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The Railway Journey

The Industrialization of Time and Space in the Nineteenth Century

With a New Preface

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[1]
The Mechanization of Motive Power

L'industrie est devenue la vie des peuples.
[Industry has become the life of the nations.]
— Marc Séguin, 1839

In the economic life of the pre-industrial era, wood was the prime material, universally used in construction and as combustible matter. The shipbuilding industry of the European maritime powers, the iron works and the machines built in the manufacturing and early industrial period were all based on the use of wood. Werner Sombart, the economic historian, regarded the exhaustion of this resource (i.e., the deforestation of Western Europe in the eighteenth century) as an essential factor, or perhaps even *the* main incentive for the development of industrial capitalism. In the pre-industrial era, 'wood affected all areas of cultural existence, being the prerequisite for the prosperity of all branches of economic life: so general was its use in the production of material goods that the characteristics of culture before the eighteenth century were decidedly wooden, and thus that culture retained an "organic" quality in its material and sensual aspect'.[1]

Next to wood, water and wind power were the main energy sources of pre-industrial economic life. The Industrial

1. Werner Sombart, *Der Moderne Kapitalismus*, vol. 2, p. 1138 (1st ed., Munich, 1902).

Revolution, generally seen as having begun in the last third of the eighteenth century, was a complex process of denaturalization. The abolition of 'live' workmanship by the division of labor, a process first described by Adam Smith, corresponded in terms of materials and energies to the 'emancipation from the boundaries of nature' (Sombart) which occurs when 'live' natural materials and energies are replaced by mineral or synthetic ones. Thus wood lost its universal function. Iron became the new industrial building material, coal the new combustible.[2] In the steam engine, the prime mover of industry, these two combined to produce energy in theoretically unlimited amounts. The technological development of the steam engine in the eighteenth century exemplified the gradual process of industry's emancipation from nature. The initial economic utilization of steam power occurred in the early part of the century when Newcomen's atmospheric steam engine was deployed in the Newcastle mining region to pump water out of mine shafts. The Newcastle region can be regarded as Europe's first industrial landscape in that coal began to determine the physical aspect of the environment. Thus Daniel Defoe, who had a clear understanding of the economics of his day, traveled through the region and expressed his astonishment at the 'prodigious Heaps, I might say Mountains, of Coals, which are dug up at every Pit, and how many of those Pits there are; we are filled . . . with Wonder to consider where the People should live that can consume them'.[3] The Newcomen engine was a crude contraption, only capable of a back-and-forth motion, consuming incredible amounts of fuel, and comparatively weak in performance. However, as it was used in the coal-producing region, its excessive fuel (i.e., coal) consumption was no problem. As early as 1767, fifty-seven Newcomen engines were working in the area.[4]

The waterwheel remained the main energy source for Eng-

2. Lewis Mumford (following the Scottish sociologist Patrick Geddes) has coined the terms 'eotechnology' and 'paleotechnology' to describe this epoch-making change in materials and energy: 'The eotechnic phase is a water-and-wood complex; the paleotechnic phase is a coal-and-iron-complex.' (L. Mumford, *Technics and Civilization*, New York, 1963, p. 11.)
3. Daniel Defoe, *A Tour Thro' the Whole Island of Great Britain* (1st ed., 1724–7; repr. 2 vols., London, 1968), vol. 2, p. 659.
4. Conrad Matschoss, *Geschichte der Dampfmaschine* (Berlin, 1901), p. 55.

land's manufacturing industry in the eighteenth century. Yet, following the evolutionary pattern characteristic of the Industrial Revolution, the water-wheel was to be aided by a curious intermediate adaptation that pointed the way to mechanization: water-powered factories attempted to end their dependence on seasonally variable water levels by installing the Newcomen engine to pump back the used water (i.e., the water that had already passed through the wheel and would have been lost otherwise).[5] This recycling process was a kind of mechanization of the mill race: it regularized the previously natural and erratic stream of water and transformed it into an aqueous driving belt. Thus water-power became a merely incidental element in a uniform and regular mechanized process whose true mover was the steam engine.

That bypass became obsolete with the development of a steam engine capable of rotary motion. Watt's low-pressure engine, perfected in the 1780s was such a technological advance. Thus steam power left its original 'natural' habitat, the coalfields, and became an essential part of the manufacturing industry. Watt's engine used only a fraction of the fuel required by Newcomen's. Its performance was also far better and it produced the rotary motion required by industry. (The immediate incentive for Watt's development of the low-pressure engine was the saturation of the coal mine market with Newcomen pump engines. Its manufacturer, the firm of Watt & Boulton, urged Watt to develop an engine for the new market of the manufacturing industries. The success of this speculation demonstrates that industry had in the meantime indeed developed a need for mechanical power.)[6]

At the turn of the eighteenth and nineteenth centuries, the evolution of the steam engine reached its culmination in Oliver Evans' high-pressure engine. Once again, the improvement was tremendous: the engine's performance was no longer based solely on condensation, but on the immediate effect of steam pressure. This made it possible to further reduce the size of the engines, which had been quite unwieldy, while increasing performance and reducing fuel consumption. On the other hand, it

5. Thomas Ashton, *Iron and Steel in the Industrial Revolution* (1st ed., 1924; repr. ed., Manchester, 1951), pp. 99–100.
6. Matschoss., op. cit., p. 77.

became necessary, in order to meet the requirements of increased temperature and pressure, to improve the quality of machine technology and its materials.

The intensification achieved by the high-pressure engine — maximal work performance with minimal machinery — permitted the *mobile* use of the steam engine, that is, its use as locomotive. This first occurred at the beginning of the nineteenth century in the coalfields around Newcastle, where the Newcomen engine had found its first application a century before. In the wake of the now full-blown Industrial Revolution and its increased demand for coal, the region, already transformed by coal production in Defoe's time, underwent further changes. The land between the mines and the river Tyne became covered by a dense network of railways up to ten miles long — descendants of the rails used in mountain mine shafts since the late Middle Ages. These railways were appendages of the mines and were used only to move coal. The wagons were first pulled by horses, but after the end of the Napoleonic Wars these were progressively replaced by steam-powered locomotives. The changeover to mechanized motive power was possible because in the mining region, fuel (coal) was cheaper than food — which latter had to be shipped from other regions. From 1815 on, coal became cheaper to use than food throughout England and in that year, Parliament, dominated by agricultural interests, passed a Corn Law which, by imposing steep taxes on imported grain, forced grain prices to rise.[7] Obviously, the artificially high level of grain prices helped to replace horsepower by mechanical power in much the same way as the shortage of wood in eighteenth-century Europe had accelerated the development of coal production. Confirmation for this is provided by a contemporary, Thomas Grahame, who, in 1834 when steam locomotion was an accomplished fact, described the

7. Concise information on the history of the English Corn Laws can be found in: Eric Hobsbawm, *Industry and Empire: From 1750 to the Present Day*, Pelican Economic History of England, vol. 3 (Harmondsworth/New York, 1968); Asa Briggs, *The Age of Improvement, 1783–1867* (New York, 1959), pp. 202, 312; R. K. Webb, *Modern England* (New York and Toronto, 1970), pp. 153, 185–6. The corn legislation after 1815 can be seen as a temporarily effective skirmish conducted by the land-owning class against the rising industrial bourgeoisie. No later than 1828 the pressure of free-enterprise interests caused the law of 1815 to be modified, and by the mid-1840s it had been abolished entirely, after the industrial bourgeoisie and the working class (i.e., the Chartists) had joined, in 1838, to form the Anti-Corn Law League.

choice the English industrial capitalists had to make: 'The landed capitalists of Britain . . . have by the taxes on corn and provisions more than doubled the price of animal labour, whether of man or horses. To avoid the effects of these taxes the monied capitalists of Britain have been for years devoting their capital to the promotion of those inventions by which taxed animal power may be dispensed with; and their endeavours have been crowned with eminent success'.[8]

From the beginning of the nineteenth century, there were plans to develop the railroads into a general and national mode of transportation. The 1820s saw the origins of a fully-fledged 'railroad movement', whose main promoters were agreed that the railroad, which in the meantime carried not only coal but other goods and passengers, must be powered by steam. The high cost of grain was a recurrent and standard argument. According to Adam Smith, the upkeep of a horse was equal to the feeding of eight laborers. Thus, it was argued, when the one million horses kept for purposes of transportation in England were made redundant by mechanization, they would release additional foodstuffs for eight million laborers.

