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tained it for twenty-two years.[1] The White Star Line that designed the *Titanic* hoped to surpass all rivals in speed and luxury. As several expert mariners testified at the British inquiry into her sinking, the pressure to keep to schedule obliged many captains to steam at recklessly high speeds through fog and ice.[2] One surivor commented that the public demanded more speed every year and refused to patronize the slower lines.[3] A bishop in Chicago condemned the "insane desire" for excessive speed on both land and sea. Another critic observed a "mania for speed and smashing records."[4] In a letter to the London *Daily News and Leader* George Bernard Shaw criticized the captain of the *Titanic* for deliberately steaming into an icefield at full throttle, and Joseph Conrad wrote an angry article in the *English Review,* predicting more irresponsibility in the future when steamships could plow across the ocean in all weather at forty knots.

The arrogance of large ocean liners, their pursuit of speed records at risk of life, was the subject of *Futility* (1898), a novel of uncanny prevision. It is a story about the largest craft afloat, a symbol of modernity that incorporated the knowledge of "every science, profession, and trade known to civilization." The designers had discovered how to close compartments automatically in case of collision, and the ship was advertised as "practically unsinkable" and carried as few life boats as law would permit. The owners announced that it would steam at full speed in all weather. The first night out it cut another ship in two, and the man on watch insisted on reporting all he knew in the hope of ending "this wanton destruction of life and property for the sake of speed."[5] The name of the ship was *Titan.*

The sinking of the *Titanic* was but the most tragic consequence of speed made possible by a broad technological revolution that also affected how people traveled to work and how fast they worked when they got there, how they met each other and what they did together, the way they danced and walked and even, some said, the way they thought. There was no question that the pace of life was greatly accelerated, but there was sharp debate about the meaning and value of speed.

The German historian Karl Lamprecht observed that in the last decades of the nineteenth century there was a sharp rise in the domestic production and importation of pocket watches (he estimated 12 million imported watches for a German population of about 52 million). At the same time people began paying specific new attention to short intervals of time—"five-minute interviews, minute-long telephone conversations, and five-second exchanges on bicycles."[6] The new profusion of watches was a response to, as well as a cause of, a heightened sense of punctuality in this period, especially in urban centers. In an essay on "The Metropolis and Mental Life" (1900), Georg Simmel commented on the impact of the "universal diffusion of pocket watches" in accelerating modern life and instilling a sense of punctuality, calculability, and exactness in business transactions as well as human relations.[7]

The bicycle was about four times faster than walking and warnings were issued about getting "bicycle face" by moving against the wind at such high speeds.[8] Its design made the bike difficult to ride, but this became easier after 1886 when the wheels were made of equal size, and more comfortable in 1890 with pneumatic tires. In America Sylvester Baxter observed that the bicycle "quickened the perceptive faculties of young people and made them more alert."[9] A French critic attributed the excitement of cycling to the sheer pleasure of movement, enhanced by a sense of mastery over the environment.[10] The popular French writer Paul Adam wrote that it created a "cult of speed" for a generation that wanted "to conquer time and space."[11]

A penetrating evaluation of its impact on human sensibilities and social relations was made in 1898 by Maurice Leblanc in a novel about cycling, *Voici des ailes!* On its title page is a drawing of a bare-breasted woman with an unbuttoned chemise trailing down over her belt, hair streaming in the wind, strings flying free from her wrists, pedaling a winged bicycle, all of which suggests the sexual, social, and spatial liberation that the two married couples of the book experience during a bicycle tour (Figure 3). The first day out Pascal observes to his friend Guillaume that nothing evokes the idea of speed more than the humming spokes of a bicycle. On the road the couples feel a new rhythm of movement, a unique sense of penetrating the surrounding world as their senses open to new parts of the terrain. They experience a new sense of time, as if they were moving through a dream rather than the French countryside. Social restrictions loosen when they address each other by first names. Sartorial and sexual liberation begins when Pascal's wife unbuttons her blouse and bathes her neck and shoulders in a public fountain. The next day both women appear without corsets. Later they strip off their blouses and cycle bare-breasted, and eventually the bonds of marriage break down as the couples exchange spouses and finish their tour re-paired.

the famous newspaper magnate Lord Northcliffe, public outrage peaked. Annoyances and inconveniences of car travel were substantial. The dust that trailed behind autos engulfed pedestrians and cyclists and ruined the crop of lettuce farmers. And since the dust *was* the road, there were complaints from taxpayers. In *The Condition of England* of 1909, C. F. G. Masterman hissed his protest about automobiles that "scramble and smash and shriek all along the rural ways."

