emphasis on subjectivity, passion, and invisible powers often went hand in hand with the development of mechanical science and the introduction of new technologies. Machines were frequently presented as symbols and tools for the realization of mind, soul, or spirit in the world. These contrasting strands of mechanical romanticism wove together in automatons and in the closely related imagery of animated objects.

The fantastic automaton was an instance of a more general, recurrent motif: the material object that springs unexpectedly into action. The unease such moments could provoke-Is it alive? And if so, what must the world be like?-were tied to historically specific uncertainties about the relation of spirit and matter and the power and limits of technology. Such experiences also resonated with a widespread interest in pantheism, an identity between God and nature, expressed both by the engineers who followed the prophet Henri de Saint-Simon and by poets including Alphonse de Lamartine and Gérard de Nerval, with his neo-Pythagorean dictum: "A mystery of love rests in metal; 'Everything senses!' And everything acts on your soul."5 Automatons were potent and paradoxical symbols for this period's clashing worldviews, whether materialism, traditional Cartesian mind-body dualism, mystical illuminism, or monistic pantheism; they could embody technological control and reduction, as well as channeling supernatural powers that defied clockwork rationality.

The subtle diagnostician of nineteenth-century Paris, Walter Benjamin, argued that the technical reproduction of works of art destroyed the experience of aura, which he defined by "the transposition of a response common in human relationships to the relationship between the inanimate or natural object and man. To perceive the aura of an object . . . means to invest it with the ability to look at us in return."<sup>6</sup> Even so, he held out hope that a new experience of a merger of mind and living nature might be realized by technology itself, in an avant-garde cinema of and for the masses.7 This article takes many of its cues from Benjamin's historical dialectics. Yet I wish to show that in the early nineteenth century, the pursuit of romantic hopes by means of technology and the "auratic" experience of having one's gaze returned by a nonhuman object did not belong simply to forgotten dreams, a receding past, or a hoped-for future. The sense of material objects as alive and even awake was a central and mainstream-if tendentioustheme in the sciences, arts, and politics of the Restoration and the July

<sup>&</sup>lt;sup>5</sup> Gérard de Nerval, Vers dorés (1845), in *Oeuvres complètes*, ed. Jean Guillaume and Claude Pichois, vol. 1 (Paris, 1989), 739.

<sup>&</sup>lt;sup>6</sup> Walter Benjamin, *Charles Baudelaire: A Lyric Poet in the Era of High Capitalism*, trans. Harry Zohn (London, 1983), 148. See also Benjamin, *The Arcades Project*, trans. Howard Eiland and Kevin McLaughlin (Cambridge, MA, 1999).

<sup>&</sup>lt;sup>7</sup> Miriam Hansen, "Benjamin, Cinema, and Experience: The Blue Flower in the Land of Technology," *New German Critique*, no. 40 (1987): 179–224.

Monarchy. The fantastic merger of mind and machine was a widespread obsession, one that guided the creation of the technical infrastructure of modernity.

Juxtapositions of contradictory views of the natural order were not restricted to the fantastic arts; they also defined the sciences of this period. A conception of matter as involving stable forces in equilibrium gave way to one that focused on volatile, interconvertible forms of energy; the self-powered steam engine was replacing the clock and the lever as a cosmic symbol.<sup>8</sup> Many suggested, controversially, that heat, electricity, magnetism, and light were merely modifications of a single underlying principle. It was an easy step to include life and thought within the circle of analogies and conversions: just as heat drove engines and electricity could move a wire, so might spirit or soul be a transferable property animating the human body-a possibility some saw proven by animal magnetism. In the expanded print culture of the July Monarchy, these debates, in which the authority of established theories and institutions were at stake, intersected with discussions about the proper order and the unifying bonds of a future society organized around industry. Such discussions often evoked uncanny mergers of machines and organisms and involved images of animated devices.

This essay will first sketch major fault lines in the sciences of this period, between a physics of determinist points and forces and one focused on ethers and conversions, between the biological assumption of the fixity of species and theories of transmutation. These discussions highlight changing understandings of machines and mechanisms, as well as the political implications of the sciences. Next I will examine closely related themes-convertible fluids, mechanical metamorphoses, the spiritualization of matter-through fantastic literature's automaton imagery, interpreting this genre's "otherworldly" obsessions as ambivalent reactions to mechanization. Automatons were also central to the "fantastic evenings" of the stage magician and "physicist" Jean-Eugène Robert-Houdin, whose performances reveal the metaphysical ambiguities at the root of modern mass entertainment. Yet such ideas were more than just playful diversions. Animated machines, living matter, and automatons played a starring role in the vibrant imaginary of early socialism. While utopian socialists have been derided as "fantastic," their views of a transformative integration between machines and

<sup>&</sup>lt;sup>8</sup> On the steam engine as a cosmic symbol, see Michel Serres, "Turner Translates Carnot," in *Hermes: Literature, Science, Philosophy*, trans. Josue Harari (Baltimore, MD, 1982), 54–62; and M. Norton Wise, "Work and Waste: Political Economy and Natural Philosophy in Nineteenth Century Britain," *History of Science* 27 (1989): 263–301, 391–449; 28 (1990): 221–61, which details the transition from balance to engine and from equilibrium to irreversibility across a vast range of fields.

humans closely matched the central concerns of the science and technology of their age.

Exploring automaton imagery from the years before 1848 lets us trace important and overlooked intersections between science, literature, and politics in a moment defined, paradoxically, by both romanticism and positivism. More fundamentally, it highlights a neglected dimension of the cultural history of industrialization by bringing out the fantastic, supernatural, and frequently religious undercurrents that accompanied the arrival of the machine. Lifelike automatons might be seen to exemplify the jarring clashes of an unstable period—an age torn between a longing for spiritual unity and the fragmentation of technical specialization and liberal individualism. At the same time, images of enlivened matter and awakened machines could be prophetic symbols of an approaching synthesis: harbingers of a new and harmonious world that might be made to spring to life from the wreckage of the old.

## Fluids, Conversions, and Fantastic Instruments

Fantastic literature's depictions of extraordinary events appearing to contradict the laws of nature have been read as a challenge to the uniform and predictable reality assumed by modern mechanistic science. Yet key themes of the fantastic—conversions among vital fluids, unexpected metamorphoses, clashes between worlds, and above all, the blurring of the mechanical and the living—were at the heart of the sciences of the early nineteenth century. Further, although the eighteenth-century dream of building machines that directly imitated living things had largely (if not entirely) evaporated, imagery of automatons played a role in scientific debates about the nature of matter and life.<sup>9</sup>

Fierce controversies divided French physicists and life scientists in the Restoration and July Monarchy along lines simultaneously metaphysical and political. During Napoléon's reign, the astronomer Pierre-Simon Laplace and his followers had laid out a program to unify physics by linking planetary motion to the earthbound phenomena of light, heat, electricity, and magnetism. These weightless or "imponderable" fluids had previously been a special class of phenomena, studied in qualitative terms; borrowing concepts from Newtonian mechanics, Laplacean physicists assumed that these fluids were composed of particles that repelled each other yet were attracted to

<sup>&</sup>lt;sup>9</sup> On the eclipse of eighteenth-century attempts to engineer organisms, see Jessica Riskin, *Mind out of Matter* (New York, forthcoming); on early-nineteenth-century research into electricity as the basis of life, see James Secord, "Extraordinary Experiment: Electricity and the Creation of Life in Victorian England," in *The Uses of Experiment*, ed. David Gooding, Trevor Pinch, and Simon Schaffer (Cambridge, 1989), 337–83.

the particles of weighted matter.<sup>10</sup> They developed precise new instruments and experiments to measure their effects and looked for inverse square laws analogous to the law of gravitation to explain their actions. This research program, which reached its apogee during the Empire, brought the lawlike regularity and determinism of celestial mechanics down to earth. Laplace's famous thought experiment about an intelligence capable of predicting all future states of the universe lent scientific authority to the notion that even human actions follow mechanical laws.<sup>11</sup>

Yet many challenged the "standard view" that light, heat, electricity, and magnetism were distinct entities, and with it Laplace's determinism.<sup>12</sup> In the eighteenth century Franz Anton Mesmer's notion of a universal subtle fluid, Erasmus Darwin's materialist account of the origins of life, Immanuel Kant's dynamic account of matter, and Humphry Davy's chemistry all suggested that the imponderable fluids were actually modifications of a single underlying fluid, power or ether. In the early years of the nineteenth century, German *Naturphilosophen* sought the fundamental principles uniting these phenomena by testing the interactions and conversions among them.<sup>13</sup> After the fall of Napoléon such ideas entered France along with the German literature, philosophy, and science introduced by Germaine de Staël, Victor Cousin, and the Paris-based Prussian geophysicist Alexander von Humboldt.<sup>14</sup>

Romantic concepts of natural unity and dynamic conversions contributed to the fall of Laplace's program of physics in the Restoration. Humboldt's close friend, the republican astronomer François Arago, led a conceptual and institutional coup against Laplace starting around 1815; the physicists he rallied together explained the action of heat, light, electricity, and magnetism by the vibrations of a continuous, all-pervading ether. Physicists studying steam engines, includ-

<sup>&</sup>lt;sup>10</sup> On the contingencies and polemics behind the consolidation of the "Newtonian Enlightenment" in France that prepared Laplace's ascendancy, see John Bennett Shank, *The Newton Wars and the Beginning of the French Enlightenment* (Chicago, 2008).

<sup>&</sup>lt;sup>11</sup> Thomas Kuhn, "Mathematical versus Experimental Traditions in the Development of Physical Science," in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago, 1977), 51–65; P. M. Harman, *Energy, Force, and Matter: The Conceptual Development of Nineteenth-Century Physics* (Cambridge, 1982), 12–19; John Heilbron, *Weighing Imponderables and Other Quantitative Science around 1800* (Berkeley, CA, 1993).

<sup>&</sup>lt;sup>12</sup> Ian Hacking, "Nineteenth Century Cracks in the Concept of Determinism," *Journal of the History of Ideas* 44 (1983): 455–75. On the "standard view," see John Heilbron, "Some Connections among the Heroes," *Revue d'histoire des sciences* 54 (2001): 11–28.

<sup>&</sup>lt;sup>13</sup> See Nicholas Jardine and Andrew Cunningham, eds., *Romanticism and the Sciences* (Cambridge, 1990); and L. Pearce Williams, "Kant, *Naturphilosophie*, and Scientific Method," in *Foundations of Scientific Method: The Nineteenth Century*, ed. Ronald Giere and Richard Westfall (Bloomington, IN, 1973), 3–22.