Thomas Gray, the most important railroad promoter of the time, whose *Observations on a General Iron Rail-Way* appeared in five editions between 1820 and 1825, considerably expanded each time, argued for his proposed steam-driven railroad as follows: 'The exorbitant demands now made on the public, for conveyance of goods and persons by waggons and coaches, are caused principally, if not altogether, by the enormous expense of a stock of horses, the continual renewal of the stock, and the intolerable expense of their keep'.[9]

It is possible to see how advanced mechanization was in Britain at this time, in both theory and practice, when one consults a roughly contemporary French statement on the question of animal versus mechanical power. Pierre-Simon Girard, an engineer and member of the Académie des Sciences, who in 1819 had been given the task of planning and realizing a

8. Thomas Grahame, *A Treatise on Internal Intercourse and Communication in Civilised States* (London, 1834) p. vi.
9. Thomas Gray, *Observations . . .*, 3rd ed. (London, 1822), p. x.

street-lighting system for the city of Paris, ostensibly summarized the state of the English debate on horse-power versus steam power in an article published in 1827; in fact, his account, tinged with eighteenth-century physiocratic theory, projects French conditions onto England:

> The use of steam engines as locomotives on the railways is still a great open question in today's England. While one is willing to agree with the partisans of this solution that locomotives would be more economical than the use of horses, it is necessary to point out that the fuel on whose consumption these engines depend for the production of their motive power has to be extracted daily from natural deposits whose vast expanses nevertheless are not inexhaustible . . . The use of horses is not subject to similar hazards; the motive power horses are able to produce is fed by products of the soil that nature renews every year and will continue to reproduce in ever greater abundance as agriculture grows more advanced.[10]

The apprehension that coal resources would be exhausted one day, combined with the notion that organic horsepower is able to reproduce itself *ad infinitum*, reflected not only the physiocratic tradition that guided Girard's thinking, but also the economic realities of France during this period: specifically, the state of French coal production. During the first third of the nineteenth century, coal, in France, was *un produit révolutionnaire*.[11] While in England, coal production was sixteen million tons in 1816, thirty million tons in 1836, forty-four million tons in 1846, and fifty-seven million tons in 1851, French production figures were much lower: one million tons in 1820, two million tons in 1837, and five million tons in 1846.[12]

In addition, French production was not centered in one region, but was scattered throughout the country. Unlike the English, whose coal industry was centralized in a way that altered both landscape and consciousness, the French were unable to perceive coal as *the* endlessly available fuel. It was precisely because of the physical reality of the concentration of English

10. P. S. Girard, Foreword to the French edition of Friedrich von Gerstner's *Mémoire sur les grandes routes, les chemins de fer, et les canaux de navigation* (Paris, 1827), pp. cxxv–cxxvi.
11. C. Fohlen, in *Charbon et sciences humaines: Colloque international de l'Université de Lille en mai 1963* (Lille, 1963), p. 148.
12. Op. cit., pp. 141–2.

coal production, and their awareness of it, that the English were able to mechanize motive power with such ease.

The mechanization of overland traffic subjected it to the same degree of regularization that had already been firmly established in bourgeois self-discipline and in industrial production. Unlike traffic on the waterways,[13] land traffic had until then been the weakest link in the chain of capitalist emancipation from the limits of organic nature, because animal power — on which land traffic was based — cannot be intensified above a certain fairly low level. Yet one should not underestimate the efforts made in the decades before the advent of the railroads to increase the efficiency of land traffic within the framework of these narrow natural limits. These efforts did, in fact, introduce a trend that eventually made mechanization appear as the final logical step. According to Bagwell — who, interpreting the material available to him, saw the English 'transport revolution' as beginning as early as 1770 — traveling time between the most important cities was reduced by four-fifths between 1750 and 1830, and cut in half between 1770 and 1830.[14] The trip from London to Edinburgh, which in the 1750s still required ten days in the summer, took only forty-five and a half hours in 1836.[15] With the increase in traveling speed came increases in the number of traveled routes, in traffic intensity and in the number of transportation enterprises. In the ten most important English cities, there were eight times as many regular departures in 1830 as there had been in 1790; Bagwell thinks that the number of passengers was multiplied by a factor of fifteen, as some of them were carried 'outside' (i.e., on top of the coach) on regular runs.[16] Due to these improvements, the stagecoach surpassed the riding horse as the fastest mode of land transportation.[17] Karl Philipp Moritz gives us a vivid impression of that highly developed mode of passenger traffic in his *Reisen eines Deutschen in England* (*Travels of a German in England*). At this time, in the 1780s, the German

13. Traditionally, traffic on waterways has always been greater than overland traffic. From the early fifteenth century to the end of the nineteenth century, sailing-ship technology was sufficient for the transportation needs of capitalism in all its phases of expansion. Fifty years after the mechanization of land traffic by means of the railroad, sailing-ship technology (i.e., the clipper) still dominated ocean traffic.
14. Philip S. Bagwell, *The Transport Revolution from 1770* (London, 1974), p. 41.
15. Ibid., pp. 42, 43.
16. Ibid., p. 43.
17. Ibid., p. 49.

traveler mostly proceeded on foot. Moritz, who attempted to wander about England in this manner, found himself regarded as a curiosity. He noted with surprise that in England even the lower orders traveled by stagecoach.

Finally, the high degree of development that the coach system achieved can be seen in its economic concentration: of the 342 scheduled daily departures from London listed in John Bates' *Directory of Stage Coach Services* for 1836, 275 were run by three enterprises, the largest of which, owned by William James Chaplin, also had considerable interests in the catering business and employed a total of more than two thousand people and eighteen hundred horses. (Bagwell, p. 50).

One of the main arguments for replacing the horse teams with steam locomotives was presented by Nicholas Wood, author of the most authoritative technical work of his time on railroads: 'The greatest exertions have been used to accelerate the speed of the mails (which have hitherto been the quickest species of conveyance), without being able to exceed ten miles an hour; and that only with the exercise of such *destruction of animal power*, as no one can contemplate with feelings except of the most painful nature; while, upon the Liverpool Rail-way, an average rate of fifteen miles is kept up with the greatest ease'.[18] (Italics added.)

How long overdue the mechanically produced means of locomotion must have seemed to the progressive contemporary consciousness — and how hopelessly anachronistic the animal power still in use — can be seen in a text from 1825 that juxtaposes both forms of locomotion:

> The animal advances not with a continued progressive motion, but with a sort of irregular hobbling, which raises and sinks its body at every alternate motion of the limbs. This is distinctly felt on horse-

18. Nicholas Wood, *A Practical Treatise on Rail-Roads, and Interior Communication in General*, 2nd ed. (London, 1832), p. xii. Within the mail system, there were attempts to increase physical capacity from the sixteenth century on: letters were no longer carried long distances by means of only one courier, but from one station to the next, 'with either changes of horses, or of couriers, *relays*, in any case, consisting of runners or riders or drivers'. (Sombart, op. cit., vol. 2, p. 382.) This subdivision of the formerly unified effort caused the process to become intensified, but the system remained subject to the limits of physical capacity, even though this was now the sum of the physical capacities of all the individual relays. This intensification also intensified costs, and thus only the mails employed this mode of transportation.