Nothing moved faster than the electricity that raced through conduits, powering motors and accelerating a variety of activities. The first electric tram was put into operation by Werner Siemens in Berlin in 1879; the first one in America ran between Baltimore and Hampden in 1885.[16] They sashayed about the inner city like those that marked the regular pace of public time in Bloom's Dublin. The electrified London underground was completed in 1890, and in the following decade there was a proliferation of electric rails everywhere. In the United States the 1,261 miles in 1890 increased to 21,290 miles by 1902.[17] Visitors to the 1900 World Exhibition in Paris were impressed by the new Otis escalator and a moving pavement designed by the French that portended faster pedestrian traffic. The telephone accelerated business transactions and enabled Wall Street to become a truly national financial center by increasing the liquidity of securities and the speed of fund raising. J. P. Morgan averted a financial panic in 1907 when, over the telephone, he extended $25 million credit to several major banks threatened with excessive withdrawals.[18] The great generating station that opened at Niagara Falls in 1895 converted the rush of water into an even faster rush of electrical current that transformed the pace of life and, some speculated, the very processes of life. An article in *The Fortnightly Review* proposed that electricity might accelerate the growth of crops and increase agricultural yield.[19] This theory was elaborated upon by the Belgian chemist Ernest Solvay in a lecture at the opening of his Institute of Physiology in Brussels.[20] Enthusiasm for this theory peaked with the work of the Nobel Prize winning chemist Svante Arrhenius, who tested the effect of electrical stimulation on the growth of children. He placed one group in schoolrooms with wires carrying high-frequency alternating current. After six months the "electrically charged children" had grown twenty millimeters more than those in the control group. The "magnetised teachers" reported that "their faculties were quickened."[21] While some researchers tried to use electricity to accelerate the processes of life, others used

it to speed up death; in 1888 New York passed a law substituting death by electricity for hanging. In 1890 the New York prison authorities first used the "electric chair" to execute a convicted murderer, although it proved to be far less speedy than expected. The first charge of current failed to kill the man, and after some delay a second charge was given. When it was all over eight minutes had elapsed, the victim was covered with blood from cuts sustained at the points of contact of the circuitry, the District Attorney was in tears, one witness had fainted, everybody was horrified, and a reporter for the *New York Times* wrote that it had been a "revolting spectacle," "far worse than hanging."[22]

The technology of speed affected newspaper reporting and modified the language of journalistic communication. On February 12, 1887, a reporter for the *Boston Globe* used a telephone for the first time to report a speech made by Graham Bell in Salem, Massachusetts; and in 1880 the London *Times* installed a direct telephone line to the House of Commons to gain 45 minutes in the reporting of late night debates for their morning edition. Robert Lincoln O'Brien noted in an essay of 1904 on "Machinery and English Style" that the telegraph came into ever greater use as the need for fast reporting increased. Because economy of expression produced monetary savings, reporters were inclined to write their stories with the fewest possible words. The telegraph also encouraged the use of unambiguous words to avoid any confusion, and the language of journalism came to be more uniform as certain words came into more frequent use. Adverbial phrases at the beginning of a sentence were especially "dangerous," because they might be confused with the preceding sentence, and writers used the simplest syntax. Information tended to be written with a minimum of punctuation. "The delicacy, intricacy, nuance of language is endangered by the wires," O'Brien concluded, as the need for speed, clarity, and simplicity shaped a new "telegraphic" style.[23] No doubt Hemingway's simplification of the English language was in part a consequence of his experience as a foreign correspondent, obliged to prepare his articles for transmission over the Atlantic cable.