<sup>14</sup> Etienne François et al., eds., Marianne und Germania: Deutsch-französischer Kulturtransfer im europäischen Kontext, 1789–1914, 2 vols. (Leipzig, 1998).

ing Arago, Pierre Dulong, and Alexis Petit, presented heat not as the distinct fluid, "caloric," that it had been for Laplace, but as a kind of motion; Augustin Fresnel argued that light traveled not in rays of particles but in waves. In 1820 Arago reported the discovery by the Danish *Naturphilosoph* Hans-Christian Oersted that an electrical current produced motion in a magnetized needle. Fresnel's landlord, André-Marie Ampère, conducted a series of experiments that set wires, compasses, metal coils, and helices into carefully controlled motion; from these devices he established laws for the invisible electrodynamic forces behind their movements. A strong supporter of Fresnel's wave theory of light, Ampère asserted the identity of electricity and magnetism in an all-pervading fluid whose vibrations were responsible for the transmission of light and heat.<sup>15</sup>

Imponderable fluids were said to be "known only by their effects"; thus scientists relied heavily on the new experimental devices that produced these phenomena in measurable and comparable forms. Arago and his allies invented new, precise instruments to harness and make visible the relations among light, heat, electricity, and magnetism; engineers of the Ecole Polytechnique developed a set of dynamometers and "brakes," as well as self-inscribing instruments inspired by James Watt's pressure indicator, to measure automatically the efficiency of steam engines; in 1839 Arago secured a patent and international acclaim for the daguerreotype, a machine that produced images of the external world by harnessing the action of light. Historians of science have recently associated these techniques with an emerging scientific ideology of "mechanical objectivity," in which automatic machines were valued because they removed the effects of human error and idiosyncrasy: such devices have been seen as weapons in the ever-renewed campaign to purify knowledge of bias, metaphysical error, and superstition.<sup>16</sup> But if we place these sensitive and self-acting instruments

<sup>&</sup>lt;sup>15</sup> André-Marie Ampère, "Mémoire présenté à l'Académie Royale des Sciences, le 2 octobre 1820, où se trouve compris le résumé de ce qui avait été lu à la même Académie les 18 et 25 septembre 1820, sur les effets des courans électriques," *Annales de chimie et de physique* 15 (1820): 59–74, 170–218; Robert Fox, "The Rise and Fall of Laplacian Physics," *Historical Studies in the Physical Sciences* 4 (1976): 89–136; Kenneth Caneva, "Ampère, the Etherians, and the Oersted Connection," *British Journal for the History of Science* 13 (1980): 121–38; Steven Brush, "The Wave Theory of Heat: A Forgotten Stage in the Transition from the Caloric Theory to Thermodynamics," *British Journal for the History of Science* 5 (1970): 145–67.

<sup>&</sup>lt;sup>16</sup> Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations*, no. 40 (1992): 81–128; Daston and Galison, *Objectivity* (Cambridge, 2007); Christine Blondel, "Electrical Instruments in Nineteenth Century France, between Makers and Users," *History and Technology* 13 (1997): 157–82; Robert Brain, "Representation on the Line: Graphic Recording Instruments and Scientific Modernism," in *From Energy to Information: Representation in Art, Science, and Literature*, ed. Bruce Clarke and Linda Henderson (Stanford, CA, 2002), 155–57; Theresa Levitt, "Biot's Paper and Arago's Plates: Photographic Practice and the Transparency of Representation," *Isis* 94 (2003): 456–76.



**Figure 2** One of Ampère's romantic machines: an apparatus for demonstrating the equivalence of electric and magnetic currents, from Ampère, "Mémoire présenté à l'Académie Royale des Sciences." AB is an electric conductor that, when replaced by a magnetic bar, produces the same rotary motion in the suspended wire NM (plate 1, explained in Ampère, 216)

alongside closely related representations of animated machines of the time—steam engines, electromagnetic apparatuses, or fantastic caricatures such as Grandville's anthropomorphic instruments (fig. 2)—the gestalt may switch. These rational devices, brought to life by obscure, protean forces, were closely linked to unorthodox metaphysical possibilities *within* the sciences (fig. 3).<sup>17</sup>

<sup>&</sup>lt;sup>17</sup> On Arago's introduction of the daguerreotype as a fantastic technology, see John Tresch, "The Daguerreotype's First Frame: François Arago's Moral Economy of Instruments," *Studies in History and Philosophy of Science* 38 (2007): 445–76.



Figure 3 Telescopes observe an eclipse. Grandville, Un autre monde, 94

By explaining heat and electromagnetism by the action of a ubiquitous, vibrating, and convertible ether, these physicists participated in a broader shift in conceptions of both matter and machines. While the clock and the balance—in which an external force was transmitted by passive and homogeneous parts—had served as emblems for the predictable and deterministic universe of Laplace, the steam engine was driven by dynamic, explosive forces within it. Converting coal into heat, water into steam, and steam into motive force or work (*tra*- vail), the steam engine dissolved the ontological distinction between heat and motion and, potentially, between matter and energy. A steam engine was an automaton whose living forces (forces vives) made it both mechanical and ambiguously alive.<sup>18</sup> Likewise, the forces unleashed by magnets and the Voltaic pile appeared to many as manifestations of an active power inherent to matter. Post-Laplacean physicists' emphasis on the connections between these hidden forces had resonances beyond the walls of the academy. Alexandre Bertrand, a polytechnician and science reporter for Le globe (the leading journal of romantic criticism and liberal politics), summarized this "revolution in the high regions of physics": "The universe appears to us now as if entirely plunged into an infinite ocean of imponderable matter, in the midst of which weighted [pondérable] matter is merely an accident." Bertrand's article went on to suggest how the analogies among heat, light, electricity, and magnetism could explain chemical interactions as well as organic processes.<sup>19</sup> Post-Laplacean physicists were seen as marching toward a unified theory of nature, one that would also embrace the study of living things.

In physiology and natural history, the action of invisible fluids was assumed to be essential to the processes of life. Relays between these fields were nothing new. The concept of "combustion" was first developed in studies of animal respiration; Luigi Galvani, Humboldt, and others had explored animal electricity; and Jean-Baptiste Lamarck had argued that interactions among matter, ambient vapors, and imponderable fluids could prompt the development of new organs and even new organisms.<sup>20</sup>

Yet by 1830-in the famous debate between Georges Cuvier and

<sup>18</sup> In 1849 Charles Dupin, a naval engineer, a statistician, and the author of *Forces productives et commerciales de la France* (Paris, 1827), announced at the last of the National Expositions of the Products of Industry before they went international: "In the first ages of the world, grateful mortals erected altars to the inventors of the means of adding living forces to human labor by taming animals. Today, we happily honor the memory of the men who teach us how to tame, and I would almost dare to say, to give intelligence and life to the inanimate forces [of electricity, heat, steam, and gas]" (*Rapport du jury central sur les produits de l'agriculture et de l'industrie exposés en 1849*, 3 vols. [Paris, 1850], 1:66). See Thomas Kuhn, "Energy Conservation as an Example of Simultaneous Discovery," in *Essential Tension*, 66–104; and Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York, 1990).

<sup>19</sup> Alexandre Bertrand, *Le globe* 2 (1825): 1000. Founded by Pierre Leroux, *Le globe* was the leading journal of liberal politics, eclectic philosophy, romantic literature, and modern science before it became the organ for the Saint-Simonian movement in 1830. See Pierre Trahard, *Le romantisme défini par "Le globe"* (Paris, 1925); and Jacques Goblot, *La Jeune France libérale: Le globe et son groupe libérale, 1824–1830* (Paris, 1995).

<sup>20</sup> Jean-Baptiste Lamarck, *Histoire naturelle des animaux sans vertèbres*, ed. G. P. Deshayes and H. Milne Edwards, 2nd ed., vol. 1 (Paris, 1835), 42–47. The political valence of debates over vitalism, materialism, and the mechanisms of life before 1830 is mapped in L. Stephen Jacyna, "Medical Science and Moral Science: The Cultural Relations of Physiology in Restoration France," *History of Science* 25 (1987): 111–46; and Elizabeth Williams, *The Physical and the Moral: Anthropology, Physiology, and Philosophical Medicine in France,* 1750–1850 (Cambridge, 1994). Lamarck's defender, Etienne Geoffroy Saint-Hilaire – such notions were given new significance. Cuvier's insistence that species were unchanging and could be classed into four distinct embranchements clashed with Geoffroy's concept of a single "animal plan"-an "abstract animal" whose parts unfolded to different degrees in different species-and a unified nature undergoing constant development. Like his ally, Arago, Geoffroy positioned himself as a scientist of the people, the enemy of specialization and elitism. His synthetic studies featured flamboyant speculations on the causes of matter, life, and death that linked physics, chemistry, life science, and technology: "Combustion of a solid body restores it to its original form, which is a state of extreme attenuation of its molecules. Electrification takes up these molecules, proceeding by a progressive chain of translations, and remakes bodies." For readers in the 1830s, Geoffroy's use of the terms combustion and electrification resonated not only with Naturphilosophie but with the unifying potentials of steam and electromagnetism and recalled the dynamic machines they set into motion; among his champions were many of the polytechnicians who followed Saint-Simon.<sup>21</sup>

The notion of a unity of invisible forces or processes was also linked to investigations of animal magnetism. Despite the heavy criticism that Mesmer had suffered at the Academy of Sciences in 1784, his disciples produced a steady stream of publications under the First Empire and returned to public prominence in the 1820s. Spurred by new accounts of surgical uses of magnetism at the Hôtel Dieu and La Salpêtrière, the Academy of Medicine appointed another commission in 1825 to investigate claims of *somnambulisme*, including cases of seeing at a distance and surgery conducted without pain. The inheritors of Mesmer contributed to automaton imagery through their frequent superimposition of humans and machines: commissioners observed scenes in which patients became immobile, and then awoke, with their actions placed under the control of the magnetizer; their gestures and speech were said to be "mechanical."<sup>22</sup>

Though far from providing a complete endorsement, the commission's report in 1831 affirmed many of the magnetizers' claims; yet it

<sup>22</sup> On the revival of animal magnetism, see Alison Winter, *Mesmerized: Powers of Mind in Victorian Britain* (Chicago, 1998); Frank Podmore, *Modern Spiritualism: A History and a Criticism,* 2 vols. (London, 1902); Alan Gauld, *A History of Hypnotism* (Cambridge, 1992), esp. 111–40, 163–78.