> back, and it is the same when an animal draws a load. Even in walking and running one does not move regularly forward. The body is raised and depressed at every step of our progress; it is this incessant lifting of the mass which constitutes that drag on our motions which checks their speed, and confines it within such moderate limits. . . . With machinery this inconvenience is not felt; the locomotive engine rolls regularly and progressively along the smooth tracks of the way, wholly unimpeded by the speed of its own motions; and this, independent of its economy, is one of the great advantages it possesses over animal power.[19]

The mechanical motion generated by steam power is characterized by regularity, uniformity, unlimited duration and acceleration. 'No animal strength', says Gray, 'will be able to give that uniform and regular acceleration to our commercial intercourse which may be accomplished by railway'.[20]

As the motion of transportation was freed from its organic fetters by steam power, its relationship to the space it covered changed quite radically. Pre-industrial traffic is mimetic of natural phenomena. Ships drifted with water and wind currents, overland motion followed the natural irregularities of the landscape and was determined by the physical powers of the draught animals. Charles Babbage observed, concerning the eotechnical utilization of wind and water power: 'We merely make use of bodies in a state of motion; we change the directions of their movement, in order to render them subservient to our purposes, but we neither add to nor diminish the quantity of motion in existence'.[21]

The earliest perceptions of how steam power dissolved that mimetic relationship can be found in descriptions of the first steam-powered ships. An eyewitness to John Fitch's steamboat experiment in 1790 found it particularly remarkable that the boat proceeded in a straight line, instead of tacking, as one would expect, in the traditional eotechnically 'natural' manner of marine vessels.[22] Putting it differently, another account said of

19. James Adamson, *Sketches of Our Information as to Rail-Roads* (Newcastle, 1826), pp. 51–2.
20. Thomas Gray, *Observations* . . . (London, 1822), p. 39.
21. Charles Babbage, *On the Economy of Machinery and Manufacture* (Philadelphia, 1832), p. 27. An application to the motion of sailing ships, the text goes on to say, would mean that 'the quantity of motion given by them [the sails] is precisely the same as that which is destroyed in the atmosphere'.
22. Report in *New York Magazine* (1790), quoted in Seymour Dunbar, *A History of Travel in America*, 4 vols. (Indianapolis, 1915), vol. 1, pp. 256–7.

steam power that 'it *forces* the ships to traverse the ocean against wind and waves'.[23] (Italics added.)

Thus steam power appeared to be independent of outward nature and capable of prevailing against it — as artificial energy in opposition to natural forces. While this was first perceived in steamship traffic, it became even clearer only a little later, when animal power was abandoned in favor of mechanical power. As long as the conquest of space was tied to animal power, it had to proceed within the limits of the animals' physical capabilities. One way of gaining an immediate perception of the distance traveled was to observe the exhaustion of the draught animals. When they were over-taxed, it was seen as 'destruction of animal power'. Steam power, inexhaustible and capable of infinite acceleration, reversed the relationship between recalcitrant nature (i.e., spatial distance) and locomotive engine. Nature (i.e., spatial distance), which had caused the animal 'locomotive engines' to strain themselves to exhaustion, now succumbed to the new mechanical locomotive engine of the railroad that, in a frequently used metaphor, 'shoots right through like a bullet'. 'Annihilation of time and space' was the *topos* which the early nineteenth century used to describe the new situation into which the railroad placed natural space after depriving it of its hitherto absolute powers. Motion was no longer dependent on the conditions of natural space, but on a mechanical power that created its own new spatiality.

> We have seen the power of steam suddenly dry up the great Atlantic ocean to less than half its breadth. . . . Our communication with India has received the same blessing. The Indian Ocean is not only infinitely smaller than it used to be, but the Indian mail, under the guidance of steam, has been granted almost a miraculous passage through the waters of the Red Sea. The Mediterranean, which is now only a week from us, has before our eyes shrunk into a lake; our British and Irish channels are scarcely broader than the old Firth of Forth; the Rhine, the Danube, the Thames, the Medway, the Ganges etc., have contracted their streams to infinitely less than half their lengths and breadths, and the great lakes of the world are rapidly drying into ponds![24]

23. W. Heimann, *Über Dampfmaschinen, Dampfwagen und Eisenbahnen* (Frankfurt, 1836), p. 2.
24. *Quarterly Review*, vol. 63 (1839), p. 23.

The shrinking of the natural world by means of mechanical transportation was perceived and evaluated in different ways, dependent on the evaluator's economic and ideological position: there was shrinkage as economic gain versus shrinkage as loss of experience. The representatives of industry and free enterprise saw transportation's release from nature's fetters as a gain: nature, in the form of distances that were hard to bridge, and exhaustible and unpredictable energy sources, had been an obstacle to the development of world trade. Mechanical energy rendered all transportation calculable. The promoters of the railroad regarded steam power's ability to do away with animal unreliability and unpredictability as its main asset. Here is Thomas Gray:

> The dangers to which the present coach system is obnoxious (such as the untractableness of horses, the imprudence of drivers, cruelty to animals, the ruggedness of roads, etc.), would not be encountered on the rail-way, whose solid basis and construction render it impossible for any vehicle to be upset or driven out of its course; and as the rail-way must also be perfectly level and smooth, no danger could be apprehended from the increased speed, for mechanic power is uniform and regular, whilst horse-power, as we all very well know, is quite the reverse.[25]

This rational and progressive evaluation was opposed by a contrary position, in which the loss of organic natural power was not seen as an elimination of interfering factors that have hitherto hindered the smooth conduct of business and transportation, but as the loss of a communicative relationship between man and nature. Thus for instance, Thomas De Quincey described the lost experience of coach travel:

> Seated in the old mail-coach, we needed no evidence out of ourselves to indicate the velocity. . . . The vital experience of the glad animal sensibilities made doubts impossible on the question of our speed; we heard our speed, we saw it, we felt it as a thrilling; and this speed was not the product of blind insensate agencies, that had no sympathy to give, but was incarnated in the fiery eyeballs of the noblest among brutes, in his dilated nostril, spasmodic muscles, and

25. Gray, op. cit., p. 55.

thunder-beating hoofs.[26]

We should not read that account of a past mode of travel merely as a reactionary-romantic tirade against the new technology. De Quincey described the disorientation experienced by the traveler when the traditional, 'natural' mode of travel, the one based on traditional technology, was superseded by a new travel technology. Contemporaries perceived the transition from coach to railroad technology as a decisively reduced expenditure of work or power: in the form of animal exhaustion, that expenditure had been immediately perceptible to the senses, and spatial distance had been experienced by means of sensory recognition of that physical exhaustion. As the sensory perception of exhaustion was lost, so was the perception of spatial distance. De Quincey's description of this process was echoed in numerous variations in contemporary literature and journalism, as in this anonymous polemic from the year 1839:

> When we are travelling by stage-coach at the rate of eight or ten miles an hour, we can understand the nature of the force which sets the vehicle in motion: we understand in a general way the nature of animal power: we see how soon it is exhausted; every successive hour do we watch the panting and reeking animals in their stalls, and, in the course of a day's journey, we can appreciate the enormous succession of efforts required to transport a loaded vehicle from London to a distant town.
>
> But, when proceeding on a journey by the rail-road, we are seldom allowed to get a sight of the wondrous power which draws us so rapidly along. The scene is altogether changed, there are no animals yoked to the car, to excite our pity by their apparently short, but really severe labour; we hear the steam gushing from the safety valve, while the machine is for a short time stationary; then we hear a number of rapid beatings: we feel that we are moving; the motion soon increases rapidly, and the journey which by the stage-coach is so tedious, is here, long before we are aware of it, at an end. The traveller then wonders not only at the rapidity of his journey, but often wishes to inspect and comprehend the means by which it was effected.[27]

26. Thomas de Quincey, *The Collected Writings*, ed. David Masson (London, 1897), vol. 13, pp. 283–4. (First published in 1849 in *Blackwood's Magazine*.)
27. *The Roads and Rail-Roads, Vehicles, and Modes of Travelling, of Ancient and Modern Countries . . .* (London, 1839), p. 279.