Factory work was accelerated by applying Frederick W. Taylor's "scientific management," which he first conceived in 1883.[24] Taylor observed skilled workers and determined the exact series of elementary operations that make up their job, selected the quickest series, timed each elementary operation with a stop-watch to establish

plained that the decline in the popularity of the theatrical melodrama, which relied on a fast pace to sustain interest, was caused by competition with the cinematograph, which could intensify action and present it much more rapidly than was possible on the stage. "The swiftness develops the breathlessness and excitement [that] the melodrama proper fails to evoke."[37] Some film makers intentionally accelerated motion for special effects: flowers boiled out of buds in seconds, and the metamorphosis of a caterpillar into a butterfly could be compressed from weeks into minutes.[38] Cinematic news coverage was greatly accelerated in 1911 when a special express train outfitted with a dark room was used to develop and transport a film of the investiture of the Prince of Wales at Carnarvon at four o'clock in the afternoon and have it ready for public viewing in London at ten o'clock that night.[39]

These "rushes" dazzled audiences. Erwin Panofsky concluded that the basis for enjoyment of moving pictures was not the subject matter "but the sheer delight in the fact that things seemed to move."[40] The early viewers were fascinated by any simple moving subject: Niagara Falls, horses jumping hurdles, workers emerging from a factory, a train pulling into a station. Some inexperienced viewers would duck in their seats to avoid an approaching train. Already in 1899 the Kinetoscope made its way into a novel, as Frank Norris's McTeague was "awestruck" at an approaching cable car on the screen.[41]

The French Cubist painter Fernand Léger identified the effect of the cinema and of technology in general on the aesthetic sensibilities of artists and the viewing public. In 1913 he observed that life was "more fragmented and faster-moving than in previous periods" and that people sought a dynamic art to depict it. Cinema and color photography have made it unnecessary to paint representational and popular subject matter. "The few working class people who used to be seen in museums, gaping in front of a cavalry charge by M. Detaille or a historical scene by M. J. P. Laurens, are no longer to be seen; they are at the cinema."[42] Evolution of the means of locomotion has affected the way people see and the art they like: "A modern man registers a hundred times more sensory impressions than an eighteenth-century artist."[43] The view through the door of a moving railroad car or the windshield of an automobile is fragmented, although at high speeds it becomes continuous the way continuity is created out of a series of stills by the cinema. Léger responded to these new dynamics with paintings that incorporated machine-like

elements in figure studies and landscapes—one can almost hear the clanging of machinery in his art.

In 1915 Luigi Pirandello created a character who might have stepped out of one of Léger's paintings. The narrator of his novel *Shoot: The Notebooks of Serafino Gubbio, Cinematograph Operator,* has internalized the characteristics of the "clamorous and dizzying" world in which he lives and of the motion picture camera that he operates. "Already my eyes and my ears too, from force of habit, are beginning to see and hear everything in the guise of this rapid, quivering, ticking mechanical reproduction." The identification with his occupation becomes so complete that Gubbio finally loses his identity to the camera: "I cease to exist. *It* walks now, upon my legs. From head to foot, I belong to it: I form part of its equipment." This fantasy of self-abnegation culminates with the outburst, "My head is here, inside the machine, and I carry it in my hand."[44]

With metaphor and fantasy, artists sought to portray the impact of technology on human experience. Leblanc envisioned the union of man and bicycle winging along the open road, Léger fused humans and machines in sleek metallic forms, and Pirandello created a character whose head got lost in a camera. The Futurists also lost their heads over the new technology and proclaimed a "new aesthetic of speed," first announced by Marinetti. "We say that the world's magnificence has been enriched by a new beauty; the beauty of speed. A racing car whose hood is adorned with great pipes that seems to ride on grapeshot is more beautiful than the *Victory of Samothrace* . . . We cooperate with mechanics in destroying the old poetry of distance and wild solitudes, the exquisite nostalgia of parting, for which we substitute the tragic lyricism of ubiquity and omnipresent speed."[45] Unfortunately Marinetti continued to exalt speed during the war and lost most of his audience. When in 1916 he wrote that "the new religion-morality of speed is born this Futurist year from our great liberating war," the public turned to thoughts about the breakdown of religion, the corruption of morals, and the killing pace of machine-gun fire. He hovered between hyperbole and madness with his fantasy that the acceleration of life would cut down the arabesque of valleys and straighten the meandering of rivers, that someday the Danube would run in a straight line at 300 kilometers an hour.[46]