<sup>&</sup>lt;sup>21</sup> Etienne Geoffroy Saint-Hilaire, Notions synthétiques, historiques et physiologiques de philosophie naturelle (Paris, 1838), 92. See Toby Appel, The Cuvier-Geoffroy Debate: French Biology in the Decades before Darwin (New York, 1987). Similarly, Jean-Baptiste Dumas equated the process of "combustion" in animal respiration to that of a steam engine, while the physiologist H. Milne Edwards wrote of "the division of organic labor." See Dana Simmons, "Waste Not, Want Not: Excrement and Economy in Nineteenth-Century France," *Representations*, no. 96 (2006): 73–98; on Geoffroy's socialist followers, see Franck Bourdier, "Le prophète Geoffroy Saint-Hilaire, George Sand et les Saint-Simoniens," *Histoire et nature* 1 (1973): 47–66.

offered no verdict as to the nature and causes of the magnetic sleep.<sup>23</sup> Geoffroy's colleague at the Museum of Natural History, J. P. F. Deleuze, explained the effects of magnetism by an invisible fluid that interacted with other forms of matter. Another die-hard mesmerist, the Marquis Chastenet de Puységur, likened the action of the magnetizer's will on a patient to the effects of heat, electricity, light, and magnetism on wires and compasses: the sleepwalker "obeys the directions of his magnetizer, just as the needle obeys the bar that makes it move."<sup>24</sup> If magnetized patients acted like machines, it was because they were directly analogous to the instruments set into motion in the study of imponderable fluids. Other interpretations saw somnambulism as empirical proof of the action of spirit in the material world; as the physician Etienne Georget stated in the Academy of Medicine in 1828, "New reflections on a truly extraordinary phenomenon, somnambulism, no longer allow me to doubt the existence, within us and outside us, of an intelligent principle completely different from material existences." Another reading-advanced by Bertrand in Le globe-was that the magnetizer's suggestions altered the organization of the patient's faculties, accessing new perceptions and the experience of extase.25

A large part of somnambulism's appeal lay in the challenge it posed to dominant norms of epistemology, physiology, and matter theory. It raised the possibility that invisible worlds have an observable impact on this one; that human consciousness and agency do not stop at the skin; and that material phenomena do not reduce to fixed atoms but must be understood as the interplay of continuous subtle fluids, powers, or patterns of vibrations. Unsurprisingly, animal magnetism therefore attracted iconoclastic etherian physicists like the chief anti-Laplacean, Arago; he joined George Sand (briefly a disciple of Geoffroy) in witnessing a thirteen-year-old somnambulist who read lines of text through a heavy blindfold. In the Academy of Sciences, Arago declared that "somnambulism should not be rejected a priori, especially by those who have kept up to date with the latest progress of physical sciences."<sup>26</sup> In 1846 he was also one of the investigators of the strange

<sup>&</sup>lt;sup>23</sup> See Nicole Edelman, "Un savoir occulté ou pourquoi le magnétisme animal ne fut-il pas pensé 'comme une branche très curieuse de psychologie et d'histoire naturelle'?" *Revue d'histoire du XIXème siècle* 1 (2009): 101–13.

<sup>&</sup>lt;sup>24</sup> A. M. J. Chastenet de Puységur, Du magnétisme animal, considéré dans ses rapports avec diverses branches de la physique générale (Paris, 1807), 12.

<sup>&</sup>lt;sup>25</sup> Georget in Alexandre Bertrand, *Du magnétisme animal en France, et des jugements qu'en ont portés les sociétés savants* (Paris, 1826), 518. On Bertrand, see also Jan Goldstein, *Hysteria Complicated by Ecstasy: The Case of Nanette Leroux* (Princeton, NJ, 2009).

<sup>&</sup>lt;sup>26</sup> François Arago, "Bailly: Biographie" (1844), in *Oeuvres complètes de François Arago*, ed. Jean-Augustin Barral and Pierre Flourens, 17 vols. (Paris, 1854–62), 2:315. In a report from the time, Arago was presented as a case study in the physiognomy of the uncanny: "I can only with difficulty

case of Angelique Cottin, a peasant girl from Normandy whose mere presence could make heavy objects fly through the air; though inconclusive trials led him to close the investigation, at first Arago believed "the electric girl" to possess an excess of somatic electromagnetism.<sup>27</sup>

Arago's interest in phenomena that challenged established scientific doctrine went hand in hand with his antiestablishment politics during the July Monarchy. Reason, he argued, required us to consider seriously phenomena that might appear unlikely—whether humans with extraordinary powers or government by the people. Likewise his studies of heat and steam engines were of a piece with his advocacy on behalf of the workers who used them. The self-moving steam engine suggested an analogy with the growing power of workers whose lives had been transformed by industry: formerly obedient tools that now appeared capable of rising up under their own power.<sup>28</sup>

#### **Uncanny Literary Technologies**

The protean fluids in physics, engineering, and animal magnetism underwrote the imagery of automatons and animated objects in romantic literature. An entire subgenre of poetry emerged that sang of the beauties and transformative potentials of mechanization: Victor Hugo urged artists to recognize industry's living, even supernatural power: "O poets! While you sleep, iron and ardent steam / erase from the earth the former gravity [*pesanteur*] of all hanging objects."<sup>29</sup> Honoré de Balzac's novel *La recherche de l'absolu* featured a chemist (modeled on both Arago and Ampère) who destroyed his family and fortune for mechanical equipment that would harness the sun's light to produce a new philosopher's stone: in his obsessive quest for the Absolute, the principle underlying all matter and life, "the First Cause, the key to all the phenomena of nature," his eyes fixated on a distant, invisible

render the astonishment painted on the handsome face of Mr. Arago when he saw the child read. He remained stymied; his eyes, fixed on the somnambulist, had a peculiar quality to them that struck all of the assistants" (quoted in Bernard Méheust, *Le défi du magnétisme*, vol. 1 of *Somnambulisme et médiumnité* [Paris, 1999], 417).

<sup>&</sup>lt;sup>27</sup> On Arago and animal magnetism, see Theresa Levitt, *The Shadow of Enlightenment: Optical and Political Transparency in France, 1789–1848* (Oxford, 2009); on the electric girl, 114; on Cottin, see also Eugène Rochas, *L'exteriorisation de la motricité* (Paris, 1896).

<sup>&</sup>lt;sup>28</sup> Bruno Belhoste, "Arago, les journalistes et l'Académie des Sciences dans les années 1830," in *La France des années 1830 et l'esprit de réforme*, ed. Patrick Harismendy (Rennes, 2006), 253–66. François Vatin traces the conceptual and practical overlaps between the study of *work* in engineering and *labor* in political economy in *Le travail, économie et physique (1780–1830)* (Paris, 1993).

<sup>&</sup>lt;sup>29</sup> Victor Hugo, Les voix intérieures, quoted in Elliott Mansfield Grant, French Poetry and Modern Industry, 1830–1870: A Study of the Treatment of Industry and Mechanical Power in French Poetry during the Reigns of Louis-Philippe and Napoleon III (Cambridge, MA, 1927), 11; see David Charles, La pensée technique dans l'oeuvre de Victor Hugo: Le bricolage de l'infini (Paris, 1997).

point; he had a "listless, mechanical way of walking," like someone magnetized.<sup>30</sup>

Many of Balzac's tales showed the influence of Hoffmann, whose translated works launched a wave of fantastic fiction. As we saw above, conflicts between incommensurable conceptions of nature focused on animated machines were an everyday occurrence in the science and technology of this time; fantastic literature dramatized such encounters. In *Le globe* in 1829 Jean-Jacques Ampère contrasted the "mechanical" effects of Ann Radcliffe with Hoffmann's "natural," "living marvelous," which prolonged readers' uncertainty without reducing unexpected events to a stable physical, psychological, or supernatural explanation. Yet in praising Hoffmann's work as antimechanical, Ampère obscured the fact that Hoffmann and his followers often intensified their uncanny effects through the imagery of animated machines.<sup>31</sup>

Hoffmann depicted inert, human-crafted objects-including scientific and musical instruments-as portals to a world of spirit and poetry.<sup>32</sup> In France this imagery often had a poignant aspect of historical revival; animated objects bridged the present and the prerevolutionary past. In Théophile Gautier's "Omphale," the narrator falls under the spell of the possessed portrait of an eighteenth-century noblewoman. Likewise, in "La Cafetière," a man falls in love with a mysterious woman who comes to him late at night: in a metallic voice she warns him that she must depart at sunrise, but when he tries to hold her, she shatters into fragments of china, revealing herself as the soul of the coffee pot on his bedside table. In both tales an object comes to life and pulls the protagonist toward a spirit realm identified with the past. Gautier's friend Alexandre Dumas similarly linked postrevolutionary pathos to vivified matter in his tale "Solange": set at the height of the Terror, the story tells of a medical student who, conducting electrical experiments on the severed heads of the guillotine's victims, finds the head of his fiancée, which opens its eyes at the sound of his voice. This brief resurrection references the lost individuality and passions of the ancien régime, while the student's laboratory-an abandoned

31 Ampère in Castex, Conte fantastique, 45.

<sup>&</sup>lt;sup>30</sup> Honoré de Balzac, *La recherche de l'absolu*, in *La comédie humaine*, vol. 10 (Paris, 1979), 657–835; Madeleine Fargeaud, *Balzac et la recherche de l'absolu* (Paris, 1968), 74–78. Balzac's notion of the Absolute assumed an identity beneath the analogies of imponderable physics, which incorporated the mind as well; as he put it in the preface to *The Human Comedy*, "Thought [may one day be] placed among the fluids that are only revealed by their effects and whose substance still escapes our senses enlarged by so many mechanical means" ("Avant-propos," in *La comédie humaine*, vol. 1 [Paris, 1976], 9).

<sup>&</sup>lt;sup>32</sup> E. T. A. Hoffmann, *The Best Tales of Hoffmann*, ed. E. F. Bleiler (New York, 1967). On Hoffmann's optical instruments, see Max Milner, *La fantasmagorie: Essai sur l'optique fantastique* (Paris, 1982), 39–93; on his musical instruments, see Emily Dolan, "E. T. A. Hoffmann and the Ethereal Technologies of 'Nature Music,' *Eighteenth-Century Music* 5 (2008): 7–26.

church fitted out with electrical equipment—suggests that magical and divine fluids, whether blood or spirit, may be more lasting than those of materialist physics and psychology.<sup>33</sup>

Other fantastic works registered a deeper historical consciousness: automatons fused notions of modern mechanical progress with evocations of ancient learning. The early nineteenth century abounded in references to Renaissance-era alchemy and hermeticism; Egyptian occult science and the tarot "rediscovered" by Antoine Fabre d'Olivet and the Abbé Constant were mingled with histories of pagan religions and Emmanuel Swedenborg's doctrines of correspondences between nature and the spirit world.<sup>34</sup> In the Renaissance, automatons, like amulets and idols, had been understood as magnets and mouthpieces for magical powers; in the early nineteenth century's patchwork of revived illuminism, automatons could be seen as allegories for the infusion of spirit in the material world.<sup>35</sup> By drawing on this earlier tradition, fantastic authors superimposed the promises and warnings found in ancient tales of knowledge on their age's technological ambitions. The poet Léon Laurent-Pichat's Ce siècle est en travail was one of many to demonstrate a reinvestment of his century's innovations with ancient myth: "At the risk of being an atheist / I love Pygmalion and I love Prometheus."36 The meaning of technologically animated objects was double: they were symbols of both forward-looking technological rationality and ancient supernatural belief.