As the new technology terminated the original relationship between the pre-industrial traveler and his vehicle and its journey, the old technology was seen, nostalgically, as having more 'soul'. In addition to this sentimental line of thought there appeared another criticism of steam power that also had a high regard for the old technology but, while using the same arguments to be found in de Quincey and others, invested them with a modern content. This was accomplished by transferring the economically obsolete old technologies to a new realm, that of leisure and sports. What de Quincey deplored as a loss of sensory perception, others now attempted to reinstitutionalize. Thus, for instance, W. B. Adams' *Pleasure Carriages*, published in 1837, was the precursor of a literature of leisure and sports whose ever-increasing growth the century was to witness.[28] In this book, the use of horse-power was no longer treated nostalgically, but from a point of view that regarded the use of steam as merely unsportsmanlike:

> Steam is a mere labourer — a drudge who performs his work without speech or sign, with dogged perseverance but without emotion. . . . He may be personified when speaking *of* him; but no one pats his neck or speaks *to* him in a voice of encouragement. It is not so with a horse or horses. They are beautiful and intelligent animals, powerful yet docile; creatures that respond to kindness, and shrink from cruelty and injustice. The driver and owner can love them or feel proud of them; they step with grace, and can vary their form and movements in a thousand ways. They are creatures of individual impulses. . . . The man who rides a horse, feels a pleasure when the creature responds willingly to his purposes; and when he responds unwillingly, he feels a pride in the exercise of his power to compel him to obedience. Even when a horse is vicious, there is a pleasurable excitement in riding him. The rider's nerves are strung, his senses are quickened; eye, hand, and ear are alike on the alert; the

28. 'In the manual on the art of driving published by the president of the Four-in-Hand Driving and Coaching Club, which was revived in 1870 by the Duke of Beaufort, there is a chapter titled "The coaching revival" that deals exclusively with the club members' new practice of driving coaches on busy routes (e.g., to Brighton, Dover, Tunbridge Wells) and racing the railway trains to those destinations; this activity made the long-abandoned inns of the coaching era come alive again with the neighing of horses and the cracking of whips.' (P. D. Fischer, *Betrachtungen eines in Deutschland reisenden Deutschen* [Berlin, 1895], pp. 43–4. Fischer also mentions the following coaching titles published in the 1880s: Stanley Harris, *Old Coaching Days*; W. Outram Tristram, *Coaching Days and Coaching Ways*.)

blood rushes through the veins, and every faculty is aroused.[29]

The final fate of carriage-riding, the traditional mode of travel, was to become the amateur sport of the privileged classes. In everyday existence, the new technology took over. Only during a transitional period did the travelers who transferred from the stagecoach to the railway carriage experience a sense of loss due to the mechanization of travel; it did not take long for the industrialization of the means of transport to alter the consciousness of the passengers: they developed a new set of perceptions. The uniform speed of the motion generated by the steam engine no longer seemed unnatural when compared to the motion generated by animal power; rather, the reverse became the case. Mechanical uniformity became the 'natural' state of affairs, compared to which the 'nature' of draught animals appeared as dangerous and chaotic. An anonymous text from the year 1825 gives us an idea of the adaptation to this industrialization of travel. It discusses the 'sensitive or nervous man' who will find the new mechanical mode of transport more agreeable than the horse-drawn vehicle:

> It is reasonable to conclude, that the nervous man will ere long, take his place in a carriage, drawn or impelled by a Locomotive Engine, with more unconcern and with far better assurance of safety, than he now disposes of himself in one drawn by four horses of unequal powers and speed, endued with passions, that acknowledge no control but superior force, and each separately momentarily liable to all the calamities that flesh is heir to. Surely an inanimate power, that can be started, stopped, and guided at pleasure by the finger or foot of man, must promise greater personal security to the traveller than a power derivable from animal life, whose infirmities and passions require the constant exercise of other passions, united with muscular exertion to remedy and control them.[30]

The 'sensitive and nervous man', in whom those horses in front of the coach, tended to cause unhealthy excitement, was enabled to relax in the railway carriage, and to sit in it without moving a muscle, without 'exertion' or any 'other passions'.

29. W. B. Adams, *English Pleasure Carriages* (London, 1837), pp. 198–9.
30. *The Fingerpost; or, Direct Road from John O'Groat's to the Land's End*, 3rd ed. (London, 1825), pp. 24–5.

Despite the apparent smoothness of transition to industrialized travel, certain residues of anxiety remained. We get an inkling of this from the report written by Thomas Creevy, the Liberal politician, about a trip on Stephenson's locomotive in 1829: 'It is really flying, and it is impossible to divest yourself of the notion of instant death to all upon the least accident happening'.[31]

31. John Gore, ed., *The Creevy Papers* (New York, 1963), p. 256.

[2]
The Machine Ensemble

Le chemin de fer et les chariots qu'il porte forme une sorte de machine complexe dont les parties ne sauraient être envisagées isolément.

[The railroad, and the carriages on it, make up a complex machine whose parts cannot be considered separately.]

— Anonymous, 1821

Like any other means of transportation, the railroad provided a medium for moving things from one place to another. Yet the precise way in which it accomplished this distinguished it from the other means of transportation.

Transportation on roads and canals, as developed in eighteenth-century England by private enterprise, made both a technical and an economic distinction between the *route* and the *means*. The capital investment companies that provided canals and turnpikes to be used upon payment of tolls did nothing further: they had nothing to do with the vehicles that were used on their routes. Anyone using one of these artificially created land routes or waterways did so with his own vehicle or hired an entrepreneur to transport the goods; that entrepreneur, in turn, operated quite independently from the canal or turnpike company. Route and means of transportation existed independently from one another, because individual movement of vehicles — their mutual flexibility in granting right-of-way, etc. — was technically possible.

The railways put an end to that liberal state of affairs. Route and vehicle became technically conjoined on the railroad: there was no leeway between the rails and the vehicle running on

them, nor was it possible for one train to pull to one side when confronted by another. This was realized early on: all initial definitions of the railroad unanimously described it as a machine consisting of the rails *and* of the vehicles running on them. 'It is necessary . . . to insist that the railroad and its carriages be considered as one machine, or, as an indivisible entity,'[1] a French author stated in 1821. In 1839 Guillaume Tell Poussin went into somewhat greater detail:

> A railway is far from being the simple construct that a canal or a turnpike is: these have to fulfil quite limited objectives. A railway, on the contrary, is a construct that has to adjust to the eventual exigencies of a new engine, in which each day of experience may cause important new modifications. Consequently, in order for there to be harmony between the two quite distinct parts that a railway consists of, i.e., its rails and its engine, there has to be reciprocal interaction, so that the ameliorations of the one determines the improvements of the other. Thus it is evident that one cannot separate the increasing knowledge of steam engines from the construction of the railways.[2]

In an early phase of the railroad's technological evolution, the concept of 'one machine' appeared with particular clarity: the locomotive was not seen, as yet, as a self-contained, autonomous motive apparatus, but simply as a steam engine mounted on an undercarriage. Thus, a report in the *Bulletin de la société pour l'encouragement de l'industrie nationale* (1815) on the railways in the English coal-mining district says: 'New application of steam engines. For some time now, a steam engine has been mounted on wheels in Leeds, making it move on rails, by