Although Marinetti's bombast at times exceeded the ambition of many Futurists, his principles provided the inspiration and theoretical framework for their art. In 1912 Balla began to paint movement.

raphy and photodynamism. He agreed with Bergson that no series of still photographs, no set of fixed images, could ever properly reconstruct motion. He also rejected the visual slurs of Bragaglia's photodynamism as a facile time exposure of a moving object that lacked artistic merit. Boccioni believed that the artist could find a single form of continuous movement that would suggest the immediate past and future of the action and the interpenetration of object and environment that is generated by it.

In Boccioni's paintings of *Dynamism of a Human Body* and *Dynamism of a Cyclist* moving limbs and spinning wheels are lost in abstract patterns of the "force-forms" and "plastic dynamism" he was defining in manifestos. In a sculpture called *Synthesis of Human Dynamism* (1912), he tried to realize two requirements of plastic dynamism: to create a sense of motion and bring surroundings into the form. But both efforts were only partially successful. Another striding figure, *Speeding Muscles* (1913), offered a sharper depiction of movement. The head is a convoluted geometrical form, face distorted as if it had been racing against the wind. The torso is twisted and arched forward like a fullback bracing to charge. Movement is most forcefully suggested by the flux of lower limbs, rendered by continuous swirls. The penultimate sculpture in this series was *Spiral Expansion of Speeding Muscles* (1913). This figure is upright, its head a hybrid of man and machine. The torso is armless and streamlined, and the striding legs, now separate, spiral up from the base. But the bulky forward leg is caught in a cluster of spiral forms like a pile of wood shavings, and interferes with the continuous forward movement.

In a successful resolution of the earlier artistic problems, *Unique Forms of Continuity in Space* is a mixture of man, energy, and machine—a fulfillment of the Futurist goal to create a new beauty of speed. The head is a montage of skull, helmet, and machine parts with a sword hilt for a face. The forward thrust of the figure is balanced by calves that are shaped like exhaust flames, suggesting propulsive energy and speed of movement. Its thigh muscles are contoured for strength and aerodynamic efficiency. The torso is armless, but the shoulders, fanned out like budding wings, suggest another source of continuous movement. The chest is shaped to withstand air pressure and must have been the inspiration for Marinetti's 1915 vision of the superhuman man of the future, who will be "built to withstand an omnipresent speed . . . He will be endowed with unexpected organs adapted to the exigencies of continuous shocks . . .

[There will be] a prow-like development of the projections of the breastbone which will increase in size as the future man becomes a better flyer."[49] The body has the pliability of a wing and the hardness of steel; it is driven by muscle, machinery, and fire. Boccioni avoided the complete abstraction of speed of Balla and the excessive concretization of it as in Marinetti's racing car. He rejected the stuttering motion of chronophotography and the sloppiness of photodynamism. He attempted to reconcile Bergson's relative and absolute motion and created an image of modern man that transcended traditional shapes and proportions as Nietzsche's overman transvaluated all values. With this sculpture the culture of speed made its most eloquent statement.

Historians of music are right to be wary of making simplistic connections between the pace of life and the tempo of music, between jazz and modernity, but in this period many composers consciously wrote music to reflect a changing world.[50] The new rhythms were not simply faster; indeed some innovations delayed or even stopped the beat unexpectedly, but the mixture of syncopation, irregularity, and new percussive textures gave an overall impression of the hurry and unpredictability of contemporary life.[51]