Alphonse Esquiros—promoter of animal magnetism, socialist critic, and member of the Club des Hachichins—recuperated the automaton's mythical past by setting his 1838 novel, *Le magicien*, in the sixteenth century. A sculptor, Gabriel Stell, falls in love with a statue

<sup>33</sup> Théophile Gautier, "La cafétière" (1831), and "Omphale" (1834), in *Contes et récits fantastiques* (Paris, 1997), 53–63, 65–76; Alexandre Dumas, "Solange," in *Les milles et un fantômes* (Paris, 1852). On the association of women and automatons, see Felicia Miller Frank, *The Mechanical Song: Women, Voice, and the Artificial in Nineteenth-Century French Narrative* (Stanford, CA, 1995); Tobin Siebers, *The Romantic Fantastic* (Ithaca, NY, 1984); and Susan Hiner, "Hand-Writing: Dismembering and Re-membering in Nodier, Nerval, and Maupassant," *Nineteenth-Century French Studies* 30 (2002): 301–15.

<sup>34</sup> Alexandre Erdan, La France mystique: Tableau des excentricités religieuses de ce tems [sic] (Paris, 1855); Auguste Viatte, Les sources occultes du romantisme: Illuminisme, théosophie, 1770–1820 (Paris, 1928); Lynn Wilkinson, The Dream of an Absolute Language: Emmanuel Swedenborg and French Literary Culture (Albany, NY, 1996).

<sup>35</sup> One of Victor Frankenstein's sources, Henry Cornelius Agrippa, wrote: "The ancient priests made statues, and images, foretelling things to come, and infused into them the spirits of the stars... they do always, and willingly abide in them, and speak, and do wonderful things by them" (in *Three Books of Occult Philosophy*, ed. Donald Tyson, trans. James Freake [St. Paul, MN, 1993], 114). On Renaissance automatons, see Victoria Nelson, *The Secret Life of Puppets* (Cambridge, MA, 2001); and William Eamon, "Technology as Magic in the Late Middle Ages and the Renaissance," *Janus* 70 (1983): 171–212.

<sup>36</sup> "Au risque d'être athée / J'aime Pygmalion et j'aime Prométhée." "Ce siècle est en travail," from *Libres paroles* (1847), in Grant, *Poetry and Industry*, 47. made by his own hands; Stell turns for help to Auréole Ab-Hakek, an Alexandrian magician rumored to have "the gift of giving life to stones or to metal" like Albertus Magnus, Roger Bacon and "Pygmalion himself." At Ab-Hakek's door, Stell is greeted by a servant whose movements "produced a hard and supernatural sound that made his hair stand on end, while at the same time the light of a lamp, in a very dark room, exaggerated the fantastic character of his features." This brass automaton leads him to Ab-Hakek, who leans over a tome murmuring: "*Homo animale rationale*: here is the definition of the great philosopher, Aristotle. . . . if I could prove that this definition holds for the man made by my own hands, I would be truly a creator and a God.'" In the Renaissance's dreams of giving a soul to a mechanical creature, Esquiros found an anticipation of the Faustian ambitions of modern industry.<sup>37</sup>

Nerval, who translated Goethe's Faust in 1828, published a series of hallucinatory tales that have been read both as accounts of his own madness and as allegories of the power of literature. Yet the visions of his most celebrated work, Aurélia; or, Dreams and Life, share a conceptual space with literary treatments of automatons, reproducing his age's obsession with the unstable boundaries between the animate and the inanimate. Haunted by memories of his lost love, Aurélia, the narrator comes to perceive Swedenborgian correspondences with "the invisible world." Abrupt, destabilizing transitions between worlds accompany material imitations of life: a mechanical bird introduces him to his dead ancestors, he reads announcements whose "typographic setting was made of garlands of flowers so well represented and colored that they seemed natural," and he observes a workshop in which workers mold "an enormous animal in the form of a llama" in clay; as limbs spring from this infernal Chia Pet, he rephrases Ab-Hakek's question: "Can we not also create men?" Committed to an asylum, he declares himself to be a god and drinks an entire bottle of ether before he is restrained.<sup>38</sup> Caught between ordinary life and "the other world," the narrator wavers between pious submission to the will of God and grandiose visions of control over nature. Aurélia's relentless metaphysical slippages echo the fundamental uncertainty of Nerval's time: What

<sup>&</sup>lt;sup>37</sup> Alphonse Esquiros, *Le magicien*, ed. Max Milner (Lausanne, 1978), 55, 60; in Gautier's "La pipe d'opium," a character named Esquiros proposes magnetic explanations for the narrator's marvelous experiences: see *Contes fantastiques* (Paris, 1962), 121–31. On Esquiros, see Naomi J. Andrews, *Socialism's Muse: Gender in the Intellectual Landscape of French Romantic Socialism* (Lanham, MD, 2006), 139–48. On the Club des Hachichins, see Charles Baudelaire, *Artificial Paradises*, trans. Stacy Diamond (Secaucus, NJ, 1996).

<sup>&</sup>lt;sup>38</sup> Ether (nitrous oxide, or sulphuric ether) was introduced for surgery in the 1840s; its perception-altering qualities encouraged an identification with the protean ethers assumed by animal magnetism and post-Laplacean physics.

will be the rewards or punishments for reproducing and modifying the natural order?<sup>39</sup>

Aurélia ends with the narrator's return to ordinary reality; yet between the publication of its first and second installments, Nerval hanged himself. This tragic fact might lead us to attribute the author's visions to madness: undeniably, a tendency to reduce fantastic experiences to individual psychopathology was growing in strength.<sup>40</sup> Such an analysis, however, favors only one of several possible interpretations of uncanny phenomena. It was not the case that at the touch of the disenchanting wand of modernity, all ghosts became mental projections and all visionaries became neurotics. In this period (and well beyond), events comparable to those depicted in fantastic literature were taken as extraordinary but plausible. Catholics affirmed the efficacy of prayer and ritual along with the reality of angels and miracles; in the margins of and in opposition to official religion, pantheist conceptions of a living, mutable substance merged with belief in access to multiple worlds. Fantastic scenarios were taken seriously at all levels of society and education-even, as we have seen in the case of animal magnetism, by the arbiters of scientific rationality.<sup>41</sup>

At the same time, beneath fantastic literature's concern with subjectivity, spiritualism, and ethereal realms lurked a technological fixation closely linked to the changing situation of printing. Strict laws, licensing, and censorship had been among the causes of the revolution of 1830. One of the few changes brought by the government of Louis-Philippe was the temporary and selective loosening of these restric-

<sup>39</sup> Gérard de Nerval, *Les filles du feu, suivi de Aurélia*, ed. Kléber Haedens (Paris, 1968), 224–38, 247, 268, 249. On the morality of creation in John Milton, William Wordsworth, and others, see Paul Cantor, *Creature and Creator: Myth-Making and English Romanticism* (Cambridge, 1984).

<sup>40</sup> For rational reductions of magic and magnetism from this period, see Eusèbe Salverte, *Des sciences occultes, ou essai sur la magie, les prodiges et les miracles* (Paris, 1843). On the psychologization of phantoms and the "spectralization" of thought, see Terry Castle, *The Female Thermometer: Eighteenth-Century Culture and the Invention of the Uncanny* (Oxford, 1995); on the doppelgänger as a by-product of technical media, see Friedrich Kittler, "Romanticism-Psychoanalysis-Film," in *Literature, Media, Information-Systems*, ed. John Johnston (Amsterdam, 1997), 85–92.

<sup>41</sup> Though he denied it in public, Geoffroy privately affirmed pantheistic sympathies (Geoffroy to George Sand, July 13, 1838, Bibliothèque Nationale, Dossier Sand, quoted in Bourdier, "Le prophète," 62). The eclectic philosopher Victor Cousin denied accusations of pantheism from the church (see Henri Maret, *Essai sur le panthéisme dans les sociétés modernes*, discussed in Jan Goldstein, *The Post-revolutionary Self: Politics and Psyche in France, 1750–1850* [Cambridge, MA, 2005], 248), yet Leroux told the eclectics, "You are a pantheist, since you are a philosopher; and, besides, Cousin, whose slave you are, with your gown and your square cap, is undoubtedly a pantheist" (quoted in Jules Simon, *Victor Cousin, trans. Gustave Masson* [London, 1889], 149). On the varieties of religious belief in this period, see in addition Wilkinson, *Dream of an Absolute Language;* Viatte, *Sources occultes;* Méheust, *Somnambulisme;* D. G. Charlton, *Secular Religions in France* (1815–1870 (Oxford, 1963); Edward Berenson, *Populist Religion and Left-Wing Politics in France* (Princeton, NJ, 1984); Lynn Sharp, *Secular Spirituality: Reincarnation and Spiritism in Nineteenth-Century France* (Lanham, MD, 2004); John Warne Monroe, *Laboratories of Faith: Mesmerism, Spiritism, and Occultism in Modern France* (Ithaca, NY, 2008).

tions. Combined with mechanical improvements, reductions in the price of paper, the rise of lithographic printing, and the introduction of steam presses-France had one in 1823, and thirty by 1830-these legal changes lifted the floodgates on affordable printed matter. Resonating with Hugo's line from Notre Dame de Paris, "Ceci tuera cela"that is, the printed book will destroy the edifice of Catholicism-many enthused about the epochal effect of the invention of printing, including Nerval, who cowrote a play on the topic.42 Ernest Legouvé was crowned at the Académie Française for his epic history of humanity retold as a history of communications technologies: after knowledge had been passed down only by song and memory ("souvent infidèle"), as well as on papyrus (which preserved sacred texts but restricted their readership), "Gutenberg appeared!" Legouvé describes his technical improvements, including moveable type and improved ink, in rhyming detail. These unleash the press's puissance magique and pouvoir créateur. The great movements of thought "change their character as they change their instruments"; Gutenberg "made the god of knowledge a popular God." Thanks to printing, "in a thousand hearts the same soul enters and lives," a whole people "rises up, animated by a single design," bringing revolution and liberty.<sup>43</sup> The printing press was a more-than-human political power joining mind and matter, revealing the inadequacies of this world and helping create a new one. Likewise, according to Lamartine-whose early poems showed a pantheist sensibility-"Gutenberg spiritualized the world."44

Some saw literature's dependence on systems of mechanized production as a threat to art's essential spirituality: a character in Grandville's *Another World* lamented that "thought is now no more than a machine; men are nothing but automatons; writing is done mechanically."<sup>45</sup> Yet the power of words and symbols over the minds of readers was an obsession of romantic-era authors, who depended for their survival on keeping a growing yet fickle public entranced; the overlapping imagery of animal magnetism and of the physics of impon-

43 Ernst Legouvé, "De l'invention de l'imprimerie," Revue de Paris 5 (1829): 297-307.

45 Grandville, Un autre monde, 272; on "la littérature industrielle," see Jean-Pierre Leduc-Adine, "Les arts et l'industrie au XIXe siècle," Romantisme 17 (1987): 67–88.