1. Quoted in Peter J. Wexler, *La Formation du vocabulaire des chemins de fer en France, 1778–1842* (Geneva and Lille, 1955), p. 31.
2. G. T. Poussin, *Examen comparatif de la question des chemins de fer en 1839 en France et à l'étranger* (Paris, 1839), pp. xi–xii. English literature does, of course, offer corresponding definitions, e.g., Lardner (see n. 20 below). The French definitions are attractive in their clarity, which is based partly on the French consciousness of language, and partly on the fact that these definitions are, essentially, descriptions of something that was still unknown to the French reading audience in any immediate sense. Thus it is amusing to read a French report from England, written in 1820, that apparently corrects erroneous notions arising from the words *'chemin de fer'*: 'Il y en a qui croient que ces routes sont pavées avec des plaques de fer, mais ce n'est pas cela du tout, ce ne sont que des ornières en fer fondu'. ('There are those who believe that these are roads paved with sheets of iron, but that is not the case at all, it is merely a matter of cast-iron rails.') (Quoted in Wexler, op. cit., p. 44.)

means of a large cogwheel'.[3]

That steam engine mounted on an undercarriage did not connect with its rails by rolling on them but by means of interlocking cogs: it moved by propelling cogwheels along proportionately serrated rails. The latter appeared as horizontal cogwheels, providing counterparts to the engine's wheels. In their experimental phase, railways were constructed according to this technical principle; it is hard to imagine a more vivid demonstration of the railways *machine* character. In retrospect, in 1849, Dionysius Lardner described one of these creations, built by the mining engineer Blenkinsop: 'He obtained a patent, in 1811, for the application of a rack-rail. The railroad thus, instead of being composed of smooth bars of iron, presented a line of projecting teeth, like those of a cog-wheel, which stretched along the entire distance to be travelled. The wheels on which the engine rolled were furnished with corresponding teeth, which worked in the teeth of the railroad; and, in this way, produced a progressive motion in the carriage'.[4]

This curious, technically redundant form of construction also existed in a variant in which the driving wheel was a cog that connected with a cograil laid between the running rails. The engineers who designed mine railways adhered to this model for a surprisingly long time. Even the illustration that Thomas Gray provided in the fifth edition of his *Observations* in 1825 showed such a cogwheeled locomotive. The 'imaginary difficulty' (Lardner) in the minds of the early railway engineers was

3. In Wexler, p. 99. On pp. 107–8 Wexler notes how hesitantly the adjective *locomotif* becomes the noun *locomotive*. Generally, Wexler provides an excellent account of the railroad vocabulary's slow development from its initial 'descriptive period' to the later stage when it has become a new technical vocabulary (p. 128). The process can be demonstrated more easily in French than in English: in the latter, the development of a railway vocabulary took a much longer time. Yet it is possible to see the corresponding trend in English, as in the simplification of the initially descriptive term *iron rail-way* to *rail-way* and finally to *railway*.

4. D. Lardner, *The Steam Engine*, 3rd American ed. from 5th British ed. (Philadelphia, 1849), p. 161. Even Lardner, who sees the cogwheel episode as a historical mistake, based on the erroneous notion that smooth rails and wheels could not provide traction, is still able to comprehend without difficulty how it was possible to arrive at this erroneous conclusion on the basis of theories of physics derived from the tradition of Galileo and Newton. He explains the notion as follows: 'If the face of the wheel and the surface of the road were absolutely smooth and free from friction, so that the face of the wheel would slide without resistance upon the road, then the effect of the force thus applied would be merely to cause the wheel to turn around, the carriage being stationary, the surface of the wheel would slip or slide upon the road as the wheel is made to revolve.' (Op. cit., p. 160.)

the notion that smooth wheels could not provide traction on smooth rails. Until simple experience proved otherwise, smooth steel on smooth steel did not seem capable of sufficient adhesiveness. That such a notion seemed plausible even to engineers, and for a relatively long time, is instructive in a number of ways: it sheds light on the history of cultural and psychological perceptions of iron and steel, and points to a fundamental change in the history of the wheel. For the first time, the wheel was no longer set in motion by a power extraneous to itself — the draught animal — but was, to all appearances, propelling itself along.

The cogwheel episode now looks merely like a symbolically exaggerated demonstration of the concept of rail and carriage as *one* machine: it shows the esthetic exuberance of technology. The final standardized form of the railroad — smooth wheels on smooth rails — retains that concept of unity of parts, which became ever more important as the railroad was technologically perfected. Franz Reuleaux, who in his *Theoretische Kinematik* (1875) summed up the development of machinery in the nineteenth century, agreed with the early chroniclers of the railroad that the joining of rail and wheel was the decisive step *'that joined carriage and road into one machine'*.[5] (Italics in original; we will return to Reuleaux's theory of the machine later on in greater detail.)[6] He then described the development of the machine in the direction of increased performance, intensification, etc., in terms of an ever more precise interaction between its individual parts: 'During the last century we have gradually become used to understanding the wheel and its cogs as a unit, a whole, and thus to seeing those cog profiles in context. It is my conviction that, in only a few decades, all cogwheels will operate *without play*'.[7] (Italics added.) While Reuleaux was speaking about the cogwheel, he used it as a paradigm for *the* machine part in general. The disappearance of 'play' concerned all parts of the machine.

This tendency in machine development appeared early on in the railroad's continuous evolution toward ever greater speed,

5. Franz Reuleaux, *Theoretische Kinematik: Grundzüge einer Theorie des Maschinenwesens* (Brunswick, 1875), p. 231.
6. See the last few pages of Chapter 10 of the present work.
7. Reuleaux, op. cit., p. 234.

regularity, and uniformity. In *An Exposition of the Danger and Deficiencies of the Present Mode of Railway Construction*, published in 1846, we find a description that anticipates the prophecy made by Reuleaux thirty years later — or, to put it another way, the descriptions of the railroad in the text of 1846 parallel the theoretical formulations on the development of machines in general made by Reuleaux in 1875:

> The wheels, rails, and carriages are only parts of one great machine, on the proper adjustment of which, one to the other, entirely depends the perfect action of the whole. And as the velocity given to the moving parts increases, so does the necessity for perfect adjustment increase also, because the imperfect action, which, at moderate speed, would only cause a *jolt*, will, when moving at high velocity, gain sufficient force to cause an overthrow. Therefore, from this cause it becomes necessary, in order to secure safety when moving at great speed, to have the parts in contact adjusted to each other in such manner as at all times, and under varying circumstances, to preserve a true relationship one to the other, at the same time having a tendency to resist and counteract the impulses which would otherwise destroy their equilibrium, and endanger the safety of the moving body.[8]

The machine character of the railroad was dual: first, the steam engine (locomotive) generated uniform mechanical motion; secondly, that motion was transformed into movement through space by the combined machinery of wheel and rail.

We observed how the process of the mechanization of formerly organic motive powers by the steam engine was experienced as denaturalization and desensualization. Let us now see how the development of the railway completes the detachment from nature initiated by the discovery of steam power.

As it is the function of the rail to overcome natural resistances, or obstacles, it can be defined as a technical means to implement Newton's First Law of Dynamics, which states: 'Every body continues in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it'.[9]

8. C. H. Greenhow, *An Exposition of the Danger and Deficiencies of the Present Mode of Railway Construction* (London, 1846), pp. 5–6.
9. The technical principle of the railroad is a practical demonstration of Newton's law of

The natural obstacles that are to be overcome by means of the rail are of two different kinds: first, the friction between wheel surface and road surface; secondly, the irregularity of the terrain. Friction may be called the microphysical resistance; the varying elevation of the land, the macrophysical. How does the rail deal with the microphysical resistance? Lardner provided a definition for the ideal (i.e., frictionless) road, acknowledging that it is directly derived from Newton: '*A perfect road should be smooth, level, hard, and straight*. Were it possible to construct a road between two places, absolutely smooth, absolutely level, absolutely hard, and absolutely straight, then a carriage put in motion from one end of this road would move to the other end without any tractive force at all, except so far as the resistance of the atmosphere would require it'.[10] (Italics in original.)