The driving pulse of the new ragtime music that began to be heard from the Mississippi, Missouri, and Ohio river valleys around 1890 expressed the playful, hopeful side of the American blacks, shifting between oppression and bursts of emotional release, between work routines and wild celebrations. The first ragtime composition was published in 1897, and its popularity quickly spread in America and Europe. The name may have come from the ragged appearance of the early performers, but most likely it came from the irregular movement of syncopated rhythm and its effect on traditional time—literally, time in tatters. The tempo was steady but there were fluid progressions of rhythmic variations. Most distinctive was the heavy syncopation that stressed the weak beat and created the oompah accents, the sudden "break" in which the rhythm pattern of the bass line stopped to accentuate the treble, and the more dramatic "stoptime" that disrupted the rhythm completely with gasping silences. In the ragtime classic, *Maple Leaf Rag* (1899), Scott Joplin generated subtle tensions with frequent shifts in rhythm all within the steady movement of a four-beat or syncopated march tempo.[52] And how it does move—deliberately with the beat, haltingly with delays and unexpected accents, and hurriedly with ani-

that results from living in the big city and includes, among its numerous symptoms, "rapidity and nervousness and lack of deliberation in all movements."[59] In *L'Energie française* (1902) Gabriel Hanotaux inventoried sources of national power and evaluated the new technology and the mobility it created: bicycles magnify the locomotive energy of the feet, automobiles liberate travelers from the constraints of railroad timetables, and thought moves with the speed of lightning. Like a contemporary conservationist he warned that the enormous increase in coal consumption is rapidly using up the accumulated reserves of antediluvian forests, the energy of millennia—"We are burning our way during our stay in order to travel through more rapidly."[60] The German writer Willy Hellpach catalogued these worries in a popular medical tract, *Nervosität und Kultur* (1902). Following Beard he set the beginning of the age of nervousness in 1880 and explained its onset with the standard list of causes including a speedup in transportation and communication that created an "overwhelming increase of normal mental processes."[61]

Cultural rejection of speed mounted as philosopher and novelist joined physician and psychiatrist.[62] In 1907 Henry Adams wrote that power has outgrown its servitude and that the unprecedented speed of life has made people "irritable, nervous, querulous, unreasonable, and afraid."[63] William Dean Howells agreed, in a sketch of life in New York:

> People are born and married, and live and die in the midst of an uproar so frantic that you would think they would go mad of it; and I believe the physicians really attribute something of the growing prevalence of neurotic disorders to the wear and tear of the nerves from the rush of the trains passing almost momently, and the perpetual jarring of the earth and air from their swift transit . . . Imagine . . . a wife bending over the pillow of her husband to catch the last faint whisper of farewell, as a train of five or six cars goes roaring by the open window! What horror! What profanation![64]

Robert Musil wrote of the rush of traffic and its profanation of a death in *The Man Without Qualities*. Although written in the 1920s, the opening of the novel is set precisely in August 1913 in downtown Vienna. Musil recreated the fabric of the city's rush: the "loose-woven hurrying" of pedestrians crossed the "stronger lines of speed" of motor-cars that came shooting out of narrow streets into

the squares. A man was run over by a truck, and people walked by unconcerned as if it were part of the natural order of things. " 'According to American statistics,' the gentleman observed, 'there are over a hundred and ninety thousand people killed on the roads annually over there, and four hundred and fifty thousand injured'."[65] Musil introduced the man without qualities, standing at a window with a watch in hand, counting the cars and pedestrians, estimating "the speed, the angle, the dynamic force of masses being propelled past, which drew the eye after them swift as lightning, holding it, letting go, forcing the attention—for an infinitesimal instant of time—to resist them, to snap off, and then to jump to the next and rush after that." But for all the hurrying, the imperial city is going nowhere, the empire is without a future, and people dream of living elsewhere.

> For some time now such a social *idée fixe* has been a kind of super-American city where everyone rushes about, or stands still, with a stop-watch in his hand . . . Overhead-trains, overground-trains, underground-trains, pneumatic express-mails carrying consignments of human beings, chains of motor-vehicles all racing along horizontally, express lifts vertically pumping crowds from one traffic-level to another . . . At the junction one leaps from one means of transport to another, is instantly sucked in and snatched away by the rhythm of it, which makes a syncope, a pause, a little gap of twenty seconds between two roaring outbursts of speed, and in these intervals in the general rhythm one hastily exchanges a few words with others. Questions and answers click into each other like cogs of a machine . . . One eats while in motion.[66]

Within a year there would scarce be time to grab a napkin. This is a caricature of Europe speeding out of control, heading toward war.