<sup>&</sup>lt;sup>42</sup> Joseph Méry and Gérard de Nerval, L'imager de Harlem, ou la découverte de l'imprimerie (Paris, 1851). See Claude Bellanger, Histoire générale de la presse française, vol. 2 (Paris, 1969); Dean De la Motte and Jeannene M. Przyblyski, eds., Making the News: Modernity and the Mass Press in Nineteenth-Century France (Amherst, MA, 1999); James Smith Allen, Popular French Romanticism: Authors, Readers, and Books in the Nineteenth Century (Syracuse, NY, 1981); and Françoise Parent-Lardeur, Lire à Paris au temps de Balzac: Les cabinets de lecture à Paris, 1815–1830 (Paris, 1999).

<sup>44</sup> Alphonse de Lamartine wrote: "Speech, through the procedure perfected by Gutenberg, will have become, through matter, just as immaterial as when it was merely thought; but this thought will have become universal as it bursts forth from the intelligence or the will of man" (*Gutenberg, inventeur de l'imprimerie* [Paris, 1853], 237).

derables allowed fantastic authors to reflect on the techniques (or technologies) of literary effect.

According to Charles Augustin Sainte-Beuve, Hoffmann "unleashed and laid bare the power of magnetism in poetry," a power that his works explicitly addressed with imagery of mechanical humans.<sup>46</sup> Like the more familiar "The Sandman," his tale "Automata" merged mechanism, mysticism, and reflections on literary power. It begins with a group of friends staring "stiff and motionless like so many statues" at a ring oscillating in obedience to an invisible force; later we hear of a speaking machine, the Talking Turk, which may possess or be possessed by divinatory powers; we meet a scientist obsessed with mechanical music and a singer who might be one of his experiments. In each case the question arises whether characters are moved or are movers, helpless puppets or godlike actors. The tale's unresolved ending links this question to Hoffmann's own philosophy of composition. In response to his friend's demand that he tie up all the loose narrative strands, the protagonist replies: "'You know,' said Theodore, 'that I told you at the beginning that I was only going to read you a fragment, and I consider that the story of the Talking Turk is only a fragment. I mean that the imagination of the reader, or listener, should merely receive one or two more or less powerful impulses, and then go on swinging, pendulumlike, of its own accord."<sup>47</sup> The pendulum, which could be used to keep musical time, measure the force of gravity, or induce mesmeric sleep, here gestures simultaneously to mechanistic law, supernatural forces, and the free play of aesthetics. Hoffmann presents his obsessed protagonists-and, by implication, his spellbound readers, whom he has artfully led to this point of suspension-as both autonomous, imaginative agents and mechanically determined objects.48

In music criticism, Hoffmann contributed to a shift toward considering works not in terms of their formal beauty or mimesis but in terms of their *effect* on listeners: the "ethereal" music he praised was only possible through close consideration of the material properties of new musical instruments and orchestral arrangements.<sup>49</sup> This shift can be seen as part of a broader change in the arts in the early nineteenth century, in which the notion of effect was increasingly the standard by which any medium could be judged: this was a move toward a techno-

<sup>46</sup> Castex, Conte fantastique, 45, 53.

<sup>47</sup> E. T. A. Hoffmann, "Automata," trans. Major Alexander Ewing, in *Best Tales of Hoffmann*, 102.

<sup>&</sup>lt;sup>48</sup> On puppets versus gods, see Heinrich von Kleist, "On the Marionette Theater," trans. Christian-Albrecht Gollub, in *German Romantic Criticism*, ed. A. Leslie Willson (New York, 1982), 238-44.

<sup>49</sup> See Dolan, "Ethereal Technologies."

logical interpretation of aesthetics—a merging of the tradition of rhetoric with machine technology.<sup>50</sup>

If literature was a technology, however, it was one with the power to bring minds together and open new worlds. We can read Nerval's *Aurélia*, for example, as an uncanny, world-bridging device: its posthumous publication—dictated, as it were, from beyond the grave—established the book's kinship with the mechanical bird, vegetable typography, and artificial llama noted above. In the romantic age, the printed word often appeared under such a doubled aspect: as both unprecedented technological object and doorway to supernatural realms. By blurring the distinctions among external reality, the interior landscape, and otherworldly experience, fantastic texts such as Nerval's fulfilled the promise of modern communications technology, harmonizing minds and imbuing matter with thought. Like the automatons and mesmerized humans on their pages, the texts of fantastic literature were simultaneously machines and living powers.

#### **Epistemic Chess**

The tensions of the fantastic were brought to life in the music of this period with works such as Hector Berlioz's *Symphonie fantastique*, Giacomo Meyerbeer's *Robert le diable*, as well as in the hallucinatory spectacles of Louis Daguerre's diorama and the *féeries*.<sup>51</sup> A new genre of spectacle was forged by the pioneer of modern magic, Robert-Houdin, in which the ambiguous relation between humans and lifelike machines was the organizing principle of his *soirées fantastiques*. Etherian physics, animal magnetism, and vivified machines were all present, making his "experiments" another site for exploring the metaphysical possibilities

<sup>50</sup> Historians of science, following Steven Shapin and Simon Schaffer, Leviathan and the Air-Pump (Princeton, NJ, 1985), have used the term literary technology to describe scientists' means of persuasion; my suggestion is that in the early nineteenth century this notion was an explicit concept of the actors: that language and other signs were reconceived as technologies constructed and deployed to produce a specific effect on readers. George Boas, in French Philosophies of the Romantic Period (Baltimore, MD, 1925), links the literature focusing on effects to the idéologues' fascination with sensation as the intersection of physiology and idea; this conception was expanded to include technical mediation by André-Marie Ampère in the field he named "la technésthétique" in Essai sur la philosophie des sciences, ou exposition analytique d'une classification naturelle de toutes les connaissances humaines, 2 vols. (Paris, 1834–43). On Delacroix's aesthetics of effect, see Michael Marrinan, Romantic Paris: Histories of a Cultural Landscape, 1800–1850 (Stanford, CA, 2009), 174. This "technologization" of aesthetics was prepared by the mesmeric revival: see Winter, Mesmerized, especially its discussions of Wilkie Collins, Hector Berlioz, and Richard Wagner (312–27). For links between the technical conception of the arts and spiritualist philosophy, see John Tresch, "La technesthétique: Répétition, habitude et dispositif technique," Romantisme, no. 150 (forthcoming). <sup>51</sup> On other aspects of fantastic spectacle, see Joellen Meglin, "Ancestors of the Sylphide in

<sup>51</sup> On other aspects of fantastic spectacle, see Joellen Meglin, "Ancestors of the Sylphide in the *Conte Fantastique*," pt. 1 of "Behind the Veil of Translucence: An Intertextual Reading of the *Ballet Fantastique* in France, 1831–1841," *Dance Chronicle* 27 (2004): 67–129; and Roxane Martin, *La féerie romantique sur les scènes parisiennes, 1791–1864* (Paris, 2007). suggested by lifelike technology. Further, if Simon During is right to see Robert-Houdin's stage magic as a founding moment for the "special effects" that dominate contemporary mass entertainment, this harmless diversion and its epistemic ambiguities turn out to have lasting significance for today's hypermediated communications environment.<sup>52</sup>

This clockmaker from Blois first won acclaim at the Exposition of the Products of Industry of 1844 for his writing automaton, attired in eighteenth-century garb, which appeared to answer questions from visitors, including King Louis-Philippe. Lauded as the heir of Vaucanson, in 1846 he acquired a theater near the Palais-Royal, the epicenter of French publishing, entertainment, and prostitution. Rejecting the histrionic exoticism of his precursors, Robert-Houdin spoke in a low-key patter, wore unadorned evening dress, and gave the proceedings a scientific air by calling his tricks "experiments." He shared the stage with automatons, many of whom we see arrayed in miniature around figure 4. He treated these objects—an android who emerged from an egg, a harlequin gymnast, a baker who delivered miniature patisseries to order—as kin. His *Memoirs* described the moment when his writing automaton came to life, wringing pathos from the scene of awakening and the creature's recognition of its maker:

"Who is the author of your being?" I pressed the spring, and the clockwork began acting. I dared hardly breathe through fear of disturbing the operations. The automaton bowed to me, and I could not refrain from smiling on it as on my own son. But when I saw the eyes fix an attentive glance on the paper—when the arm, a few seconds before numb and lifeless, began to move and trace my signature in a firm handwriting—the tears started to my eyes, and I fervently thanked Heaven for granting me such success.<sup>53</sup>

Strengthening this impression of a paternal link, he rotated his fleshand-blood sons through his act as well. In the "Etherian Suspension," his son drank "ether"—a substance recently introduced as a surgical anesthesia but whose name evoked both physical theory and animal magnetism. The "etherized" boy would levitate; as the boy's movements were "so stiff and mechanical," some viewers assumed that he was actually an automaton (fig. 5, left).<sup>54</sup> Another of Robert-Houdin's demonstrations was patterned on a scene of somnambulism: on the poster (fig. 4) we

<sup>52</sup> Simon During, Modern Enchantments: The Cultural Power of Secular Magic (Cambridge, MA, 2002).

<sup>&</sup>lt;sup>53</sup> Jean-Eugène Robert-Houdin, *Memoirs of Robert-Houdin, Written by Himself*, trans. Lascelles Wraxall (London, 1959), 151; discussed in Riskin, "Modern Magic."

<sup>54</sup> Michel Seldow, Vie et secrets de Robert-Houdin (Paris, 1971), 101; see also Paul Metzner, Crescendo of the Virtuoso: Spectacle, Skill, and Self-Promotion in Paris during the Age of Revolution (Berkeley, CA, 1998), esp. chaps. 1 and 5 on Robert-Houdin and "the vogue of the automaton-builders."



Figure 4 Publicity poster for Robert-Houdin's soirées fantastiques, with a border of automatons. Seldow, Vie et secrets de Robert-Houdin, 84

read: "The son of M. Robert-Houdin, gifted with a penetrating second sight, will offer with his father an entirely new experiment [*expérience*]." This claim about twelve-year-old Emile's abilities was strengthened by the fact that his "pale, intellectual, and ever-thoughtful face represented the very type of a boy gifted with some supernatural power." After blindfolding him, Robert-Houdin rang a "mysterious little bell," prompting the boy to describe objects submitted by audience members (fig. 5, right).<sup>55</sup> The physical and metaphysical implications of scenes like this one, in which sensitive individuals performed acts of extraordinary perception under the influence of a charismatic guide, were the subject of lively debate both in the press and in the academies.