According to Lardner, the railway line was the optional approximation of that ideal road. Significantly, he based his argument on a brief delineation of traditional road-building technology. Only when the draught animals were replaced by mechanical motive power did it become possible to construct a road that possessed all four qualities — smoothness, hardness, levelness, and straightness: as long as road traffic relied on animal power, internal contradictions were inevitable. The smoothness and hardness of the road that the wheel required were directly opposed to the animals' technical demands, as their hooves could not get traction on a smooth and hard road; conversely, a road with a soft and uneven surface, ideal for hooves, did not meet the technical demands of the wheel. This contradiction was impossible to resolve as long as wheeled vehicles were pulled by draft animals. 'A road, then,' Lardner concluded, 'cannot be perfect, or even nearly perfect, for both purposes.' A 'compromise between the two principles is inevitable: a road that is as smooth and hard as possible, while being as soft and rough as is necessary for the horses' hooves'.[11]

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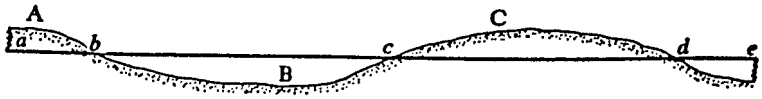
motion; Newton's law, on the other hand, is based on the technical realities of its own time (i.e., shipbuilding, machine construction, and arms technology, especially ballistics), being, as it were, the theoretical sum of that technology. These connections are discussed brilliantly in B. Hessen's *The Social and Economic Roots of Newton's 'Principia'* (New York, 1971). (Originally an address to the International Congress of the History of Science and Technology in London in 1931.)

10. D. Lardner, *The Steam Engine, Steam Navigation, Roads and Railways*, 8th ed. (London, 1851), pp. 315–16.
11. Lardner, op. cit., pp. 339–40.

As the latter were replaced by the locomotive, the contradiction ceased to exist. Henceforth the four essentials of the mechanically perfect road could be realized without compromise. The railroad did this first and foremost by means of the rail, which was harder, smoother, more level, and straighter than any road before it. While this revolution in transportation technology took place in a location separate from the traditional road grid, it influenced the latter nevertheless. Serving the need for short-distance transportation not provided by the railroads, the old type of highway survived until the end of the nineteenth century; it became obsolete as the automobile began to mechanize road traffic, and as road-building technology made an effort to approximate the technical principles of the railroads. When road vehicles were no longer pulled by horses but propelled by the internal combustion engine, the roads they ran on tended to become as smooth, hard, level and straight as the rails. By the twentieth century, their surfaces were covered with asphalt and concrete, whereby they achieved the technical standards set by the railroads in the nineteenth century.

The rail's primary function, to minimize the resistance caused by friction, was complemented by its further function of leveling the irregularities of the terrain. To keep friction at a minimum, the rail must be smooth and hard, to achieve optimal performance with the least expenditure of energy, the rail must run a level and straight course. Before laying the track, considerable earth moving was necessary to lay a level and straight roadbed through uneven terrain. Nicholas Wood provided an illustration and description of this in the third edition of his standard technical work of 1838:



Let A, B, C, Fig. 1, represent a section or the outline of the country over which the railways is to pass, and a, b, c, d, e, the level at which the railway is to be formed. All those parts of the section which are above the line a, b, c, d, e, to the extent of the width required for the railway, will, therefore, require to be cut through, excavated, or levelled down; and those portions which are below that line, will

require to be embanked or levelled up. The portions A and C, will, therefore, have to be cut down, and the portion B, raised up or embanked. The portions of railway, a b, and c d, of the section, are, consequently, called *excavations*, or *cuttings*; and the portions b c, d e, *embankments*, or *embanking*.[12] (Italics in original.)

Cuttings and embankments were the staple procedures of railroad construction. Greater irregularities of the terrain, such as valleys and mountains, were overcome by means of tunnels and viaducts.

The railroad, built thus across the terrain by means of cuttings, embankments, tunnels, and viaducts, made its mark on the European landscape from the 1850s on; it also made its mark on travelers' perceptions. The alienation from immediate, living nature that was initiated by the mechanization of motive power was increased as the railroad was constructed straight across the terrain, as if drawn with a ruler. The railroad was to the traditional highway as the steam engine was to the draught animal: in both cases, mechanical regularity triumphed over natural irregularity. The abandonment of animal power in favor of steam was experienced as the loss of sensorially perceptible animal power/exhaustion, i.e., as the loss of the sense of space and motion that was based on it. As the natural irregularities of the terrain that were perceptible on the old roads were replaced by the sharp linearity of the railroad, the traveler felt that he lost contact with the landscape, and surely experienced this most directly when going through a tunnel.

Early descriptions of journeys on the railroad noted that the railroad and the landscape through which it ran were in two separate worlds. Thus a report on a trip from Manchester to Liverpool in 1833: '. . . we enter the Olive Mount excavation. Here a passage for the railway has been effected through the solid rock by a cutting seventy feet deep and about fifteen wide. . . . Several bridges are thrown over to connect the opposite precipices, and appear to the eye, as we move along the depth below, like communications belonging to beings of another sphere'.[13]

Similarly, a description of a journey from London to Birming-

12. Nicholas Wood, *A Practical Treatise on Rail-Roads*, 3rd ed. (London, 1838), p. 136.
13. *The Railway Companion* (London, 1833), p. 40.

ham in 1839: 'As far as the eye can range, one immense chasm through the earth appears before the observer, and at intervals are bridges carrying roads across the railway at a frightful height. . . . The echoes in this place are very distinct, and whilst traversing its extent you seem shut out from all communication with the world'.[14]

The empirical reality that made the landscape seen from the train window appear to be 'another world' was the railroad itself, with its excavations, tunnels, etc. Yet the railroad was merely an expression of the rail's technological requirements, and the rail itself was a constituent part of the machine ensemble that was the system. It was, in other words, that machine ensemble that interjected itself between the traveler and the landscape. The traveler perceived the landscape as it was filtered through the machine ensemble.

That was the nature of the new perception of landscape and motion. If the material bases for the old perception of landscape and motion were the physical power of the draught animals, the road that followed the contours of the terrain, and the 'leeway' given to the vehicle on the road,[15] and if the old perception occurred via all these natural and only loosely connected elements of transportation technology, then the character of the new machine ensemble was one of tremendous technical discipline. To follow Reuleaux's argument, the appearance of the machine ensemble signalled the end of free play between the individual elements of machines in general. Compared to the old technology, the new appeared more derived, more unnatural, even more restrictive: this has been documented in contemporary literature and journalism. Yet it was not only the critical mind of the era that found it hard to accommodate itself to the new transportation technology. The railroad was such an entirely novel apparatus that even those who advocated its use

14. Thomas Roscoe, *The London and Birmingham Railway, With the Home and Country Scenes on Each Side of the Line* (London, 1839), pp. 67–8. The Liverpool–Manchester Act actually required the isolation of the railroad from the surrounding countryside, highways, etc., as Cohn points out while summarizing the edicts, 'a railway shall at no point intersect with another road, but shall proceed separately from all other thoroughfares by means of viaducts etc.' (Gustav Cohn, *Die Entwicklung der Eisenbahngesetzgebung in England, Untersuchungen über die englische Eisenbahnpolitik*, vol. 1 [Leipzig, 1874], p. 34.)