Stefan Zweig recalled the slow-paced and secure world of his childhood in Austria before the introduction of the new technology. "It was a world with definite classes and calm transitions, a world without haste." The adults walked slowly and spoke with measured accents; many were corpulent at an early age. He could not remember his father ever having rushed up the stairs or done anything in a visibly hasty manner. "Speed was not only thought to be unrefined, but indeed was considered unnecessary, for in that stabilized bourgeois world with its countless little securities, well palisaded on all

wandered and the way barges drifted on them. The Danube never seemed so deliciously slow until he suggested speeding it up. And of all the technology that affected the pace of life, the early cinema most heightened public consciousness of differential speeds. Since many early projectors were hand cranked, no two showings ever went at the exact same speed. They varied from scene to scene with inspired nudges from the cinematograph operator, and there were more irregularities from the interplay between the organ player and the film operator. To the delight of audiences they would suddenly shift the tempo, foil and tease each other with unpredictable lapses and rushes.

On the surface there was agreement: Taylorism and Futurism, the new technology, the new music, and the cinema had set the world rushing. But beneath there ran countercurrents. As quickly as people responded to the new technology, the pace of their former lives seemed like slow motion. The tension between a speeding reality and a slower past generated sentimental elegies about the good old days before the rush. It was an age of speed but, like the cinema, not always uniformly accelerated. The pace was unpredictable, and the world, like the early audiences, was alternately overwhelmed and inspired, horrified and enchanted.

6

THE NATURE OF SPACE

In an autobiographical sketch Einstein recalled two incidents from his childhood that filled him with wonder about the physical world. When he was five years old his father showed him a compass. The way the needle always pointed in one direction suggested that there was "something deeply hidden" in nature. Then at twelve he discovered a book on Euclidean geometry with propositions which seemed to be about a universal and homogeneous space.[1] These early memories embodied two opposing views about the nature of space. The

Deutsche Rundschau, 8 (1897): 111–122, discusses how the introduction of paper money accelerated the pace of business transactions and the tempo of life.

19. William Crookes, "Some Possibilities of Electricity," *The Fortnightly Review,* 5 (1892): 179.

20. Ernest Solvay, "Rôle de l'électricité dans les phénomènes de la vie," *Revue scientifique,* 52 (1893): 769–778.

21. John B. Huber, "Arrhenius and His Electrified Children," *Scientific American* (April 13, 1912): 334.

22. *New York Times,* August 7, 1890, 1–2.

23. Robert Lincoln O'Brien, "Machinery and English Style," *Atlantic Monthly* (October 1904): 464–472.

24. Samuel Haber, *Efficiency and Uplift: Scientific Management in the Progressive Era 1890–1920* (Chicago, 1964).

25. Frederick W. Taylor, *The Principles of Scientific Management* (New York, 1911), 94.

26. Frederick W. Taylor, "A Piece-Rate System, Being a Step Toward a Partial Solution of the Labor Problem," read at American Society of Mechanical Engineers in 1895. An early study of the pace of competitive activity was made by Norman Triplett, "The Dynamogenic Factors in Pacemaking and Competition," *The American Journal of Psychology* (July 1898). He concluded that the presence of another contestant in a bicycle race increased the pace on an average of 5.15 seconds per mile.

27. Frederick W. Taylor, "Shop Management," reprinted in his *Scientific Management* (New York, 1947), 150–154.

28. Frank B. Gilbreth and Lillian M. Gilbreth, *Fatigue Study* (New York, 1916), 121.

29. Frank B. Gilbreth, "Motion Study in the Household," *Scientific American* (April 13, 1912): 328.

30. Frank B. Gilbreth, Jr., and Ernestine Gilbreth Carey, *Cheaper by the Dozen* (New York, 1948), 3.

31. F. Gilbreth and L. Gilbreth, *Fatigue Study,* 159.

32. Standish D. Lawder documents the influence of the cinema on the Cubists and their subsequent work with it in *The Cubist Cinema* (New York, 1975), 21–25.