A recent study by During emphasizes nineteenth-century magic's secular nature, showing how performers like Robert-Houdin played an endlessly intriguing epistemological game with the audience. Viewers were surprised by unexpected phenomena while knowing that it was all a trick; their pleasure resided in the puzzle posed by the deception's hid-

55 Robert-Houdin, Memoirs, 194.



Figure 5 "La suspension éthérienne" and "La seconde vue." Seldow, Vie et secrets de Robert-Houdin, 91, 103

den mechanism. Similarly, Jessica Riskin has spoken of Robert-Houdin tipping his hand to let the audience in on the joke that his automatons are not the robust reproductions of life that they seem, assuring them that the only "magic" at work was an exceptional mastery of the rational laws of nature. While these analyses capture the bluff and misdirection in Robert-Houdin's presentations, they take for granted that the performer and his public shared a single, well-defined understanding of nature.<sup>56</sup> Yet it was precisely the absence of such a firm common ground-among audiences composed of kings, workers, and everyone between-that made these evenings "fantastic."57 Robert-Houdin's soirées capitalized on the uncertain status of the ether, electricity, and animal magnetism, as well as on the constantly expanding possibilities of machines. Performances like "The Second Sight" encouraged a hesitation between multiple conceptions of the natural order; they could be taken in without succumbing to either complete belief or utter refusal.58

<sup>56</sup> See During, *Modern Enchantments*; and Riskin, "Modern Magic." Metzner, in *Crescendo*, also interprets Robert-Houdin's flirtations with the supernatural this way.

<sup>57</sup> The poster shows entry prices between 1.5 francs for the gallery up to 4.0 francs for *loges*, plus half-price entries at certain hours. Though he moved to England after 1848, in the immediate aftermath of the revolution Robert-Houdin handed out free tickets to the *soirées*, a gesture of solidarity or, perhaps, of self-defense.

<sup>58</sup> Robert-Houdin's stances were deliberately ambivalent. The poster emphasizes his status as *mécanicien* and *physicien* while proclaiming the *seconde vue* of his son. Although his *Memoirs* revealed the trick behind his clairvoyance, nothing in the performance discouraged those inclined to see the act as genuine. Although he debunked charlatans, in 1847 he testified to observing the medium Alexis Didier reading while blindfolded, without "any doubt as to Alexis's lucidity." Similar ambivalence appears in his claims of mechanical provess. By debunking the illusions of other magicians with "mechanical" explanations, he *strengthened* a mechanistic reading of his own life-imitating inventions: in the passage on the quickening of his writing automaton, for instance, he never lets on that "this is play." *We* might know that such a machine was impossible at the time, as some audience members might have, but there is no reason to attribute to all of them an identical threshold of belief. See Bertrand Méheust, "Enquête sur la rencontre entre l'illusioniste Robert-Houdin et le somnambule Alexis Didier: Y a-t-il des faits attestés?" in *Des savants face* 

	Two substances (dualist)	One substance (monist)
Established, rationalist metaphysics	spiritualism, Cartesianism	physicalist/materialist reductions of life and consciousness
Mystical, nonstandard metaphysics	Swedenborgianism, Neoplatonism	pantheism, Spinozism

 Table 1 Metaphysical possibilities of the automaton

To reckon with such scenes-and as an attempt to give analytic form to the metaphysical possibilities they raised and that we have seen running through previous sections-table 1 may be of use. In the various situations in which we have seen them, mechanized humans and lifelike machines moved around on this little chessboard, depending on the setting and the commitments of the interpreters. Magnetized somnambulists, for example, behaved like reliable Cartesian subjects at first (upper left). Once magnetized, they appeared as instruments obedient to the will of the magnetizer (upper right); in this state, however, they were capable of extraordinary feats, such as seeing at a distance, which implied connections with the spirit world (lower left) or the transmission of impulses through a single material, energetic, or divine medium (lower right). Automatons made similar moves. While they might at first seem to be nothing but inert machines (upper right), they could subsequently appear to be invested with, or operated by, a vital force or mind (upper left). The question of how they worked might lead to discussions of invisible forces either natural and immanent (lower right) or coming from another domain of reality altogether (lower left). Any of these positions, or combinations of them, might be evoked by the presence of animated machines.

Scientists and science promoters since Francis Bacon and Voltaire have often been seen as in the business of moving phenomena from the bottom half of the diagram to the top, by giving supposedly supernatural phenomena a physical, mechanical, or psychological explanation. Yet in this period, not only were the objects being explained highly mobile but the categories of explanation were themselves also fluid. Scientific controversies like those between the Laplaceans and their dissenters, between Geoffroy and Cuvier, or between the magnetizers and their critics were occasions to blur and shift the lines of the diagram. It was hard to say, for example, just where the line dividing rational science from mystical speculation lay. The theories of ether

à l'occulte, 1870-1940: Science et société, ed. Bernadette Bensaude-Vincent and Christine Blondel (Paris, 2002), esp. 63-83.

that opposed notions of action-at-a-distance, for instance, drifted easily into speculations about vital fluids or spirit communication; further, as we have seen, mystical and religious threads wove through many discourses ostensibly concerned with rational science and mechanical progress. Performances of lifelike machines in fantastic literature and stage magic made the most of such mixtures and oscillations to generate fear and delight, profits and fame; at the same time they enacted the central concerns of a society undergoing a thorough technological metamorphosis.

# "Apotheoses and Other Things"; or, The Theopolitical Automaton

The fantastic automaton did not exert its influence only in science, literature, and the popular stage. It also entered politics. Images of automatons could suggest arbitrary despots and unthinking subjects, as in an imaginary travel narrative from 1836, signed by Charles Nodier, which tweaked the "bourgeois monarchy" of Louis-Philippe. On the "Isle of Civilization," citizens were dazzled by Volta's Pistol, an electric train so fast that times of departure and arrival were indistinguishable. Its government

flourishes under the laws of a charming little monarch of encrusted rosewood who is moved by very simple gears, like a wooden clock. When the boards are wound up and the springs set in motion, this debonair autocrat can sign with his right hand, in a superb cursive, twenty or thirty beautiful governmental decrees that cost no more than a stamp; and what is infinitely remarkable in this marvelous constitutional machine is that it would just as soon sign on the left, if such had been the wish of the mechanic.<sup>59</sup>

Like Louis-Philippe, this petty despot—the puppet of a wealthy few—ruled over a populace made docile by rapid technological change.

Others continued a tradition of associating machine-humans with the ignorant subjects of tyranny. The *idéologue* and linguist C. F. Volney had written that "the Chinese, governed by an insolent despotism . . . appear to be in their abortive civilization nothing but a race of automata"; Charles Fourier wrote of "these *living automata* we call peasants, who are so coarse as to be closer to the animal than the human species." For these authors, to belong to an earlier stage of humanity

<sup>&</sup>lt;sup>59</sup> Charles Nodier, "Voyage pittoresque et industriel dans le Paraguay-Roux et la Palingénésie Australe par Tridace-Nafé-Théobrome de Kauot't'chouk, etc.," in *Contes: Avec des textes et des documents inédits*, ed. Pierre Castex (Paris, 1961), 459. Nodier's authorship of this text is questioned by Marie-Christine Pollet, "Un plagiat méconnu de Charles Nodier: Le *Voyage dans le Paraguay-Roux,*" *Histoires littéraires* 1 (2000): 77–83.

meant to be an automaton. But rather than elevate the masses and make them "more than a machine," which Kant saw as the direction of enlightenment, industrial progress appeared to make workers less than human: already in 1809 the critic Pierre Lemontey worried about the division of labor's tendency to create *ouvrier-machines*, a concern reiterated in the 1840s by Jules Michelet, who spoke of textile workers as the "little race of man-machines" and condemned *machinisme* for "uniting forces without needing to unite hearts."<sup>60</sup> Romantic poets lent their voices to this chorus: one wrote,

The heart breaks to see these somber bunkers Where human beings, like automatons Using up their life and health, mechanically perform The same movement from morning until night.

Hugo warned against the "somber machine, hideous monster," which devours the child laborer.<sup>61</sup> By replacing workers, automatic machinery threatened to make them obsolete. From this perspective, new technology was the nemesis that had to be destroyed. At the start of the 1830s printers in Paris smashed new steam presses; in September 1831 fifteen hundred textile workers attacked a new apparatus for cutting shawls, to the cry of "Down with the machines!" The following years saw the revolts of the Canuts in the Lyon silk factories and similar Luddite uprisings by Parisian workers. Here, self-powered machines were diabolical rivals to humanity.<sup>62</sup> Yet these explosions of antimechanism contributed to a significant reversal. As François Jarrige has argued, the epidemic of machine breaking created a demand for new social ideologies that recast industrial machines as living in harmony with industrial workers.<sup>63</sup>

<sup>60</sup> C. F. Volney, *The Ruins; or, Meditation on the Revolutions of Empires* (New York, 1890), 60. Charles Fourier, *Theory of the Four Movements*, trans. Gareth Stedman Jones and Ian Patterson (Cambridge, 1996), 69; Lemontey quoted in François Vatin, "Romantisme économique et philosophie de la misère en France dans les années 1820–1840," *Romantisme* 133 (2006): 38; on Michelet, see Vatin, "Machinisme," Marxism, Humanism: Georges Friedmann before and after WWII," *Sociologie du travail* 49 (2007): 16–33. See David K. Cohen, "Lemontey: An Early Critic of Industrialism," *French Historical Studies* 4 (1966): 290–303.

<sup>61</sup> Victor-Louis-Amédée Pommier, "Aurolatrie," and Victor Hugo, "Les contemplations," in Grant, *Poetry and Industry*, 30, 40.

62 In the journal L'écho de la fabrique (1831), quoted in Sarane Alexandrian, Le socialisme romantique (Paris, 1979), 16; Fernand Rude, La révolte des canuts, 1831–1834 (Paris, 2001); François Jarrige, "Les ouvriers parisiens et la question des machines au début de la monarchie de juillet," in Harismendy, France des années 1830, 211–22.

63 François Jarrige, "Au temps des 'tueuses de bras': Le bris de machines et la genèse de la société industrielle (France, Angleterre, Belgique, 1780–1860)" (thèse d'histoire, Université de Paris 1–Panthéon-Sorbonne, 2007). On the development of the discourses of labor, liberation, and association, see William Sewell, Work and Revolution in France: The Language of Labor from the Old Regime to 1848 (Cambridge, 1980); see also Langdon Winner, Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought (Cambridge, MA, 1977).

The uncanny powers of machines evoked in fantastic literature appeared in new programs of social science and social reform as tools and symbols of a new spiritual unity. Worries about social fragmentation had been expressed in reactionary criticisms of the revolution; according to Joseph de Maistre, Enlightenment philosophes had brought a reign of egoism and anarchy by undermining the church's influence. Maistre urged a return to the organic polity of the Middle Ages, with a proper submission of the temporal power of the sovereign to the spiritual power of the pope.<sup>64</sup> During the Restoration and the July Monarchy the reactionaries' call for spiritual renewal and unification was taken up not only by traditionalists but also by reformers and revolutionaries.65 These new social philosophers, however, believed that unity would be achieved not by turning back the clock to the medieval era, nor by retreating to a Rousseauian nature, but by developing the arts and industry, reorganizing the conditions of labor and ownership, and creating a new doctrine; a new industrial order called for a new religion. In the examples of the Fourierists, the Saint-Simonians, and Pierre Leroux, we see how early socialism reshaped the technologies that harnessed steam, imponderable fluids, life, and thought into the instruments and symbols for a new social and cosmic harmony.