15. It is true that the highway and the vehicle moving on it also constitute a machine ensemble, because of their interrelationship. Yet that unity is, in practical terms, a very loose one, as the vehicle is individually manoeuverable and mobile on the road.

as a means of public transportation misunderstood it at first. They regarded it as a means like any other: they were aware of the peculiarity of rails but unable to recognize the consequences. It was obvious that an iron wheel running on an iron rail had less friction to contend with than a wheel on a highway, yet at first no one considered the possibility of constructing railroads independent from existing traditional roads. Thus, for instance, Richard Lovell Edgeworth — who in 1802, twenty years before Gray, published the first proposal to construct railways for public transport — saw the rail entirely in the context of the road, and thus proposed that the existing roads, more specifically, the ones with the heaviest volume of traffic, be furnished with rails. Here, the railroad was not seen as an autonomous traffic system, but merely as a highway provided with rails which essentially retained its traditional traffic pattern. The only change perceived was that friction was reduced. The vehicles remained individual road vehicles, but for the duration of their travel on the rails they had to be lifted onto an undercarriage that is fitted to the rails:

> Now to accommodate coaches and chaises, etc., to these rail-ways, I would have them carried, wheels and all, in cradles or platforms, *which should have wheels adapted to the rail-ways*. By these means no alteration would be necessary in any of the carriages commonly used; but the horses of any coach or chaise might, as soon as they had got out of town, walk up an inclined plane into the cradle or platform, and draw their respective carriages after them: the horses should then walk out at the farthest end of the platform, upon the road belonging to the rail-ways. They would then draw the chaise not upon its own wheels, but upon the wheels of the platform or cradle in which the *chaise* should be detained.[16] (Italics in original.)

A little later, in the same text, Edgeworth stressed once more the autonomy retained by the private vehicles using the rails: 'The chief convenience of this project arises from the mode of receiving and transporting on rail-ways every carriage now in use *without any change in their structure* so that a traveller may quit and resume the common road at pleasure'.[17] (Italics in

16. William Nicholson, *Journal of Natural Philosophy, Chemistry, and the Arts* (London, 1802), p. 222.
17. Op. cit., p. 223.

original.)

While Edgeworth still saw his 'rail-way', quite naively, as a potential extension of the common road, he was, however, aware of the rail's tendency to restrict the free and individual maneuvering of vehicles. This gave rise to his suggestion that four separate railways be constructed on a road, two in either direction, and in each pair, one for coaches, one for vehicles carrying goods. That first premonition of a reorganization of traffic according to the technology of the rail was developed further twenty years later in Gray's proposal for a *national* system of railways. Gray still thought in terms of the categories of individual traffic, but his railways were to constitute a traffic system independent from the existing highways.[18] Gray quite clearly demonstrates the ever-more acute perception of the inherent contradiction between the rail and individual traffic, a contradiction that remained unresolved until the late 1830s. While the technical concept of the rail did not tolerate individual traffic, the economic thinking of the time could conceive of nothing *but* such individual traffic. As long as the contradiction remained unresolved, the only way in which both conditions could be satisfied was to multiply the number of parallel railways. Between Edgeworth's time and Gray's, their number had already grown: 'In order to establish a general iron rail-way, it will be necessary to lay down two or three rail-ways for the ascending, and an equal number for the descending vehicles. In the immediate neighbourhood of London the traffic might demand six rail-ways'.[19]

In the writings of Edgeworth and Gray, the conflict between the rail and individual traffic appeared merely in the form of proposals and projections for ways of organizing railways for public transportation; however, the actual practice of such transportation, as it became a reality in the 1820s, became more and more seriously impeded by that conflict.

In 1855, Lardner retrospectively described the economic views

18. The very first edition of Gray's *Observations* (1820) contains a map of England, Scotland and Wales, on which the national railroad network has been drawn in as a series of *straight* connecting lines between the major cities. In the subsequent editions we find an increasingly strong emphasis on the idea that this would have to be a transportation network of an entirely novel kind. Thus, for instance, in the fifth edition, Gray speaks of the 'absolute necessity of an entirely new system of national intercourse'. (p. 1.)
19. Gray, 5th ed. (London, 1825), p. 12.

of the early period, when the railroad was regarded simply as a means of transportation similar to canal and turnpike, to be used by individual vehicle owners upon the payment of tolls:

> It was expected that the public should be admitted to exercise the business of carriers upon them [the rails], subject to certain specified regulations and by-laws. It soon became apparent, however, that this new means of transport was attended with qualities which must exclude every indiscriminate exercise of the carrying business. A railway, *like a vast machine*, the wheels of which are all connected with each other, and whose movement requires a certain harmony, can not be worked by a number of independent agents. Such a system would speedily be attended with self-destruction. The organization of a railway requires unity of direction and harmony of movement, which can only be attained by the combination of the entire carrying business with the general administration of the road.[20](Italics in original.)

It took a while before the technological necessity of the railroad companies' monopoly on transportation (i.e., the management of both rails and carriages under one supervisory agency) prevailed against the liberal view that was based on principles applicable to canals and turnpikes. As late as 1838, there were private vehicles on the Liverpool–Manchester line.[21] W. T. Jackman enumerates the following reasons for the termination of such individualism in transportation, which was occurring despite the fact that 'laissez-faire doctrines were so predominant in every other aspect of the national life':

(1) Dangers caused by non-coordination of trains of vehicles traveling on the line.
(2) The absence of technically necessary facilities along the line (coal and water depots).

20. D. Lardner, *Railway Economy* (London, 1851), pp. 421–2.
21. W. T. Jackman, *The Development of Transportation in Modern England* (1st ed., 1916; repr. London, 1962), p. 573. Jackman deals with the entire complex on pp. 572–9. Cohn quotes the clause of the Liverpool–Manchester Act which guarantees free access to all vehicles: 'All persons shall have free liberty to use with carriages all roads, ways and passages for the purpose of conveying goods or passengers or cattle' (op. cit., p. 36). Cohn continues: 'For this to be possible, the carriages used by the freight entrepreneurs have to conform to those regulations that the railroad company deems practicable and adverfises in every station. Furthermore, the owners of adjoining property receive the right to construct branch lines to the Liverpool–Manchester line' (op. cit., pp. 36–7).

(3) Negligible profits for the private transport entrepreneurs.
(4) The disregard evinced by those entrepreneurs and private users of the line towards the railroad's technical regulations.[22]

Jackman describes the end of individual rail traffic:

> Soon it became evident to the railway companies that, with due regard to the efficiency of their line and to the public convenience and safety, they could not allow rival parties to run engines and carriages on the same line; and it was eventually acknowledged that these lines of communication must be placed under undivided control and authority. Accordingly, a Parliamentary Committee of 1839 urged the necessity of prohibiting, as far as locomotive power was concerned, the rivalry of competing parties on the same line of railway; and the Committee of 1840 decided that railway companies using locomotive power possessed a particular monopoly for the conveyance of passengers, from the nature of their business.[23]

Thus, finally, after many vain efforts to accommodate the new transport technology to juridical concepts appropriate to the old, the inherent character of that new technology prevailed even in the juridical realm. The railroad as a machine ensemble received its legal and politico-economic sanction in the form of the transport monopoly.

The process by which the institutions accommodated themselves to the railroad as a machine ensemble did not end with the acceptance of the transport monopoly. The chaos caused by individual traffic on the rail lines, now terminated by the monopoly, repeated itself on a higher level. In England (although not in Belgium or France) the railroad system grew without central planning, on a purely private-enterprise basis. The railway network grew denser through the construction of more and more lines, but never became a unified entity: it remained merely the sum of numerous local and regional lines that operated independently from each other. Technologically, it was a national transportation grid, providing fast and comfortable

22. Op. cit., pp. 573–4.
23. Op. cit., p. 574; see also Cohn, p. 45.

access to all its parts; but as an organization, based on private enterprise, it was a multitude of individual lines, isolated, working without coordination, or even working against each other. While objectively the expansion of the system should facilitate travel, in fact it increased the difficulties involved in changing trains and in transferring goods from one line to another, by creating impediments such as uncoordinated schedules and stations located at long distances from one another.

The unification of the railway network proceeded just as slowly and reluctantly as did the development of the transport monopoly. Finally, in 1842 the English railway companies created a cooperative and coordinating authority to deal with traffic moving along more than one line — i.e., through traffic, as distinct from merely local and regional traffic.[24] This through traffic was becoming more and more important to the national economy.