33. Cited by Katherine Kuh, *Break-Up* (New York, 1966), 48.

34. A wildly speculative article entitled "Does Everything Go by Jerks?" suggested that all processes in the universe might occur by means of a series of infinitesimally small jerks rather than continuously. "There are 'atoms' of energy as well as of matter, and possibly also 'atoms' of time, causing all duration to be jerky instead of smooth, as it appears to be." And nature might therefore be "one vast cinematograph." See *The Literary Digest* (April 13, 1912).

35. Rudolf Arnheim, *Film as Art* (New York, 1933), 165–166.

36. E. A. Baughan, "The Art of Moving Pictures," *The Fortnightly Review,* 12 (1919): 450–454.

37. Horace M. Kallen, "The Dramatic Picture Versus the Pictorial Drama: A Study of the Influences of the Cinematograph on the Stage," *The Harvard Monthly* (March 1910): 28.

38. Jules Guiart, "La Vie révélée par le cinématographe," *Revue scientifique* (1914): 749. See also Charles B. Brewer, "The Widening Field of the Moving Picture," *The Century Magazine,* 86 (1913): 72.

39. Hugo Münsterberg, *The Film: A Psychological Study* (New York, 1970), 10.

40. Erwin Panofsky, "Style and Medium in the Motion Pictures," *Critique* (January-February 1947); reprinted in *Film: An Anthology,* ed. Daniel Talbot (Berkeley, 1969), 16.

41. Frank Norris, *McTeague* (1899; rpt. New York, 1964), 85.

42. Fernand Léger, "The Origins of Painting and Its Representational Value" (1913), in *Cubism,* ed. Edward F. Fry (New York, 1966), 121.

43. Fernand Léger, "Contemporary Achievements in Painting," in *Functions of Painting,* ed. Edward F. Fry (New York, 1973), 11.

44. Luigi Pirandello, *Shoot: The Notebooks of Serafino Gubbio, Cinematograph Operator* (1916; rpt. New York, 1926), 4, 10, 86.

45. Filippo Marinetti, "The Founding Manifesto of Futurism," *Le Figaro,* February 20, 1909, in *Marinetti: Selected Writings,* ed. R. W. Flint (New York, 1971), 41.

46. Filippo Marinetti, "The New Religion-Morality of Speed," *L'Italia Futurista,* May 11, 1916; in Flint, *Marinetti,* 94–95.

47. Umberto Boccioni, Carlo Carrà, Luigi Russolo, Giacomo Balla, Gino Severini, "Futurist Painting: Technical Manifesto" (1910), in *Futurist Manifestos,* ed. Umbro Apollonio (New York, 1973), 27–30.

48. Umberto Boccioni, "Absolute Motion + Relative Motion = Dynamism," in ibid., 150–154.

49. Marianne W. Martin cited this passage from Marinetti's 1915 interventionist tract, *War, the World's Only Hygiene* and made the connection with Boccioni, *Futurist Art Theory 1909–1915* (Oxford, 1968), 172.

50. In a general study of technology and culture, Werner Sombart linked the two-step with the rhythm of a machine; the "nervous and hurried" pace of music with urban life; and the city's "hard, cold, loveless" quality with the "rush and racket" of his age; see "Technik und Kultur," *Archiv für Sozialwissenschaft und Sozialpolitik,* 23 (1911): 342–347.

51. There were also studies of the origin of our sense of rhythm and its application to work. A pioneer article of 1894 identified several possible sources: the cosmic rhythms of the earth's rotation and orbiting; the living rhythms of gestation, menstruation, pulse, breathing, and sleeping; and the rhythm of walking or a horse's hoofbeat; see Thaddeus Bolton, "Rhythm," *The American Journal of Psychology,* 6 (1894): 145–238. See also Margaret Kiever Smith, "Rhythmus und Arbeit," *Philosophische Studien,* 16 (1900): 71–133.

52. William J. Schafer and Johannes Riedl, *The Art of Ragtime* (Baton