Fourier built correspondences between celestial constellations and human personalities into the physical architecture of his ideal commune, the Phalanstery. His disciple, Victor Considérant, described Fourier's vision in language that echoed his engineering training at the Ecole Polytechnique. Fourier had discovered "a new *social mechanism*, capable, in our view, of UTILIZING all the energy of the *motive force* which resides in human nature"; "We are SOCIAL ENGINEERS," he declared.<sup>66</sup> The lapsed Fourierist Constantin Pecqueur presented steam as a magical animator and unifier that would produce, "through the magic of spontaneous creation, innumerable cities and populations, immense factories, workshops, mines and quarries." Wisely administered, steam would deliver equality, international federation, and the blessings of God: "Spirits seek to draw near to each other, to connect with each other, and the networks of iron rails will be nothing other than the

<sup>64</sup> Joseph de Maistre, Du Pape (Lyons, 1809).

<sup>65</sup> Even the liberal Constant urged a renovation of religion: see Helena Rosenblatt, "Re-evaluating Benjamin Constant's Liberalism: Industrialism, Saint-Simonianism, and the Restoration Years," *History of European Ideas* 30 (2004): 23–37; Paul Bénichou, *Le sacre de l'écrivain, 1750–1830: Essai sur l'avènement d'un pouvoir spirituel laïque dans la France moderne* (Paris, 1973); and Pierre Rosanvallon, *Le moment Guizot* (Paris, 1985).

<sup>66</sup> Bases de la politique positive: Manifeste de la société fondée par Fourier (Paris, 1841), quoted in Alexandrian, Socialisme romantique, 197. See Jonathan Beecher, Charles Fourier: The Visionary and His World (Berkeley, CA, 1987); and Beecher, Victor Considérant and the Rise and Fall of French Romantic Socialism (Berkeley, CA, 2001).

conducting wires of these relationships . . . nothing but material links destined to realize spiritual links." Social engineering was coterminous with engineering proper: technical unification brought spiritual unity.<sup>67</sup>

The industrial prophet Saint-Simon's call for a "New Christianity" was taken up in the 1820s by his followers, many of whom were polytechnicians. Aiming to convert workers and professionals through a strategy of propaganda organized by Hippolyte Carnot-son of Lazare, the founder of the Ecole Polytechnique, and brother of Sadi, the founder of thermodynamics-the Saint-Simonians sought to convert the organization of society from "the government of men to the administration of things," to redirect the nation's powers toward the development of its "productive forces." As in fantastic literature, Saint-Simonian prophecies channeled the convertible fluids of ether physics into uncanny metamorphoses. They spoke of connecting France, its neighbors, and its colonies by water, steam, and electricity.68 The Saint-Simonian engineers Emile Clapeyron and Gabriel Lamé measured and improved the efficiency of steam engines and helped build the French railway system; their studies of the conversion processes in engines were closely linked to their efforts to convert new followers.

The Saint-Simonians' charismatic leader, Prosper ("Père") Enfantin, rejected a soulless science in favor of a mechanically informed pantheism: "Physiology and materialism [are] a mere play on words: but *bring the machine to life* and I feel love and admiration; I am moved to join with it." He argued that "critical periods" like the present often produced "a cult for electricity, magnetism, molecular attraction," yet *love* was the most important of the invisible powers, one whose reach he and his followers sought to extend through poetry, art, and music.<sup>69</sup> The Saint-Simonians' visions of networks of machines that were both autonomous and associated were reflected in the model of selfhood Enfantin described to his disciple, Charles Duveyrier. He criticized the proponents of animal magnetism for presenting man as

no more than a passive tool [*organe*] of the milieu that surrounds him . . . whereas I, I see you *awakened*, and if my saddened eye meets yours, I see yours grow moist. . . . You do not *sleep*, you are awake,

<sup>67</sup> Constantin Pecquer, Economie sociale: Des intérêts du commerce, de l'industrie, de l'agriculture et de la civilisation en général, sous l'influence des applications de la vapeur, machines fixes, chemins de fer, bateaux à vapeur, etc. (Paris, 1839), 5, 409.

<sup>68</sup> See Magali Morsy, ed., Les Saint-Simoniens et l'Orient: Vers la modernité (Aix-en-Provence, 1989).

<sup>69</sup> According to Enfantin, the coming earthly paradise was also augured by the increasing love of old women for cats and dogs: "These estimable quadrupeds are generally adored in direct proportion to the disunity between humans" ("Lettre du père Enfantin à Charles Duveyrier, sur la vie éternelle," in Prosper Enfantin, *Lettres sur la vie éternelle* [Paris, 2004], 71).

and you and I are *doubly* happy about it. I say more—we will each of us have our distinct consciousness, each reacting on the other, not as *master* and *slave*, not as *agent* and *patient*, but as powers of *authority* and *obedience* by *reciprocal* LOVE.<sup>70</sup>

In Enfantin's vision of hierarchical sociability, dependence and obedience follow from an "awakened" choice and act through the medium of love; the individual obeys yet remains free.

Technology shaped the Saint-Simonians' view of both human society and nature; it would awaken and organize the latent powers of each.<sup>71</sup> In their prophecies, the entire planet became a living automaton, an "organized machine" with veins of roads, canals, railroads, and telegraphs. Industrial expansion would be coordinated by a religion directed by the Père and the "Mère" discovered in the Orient; their marriage would unite East and West. Michel Chevalier evoked this technological syncretism:

At the summit of the minarets The telegraph waved its arms And from all directions delivered The Good News to the people.<sup>72</sup>

In his essay "La ville nouvelle" Duveyrier described a future Paris at whose center stood a gigantic, woman-shaped temple filled with meeting places, shops, and offices. Chevalier rhapsodized: "A temple that is a Voltaic battery; a temple built of colossal magnets, a temple of melody and harmony, a temple through whose mechanism enormous lenses will throw torrents of heat and light. . . . What an immense communion! What a gigantic moralization of a whole people! What a glorification of God, of his messiah, and of humanity!"<sup>73</sup> In this industrial fetish, powered by imponderables, the automaton underwent an apotheosis; it became the living incarnation of a society and a world harmoniously engineered (fig. 6).<sup>74</sup>

70 Enfantin, "Lettre à Duveyrier," 70.

<sup>72</sup> Michel Chevalier, "Le temple," in *Le livre nouveau des Saint-Simoniens*, ed. Philippe Régnier (Tusson, 1991), 238.

73 Charles Duveyrier, "La ville nouvelle des Saint-Simoniens," in Paris, ou le livre des cent-etun, ed. Pierre-François Ladvocat, vol. 9 (Paris, 1832), 251–75; Michel Chevalier, "Conversations avec le Père," in Régnier, Livre nouveau, 181. On Saint-Simonian views of machines as mediators between matter and spirit, see Pierre Musso, Télécommunications et philosophie des réseaux: La postérité paradoxale de Saint-Simon (Paris, 1997), 204; and Antoine Picon, Les Saint-Simoniens: Raison, imaginaire et utopie (Paris, 2002).

74 Duveyrier in Philippe Régnier, Les Saint-Simoniens en Egypte (1833–1851) (Giza, 1989), 38–40; Spyros Papapetros suggests that the sculptor Frédéric Auguste Bartholdi took inspiration from these plans for his design of the Statue of Liberty ("Paris Organique, Paris Critique: Urbanism, Spectacle, and the Saint-Simonians," *Iconomania: Studies in Visual Culture* 2 [1998], www.humnet

<sup>&</sup>lt;sup>71</sup> Enfantin in Robert Carlisle, *The Proffered Crown: The Saint-Simonians and the Doctrine of Hope* (Baltimore, MD, 1987), 116.



**Figure 6** Le Temple-Femme (Album Machereau, Bibliothèque de l'Arsenal). Reproduced by permission of Bibliothèque Nationale de France

The religious speculations and imaginative flights of the early socialists frequently made them the target of ridicule: Gustave Flaubert's *Sentimental Education* detailed the unruly carnival of social ideas of 1848; Charles Baudelaire wrote that 1848 "was only entertaining because everyone built utopias then like Spanish Castles"; Marx's *Manifesto of the Communist Party* used the word *fantastic* five times on a single page to mock "utopian socialists."<sup>75</sup> The overlapping currents of socialism, illuminism, and the fantastic arts provided the materials for Grandville's *Another World*; the sheer copiousness of its subtitle suggests the book to be a satire: *Transformations, Visions, Incarnations, Ascensions, Locomotions, Explorations, Peregrinations, Excursions, Stations, Cosmogonies, Phantasmagorias, Reveries, Foolishness, Facetiousness, Whimsies, Metamorphoses, Zoomorphoses, Lithomorphoses, Metempsychoses, Apotheoses and Other* 

<sup>.</sup>ucla.edu/humnet/arthist/Icono/papapetros/simonian.htm). Thanks to the emergence at this time of a scholarly field of history of religions (to which the Saint-Simonians contributed), "fetishism" was rediscovered and seen by some, including Auguste Comte, as the core of the religious life. In a comparable attempt to rehabilitate the concept, Bruno Latour discusses "factishes," surprisingly autonomous objects in both science and religion, in *Pandora's Hope: Essays on the Reality of Science Studies* (Cambridge, 1999).

<sup>&</sup>lt;sup>75</sup> Charles Baudelaire, *Mon coeur mis à nu*, ed. Claude Pichois (Geneva, 2001), 16; Marx and Engels, "Manifesto," 498.

*Things.* Yet though the work employs and exaggerates aspects of socialist doctrines, Grandville's images and the anonymously penned text that accompanies them never settle into obvious mockery or settle on fixed targets.<sup>76</sup>

A major influence on John Tenniel, the illustrator of Alice in Wonderland, Another World shows a world upside down in which animals, vegetables, minerals, and machines exchange roles with humans. With pages cluttered with animated objects of various kinds-a vegetable revolution, a playing-card riot, an electric opera, dancing trombones, and paintings that leap off the wall-the book revels in the metaphysical ambiguity and political versatility of automaton imagery. The desultory plot follows Puff, a down-on-his-luck publicist who realizes that there is money to be made by inventing a new religion. To help him diffuse his "neo-paganism" through the water, earth, and air, he conjures up two other "neo-Gods," Kracq and Hahblle: the three resemble the pantheist ex-Saint-Simonian philosopher Pierre Leroux, the political theorist Pierre-Joseph Proudhon, and Saint-Simon. Yet Grandville acknowledges that he is in the same boat as the utopian prophets who seek to earn a profit from their visions of another world: the book worries about the conditions of its own production and consumption, lampooning publicity, the vast quantity of print, mass-produced literature, the fashions of the salons and boulevards, the mechanization of production and tastes. Text promoting the book-originally sold in installments-is worked into the introduction and the self-congratulatory conclusion; thus the book's satire of "puffing" and inflated critical currency applies to itself. It even features a laudatory introduction by Robert Macaire, the mythical grifter and practitioner of the subtler forms of the Parisian scam.77

Similarly, the book consistently undercuts its own potential for either satire or endorsement with regard to industrial technology. It is obsessed with steam: according to an epic poem to which it alludes, *De la vapeur*, "The piston of Papin is the scepter of the world." The "Steam Concert" I mentioned at the start of this article was a "humanomechanical concert" demonstrating that "in this century of progress, the machine is a perfected man."<sup>78</sup> The symphony's title, *Le moi et le non-moi*, comes from the philosophies of Leroux and Victor Cousin who borrowed the language of "the self" and "the not-self" from Johann

<sup>&</sup>lt;sup>76</sup> The author of the text was later revealed to be J. P. Stahl, which was, in fact, the pseudonym of the book's publisher, Pierre-Jules Hetzel, a committed republican who worked for Lamartine during the Provisional Government of 1848 and who published works by Proudhon and Baudelaire as well as the distinctively ornate and embossed editions of Jules Verne's works.

<sup>77</sup> James Rousseau, Physiologie du Robert Macaire (Paris, 1842).

<sup>78</sup> Grandville, Un autre monde, 283, 22.

Gottlieb Fichte-and underlines that these living machines both are and are not their human counterparts. Following Benjamin's reading of Grandville, we might take the implication to be one of alienation: that the logic of mechanical production and commodification invades all domains of existence and "perfects" workers only by turning them into machines.<sup>79</sup> Yet with the players' manic gestures and expressions and the clouds of steam that spiral from their heads, the scene threatens to spin out of control: progressive schemes of mechanization may bring not suffocating order and monotony but chaos. What holds this clangorous symphony together appears to be the baton of a pressure indicator at the center; yet in the lower left we see a hand adjusting a valve-a suggestion that human interests still run the show and, perhaps, that "mechanization" is really just a new means of very human domination. If this is a satire of socialist criticism, it is a strange one, as at this level, the message-that mechanization and spectacle can be tools of oppression-would be wholeheartedly endorsed by most reformers.

Another World can be read as a satirical jab at the writings of utopian socialists or, perhaps just as easily, as a contribution to the genre; it is neither a straightforward satire of those who sought to redirect the emerging industrial regime nor a condemnation of mechanization. Instead, it affirms the polymorphous, world-making potentials of new, autonomous technology-as sources of oppression, liberation, creativity, inhibition, prophecy, and absurdity.<sup>80</sup> In the book's final pages the neo-Gods give up their lives after hearing a prophecy that their world will end "when we will see matter animated." This apocalyptic event was already occurring on all sides: in both the world of the text and that of its readers, the birth of "another world," one of matter brought to life, was already under way. Rather than undermine contemporary reformers and revolutionaries, the book intensifies and repeats their central moves by showing the relationship among the exaggeration of existing conditions, the denunciation of them, and the construction of alternatives; it further highlights the indispensable material and technical supports required to bring ideas to life.

In 1832 Père Enfantin and his chief disciple, Chevalier, discussed the importance of innovative symbolism and "play" in the functioning of religious rites and festivals. This led them to a consideration of forms of madness in which individuals identify themselves with objects and "animate everything: stones, metals, engines, plants"; in these per-

<sup>&</sup>lt;sup>79</sup> Benjamin saw in Grandville the reification of human labor and the penetration of the commodity form into all aspects of life. See "Fourier or the Arcades," and "Grandville, or the Expositions," in *Arcades Project*, 1–5, 7–8.

<sup>&</sup>lt;sup>80</sup> Fourier's writings likewise waver between seriousness and a playful hysteria verging on self-parody; see Roland Barthes, *Sade, Fourier, Loyola*, trans. Richard Miller (New York, 1976).

ceived sympathies "there is a form of animal magnetism" that must have been present at the creation of all of humanity's most important inventions: the principles of agriculture and metallurgy, for instance, must have been discovered through a sympathetic identification with plants and metals. For the Saint-Simonians, who sought to redirect the energies of industrial society toward the marriage of humanity and the earth through the mediation of technology, there was wisdom in this madness. As Enfantin put it, and as Grandville would agree, "We must follow the lead of the imaginary; there is a lesson to be derived from the fantastic."<sup>81</sup>

#### **Androids Dream**

Objets inanimés, avez-vous donc une âme? [Inanimate objects, do you therefore have a soul?]

Alphonse de Lamartine, "Milly ou la terre natale"

Spurred by unemployment, low wages, government repression, and the arguments of social reformers, opponents of the July Monarchy in 1848 took Paris's streets: workers, republican conspirators, polytechnicians, and poets built barricades, clashed with the National Guard, and seized the palace at the Tuileries. Central to the insurgents' demands was the collective administration of productive machinery and an equal distribution of its fruits. Louis-Philippe abdicated; the Second Republic was declared. At the head of the new national body stood a provisionary government composed of journalists, a representative worker named Albert, and left-wing politicians, including the astronomer Arago and the pantheist poet Lamartine. The worker's republic was the offspring of the age's obsessions: the cult of love and nature, the struggle for social justice, and the mechanics of fluids and ethers. It was itself a romantic machine.<sup>82</sup>

Yet this heterogeneous creature died before making its first steps. The betrayals and compromises preparing the way for Louis-Napoléon Bonaparte's coup d'état of 1851 and the Second Empire's rigid hierarchies, deceptive spectacles, and economic polarization have been a focal point for social historians since Marx's "Eighteenth Brumaire of Louis Napoléon." For Baudelaire, who lent a hand to the revolution of 1848, the coup proved that "the first to arrive, by taking over the telegraph and national press, can govern a large nation";<sup>83</sup> he deplored the

<sup>81</sup> Chevalier, "Conversations avec le Père," 184-85.

<sup>&</sup>lt;sup>82</sup> Maurice Agulhon, 1848 ou l'apprentissage de la République (1848–1851) (Paris, 1973); William Fortescue, France and 1848: The End of Monarchy (London, 2005).

<sup>83</sup> Karl Marx, "The Eighteenth Brumaire of Louis Napoléon," in Marx-Engels Reader, 594-617; Baudelaire, Oeuvres complètes, 1:692.

emperor's bad faith in sending none other than the master of illusions and builder of automatons, Robert-Houdin, to the recently conquered colony of Algeria to awe the followers of insurrectionary Arab chiefs with mechanical miracles.<sup>84</sup> For Baudelaire, Napoléon III's reign was as tragic as it was comic; the new media regime in place by midcentury made possible the control of an empire through tawdry stage effects transmitted on a mass scale.

Baudelaire's interpreter, Benjamin, famously began his "Theses on the Philosophy of History" with an allusion to a chess-playing automaton; this machine, apparently capable of independent thought, was actually controlled by a dwarf hidden within it. Benjamin turned this specious chess player into an allegory for his own historical method: a materialism covertly powered by theology, an assembly of facts and objects that might summon shocks of insight and usher in a messianic time.85 This machine-human, I suggest, serves as an emblem not only for Benjamin's method but also for his primary historical object: the social and cultural impact of industrialization in nineteenth-century France. While Benjamin tended to concentrate on the insights to be found in curiosities of the past-the detritus of fads like the diorama, the reverie of nostalgic poets, the short-lived glamour of the Arcades-this article has shown that visions of a technologically awakened nature, imbued with religious and prophetic significance, developed out of central, pressing concerns in mainstream science, engineering, and politics.<sup>86</sup> Images of fantastic automatons in the postrevolutionary period reveal the mercurial, often supernatural powers nested within dominant narratives of rational, material progress; they suggest that the emerging ideologies of positivism and technocracy were bound fast to religions ancient and new, to hidden regions of the mind, and to occult dimensions of reality.

Marx and Engels chased these shadows with "scientific socialism." Yet like his contemporaries, Marx frequently turned to phantasmagoric imagery—fetishes, sorcerers, specters—to convey processes of his-

<sup>85</sup> Walter Benjamin, "Theses on the Philosophy of History," in *Illuminations*, trans. Harry Zohn (New York, 1986), 253.

<sup>86</sup> T. J. Clark argues that Benjamin's focus on the dusty passages of the nineteenth century has led to a neglect of more central and influential developments, including the "panoply of philosophical and artistic positivism" that engineered Paris as "a regime of false openness"—in particular, the "intersection between socialism and machinolatry" ("Should Benjamin Have Read Marx?" *boundary* 230 [2003]: 31–49); as this article has shown, this intersection was frequently signaled by automatons.

<sup>&</sup>lt;sup>84</sup> "It was appropriate that an unbelieving society should send Robert-Houdin to the Arabs to turn them away from miracles" (Charles Baudelaire, "Fusées," in *Oeuvres complètes*, 1:654). In one of these command performances, Robert-Houdin challenged an Algerian strongman to lift an apparently light object made unbearably heavy by an electromagnetic current; he then reversed the current to add shock to awe (*Memoirs*, 286–339).

torical transformation and misrecognition. Like them, he placed his hopes for overcoming the age's contradictions in a reorganization of human relations with machines, aided by autonomous technology: "Steam, electricity, and the self-acting mule were revolutionaries of a rather more dangerous character than Barbès, Raspail and Blangui."87 Along with their richly varied conceptions of human happiness and nature's creativity, the early socialists' recurrent imagery of living machines-driven by the fluids of labor, steam, electricity, as well as spirit and love-testified to the centrality of science and technology to their alternative modernities. Romantic socialism vibrated with cosmic forces and starry-eyed prophecies, yet its visions were grounded in cutting-edge techniques of analysis, construction, and communication. Aided by vital technologies and a reconstituted religion, action might be the sister of the dream – a dream perhaps more robust, colorful, and welcoming than the plans realized by either scientific socialists or their laissez-faire opponents.

In the years before the revolution of 1848, living machines embodied both the imprisonment of nature and its renewal; they crystallized fears of becoming the puppet of others' wills even as they symbolized a collective liberation. Shaken by rapid geopolitical shifts and a new technological regime, these early industrial ancestors felt the insufficiency of inherited ideologies and social forms. Yet rather than flee into the illusory comforts of an unmodified nature, a halcyon past, or other artificial paradises, they grappled with the question of the proper role and ownership of new technologies with the power to reshape reality; they reimagined and reappropriated these devices as tools to build a just society. Today's avatars of the automaton-whether digital phantasmagoria, biotechnology, or devices that think and feelprovoke similar anticipations.<sup>88</sup> As our enmeshment with machines grows more complete, automatons continue to speak of the power of human technology-at once pragmatic and mysterious-to bewitch, transform, and awaken.

<sup>87</sup> Karl Marx, "Speech at the Anniversary of the People's Paper," in Marx-Engels Reader, 577.

<sup>&</sup>lt;sup>88</sup> See Riskin, Genesis Redux; N. Katherine Hayles, How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics (Chicago, 1999); and Francisco Varela, "The Re-enchantment of the Concrete," in The Artificial Life Route to Artificial Intelligence: Building Embodied, Situated Agents, ed. Luc Steels and Rodney Brooks (New Haven, CT, 1995), 11–20. On "emotionally sensitive" robots, see Sherry Turkle, "Diary," London Review of Books, Apr. 20, 2006, 36–37.