Thus the railroad as a machine ensemble finally became institutionalized even in this respect, despite the resistance offered by the economic thought of the period, which was based on the principle of competition. The machine ensemble, consisting of wheel and rail, railroad and carriage, expanded into a unified railway system, which appeared as one great machine covering the land.[25]

In order to guarantee the proper functioning of this machine, juridical and politico-economic regulations had to be revised, but technological improvements proved equally necessary. The most important technological addition to the railways was the electrically operated telegraph system.

While this telegraph system had been technically perfected at the beginning of the nineteenth century, before the advent of the railroad it did not, at first, find any practical application; there was no part for it to play. That changed with the coming of

24. The institution was the Railway Clearing House, based on the Clearing House of English Banks. The best description of its genesis and function can be found in Philip S. Bagwell, *The Railway Clearing House in the British Economy, 1842–1922* (London, 1968).

25. The notion of the railroad as a great machine spread out over the land is implicit in the early definitions of the railroad as a machine ensemble. There is a vivid example of it in Governor Everett's speech at the opening of the Boston–Albany Line (quoted in J. S. Buckingham, *The Eastern and Western States of America* [London, 1842], vol. 1, p. 51): 'Let us contemplate the entire railroad, with its cars and engines, as one vast machine! What a portent of art! its fixed portion a hundred miles long; its moveable portion flying across the State like a weaver's shuttle'.

the railways, on which a signaling system played a vital part from the very beginning. The machine ensemble, whose parts had to be minutely adjusted to each other, must not fall prey to catastrophes. Contemporary illustrations demonstrate the tense watchfulness that characterized early journeys on the railroad. On each carriage of the train we see one, two, sometimes three persons, whose sole task it is to scan the line ahead for obstacles, approaching trains, etc. The first optical and acoustical signals that were devised to assist in this activity soon proved insufficient in dark, foggy or noisy conditions and, of course, when going through tunnels.

Tunnel passages provided the telegraph with its first practical application.[26] The system devised for its use (first in tunnels, later all along the line), the 'space interval system', consisted of a division of the entire line into separate 'blocks', each served by a telegraph transmitter. This transmitter signalled to the block ahead when the line was clear; the engine-driver then received an optical signal that told him to go ahead. The system relieved the engine-driver from any remaining obligation to exercise his personal powers of perception and judgement on the conditions that prevailed around him and his train: all he needed to do was to follow the signals given by a distant telegraph center. Because a train runs on a predetermined line an engine-driver could never aspire to the social role of a 'captain on dry land': the electric telegraph confirmed his true status, that of an industrial worker, an operator of a machine. The telegraph became an integral element of the machine ensemble; Max Maria von Weber, a philosophically-minded railroad expert and son of the well-known composer, observed that without the telegraph the railway would be like an organism without a nervous system: '. . . as the muscle of a human body without the nerve flashing through it would be a mere lifeless hunk of flesh, so would the flying muscles that Watt's and Stephenson's inventions have lent to humanity be only half as capable of winging their way, if they were not animated by the guiding thought imperiously flashing through the nerves of the telegraph wires'.[27]

26. Cooke and Wheatstone introduced it from Germany to England in the early 1830s. (Karl Zetsche, *Geschichte der elektrischen Telegraphie* [Berlin, 1877], p. 157.)
27. In Dolf Sternberger, *Panorama, oder Ansichten vom 19. Jahrhundert*, 3rd ed. (Hamburg, 1955); transl. as *Panorama of the Nineteenth Century* (Oxford and New York, 1978). The

However, the electric telegraph did not gain such tremendous significance solely for its effect on the actual running of the machine ensemble. Its visual imagery became a major emblem of railway travel: the outer world beyond the compartment window was mediated to the traveler by the telegraph poles and wires which flashed by — no longer did he see only the landscape through which he journeyed, but also, continuously, the poles and wires that belong to the railroad as intimately as the rails themselves do. The landscape appeared *behind* the telegraph poles and wires; it was seen *through* them. As we noted earlier, the rail traveler's perceptions were changed by the intervention of the machine ensemble between him and the landscape; there was a material demonstration of that intervention in those poles and wires, which were a part of the machine ensemble. They interposed themselves, both physically and metaphorically, between the traveler and the landscape.[28] To use Dolf Sternberger's term, the resulting perception was 'panoramic'. Verlaine, in the seventh poem of his cycle *La Bonne Chanson*, describes it with technical precision. The hurtling railroad train appears as the very motion of writing and the telegraph poles and wires are the calligraphic instruments with which the new perception inscribes the panoramic landscape upon the real one:

Le paysage dans le cadre des portières
Court furieusement, et des plaines entières
Avec de l'eau, des blés, des arbres et du ciel
Vont s'engouffrant parmi le tourbillon cruel

passage comes from the posthumously published volume *Vom rollenden Flügelrade* (1882). The phrase 'flying muscles' refers to the railroad's trademark, or symbol, the winged wheel. Sternberger quotes the passage while discussing the mutual influence exercised by technological and organic metaphors in the nineteenth century.

28. A prosaic footnote to the poetic perception of telegraph poles can be found in an anonymous work of 1848, *Railway Appliances in the Nineteenth Century; or, The Rail, Steam, and Electricity* (London, 1848), p. 32. It is a proposal to determine the speed of the train (which could not yet be determined directly due to lack of technical 'instinct') by means of close observation of the telegraph poles, i.e., by measuring the time that the train needs to pass from one pole to the next. 'These [the poles] are generally erected about sixty yards apart, or thirty in the mile, so that the speed of the train is easily found by counting the number of poles passed in a minute and multiplying by two, which, of course, gives the rate per hour'. Thus the telegraph poles act as a kind of gauge for determining an element of the journey, i.e., velocity, that can no longer be experienced in an immediate way. This is a factor that contributes to the traveler's alienation from the landscape.

Où tombent les poteaux minces du télégraphe
Dont les fils ont l'allure étrange d'un paraphe.

(The scene behind the carriage window-panes
Goes flitting past in furious flight; whole plains
With streams and harvest-fields and trees and blue
Are swallowed by the whirlpool, whereinto
The telegraph's slim pillars topple o'er,
Whose wires look strangely like a music-score.)[29]

29. Paul Verlaine, *Oeuvres poétiques complètes* (Paris, 1951), p. 106. The cycle 'La bonne chanson' was written in the winter of 1869/70; transl. Gertrude Hall, in *Baudelaire, Rimbaud, Verlaine: Selected Verse and Prose Poems*, (New York, 1947).

[3]
Railroad Space and Railroad Time

> Economically, the railways' operation . . . causes distances to diminish . . . Lille suddenly finds itself transported to Louvres; Calais to Pontoise; le Havre to Poissy; Rouen to Sèvres or to Asnières; Reims to Pantin; Strasbourg to Meaux; Lyon to a place half-way between Melun and Corbeil; Marseilles to Nemours; Perpignan to Pithiviers; Bordeaux to Chartres or to Étampes; Nantes to Arpajon, etc.
>
> — Constantin Pecqueur, 1839

'Annihilation of space and time' was the early-nineteenth-century characterization of the effect of railroad travel. The concept was based on the speed that the new means of transport was able to achieve. A given spatial distance, traditionally covered in a fixed amount of travel time, could suddenly be dealt with in a fraction of that time; to put it another way, the same amount of time permitted one to cover the old spatial distance many times over. In terms of transport economics, this meant a shrinking of space: 'Distances practically diminish in the exact ratio of the speed of personal locomotion', Lardner says in his *Railway Economy*.[1]

The average traveling speed of the early railways in England was twenty to thirty miles an hour, or roughly three times the

1. D. Lardner, *Railway Economy* (London, 1850), p. 35.

speed previously achieved by the stagecoaches.[2] Thus, any given distance was covered in one-third of the customary time: temporally, that distance shrank to one-third of its former length. In early-nineteenth-century writings the temporal diminution is expressed mostly in terms of a shrinking of space. An article published in the *Quarterly Review* in 1839 speaks of 'the gradual annihilation, approaching almost to the final extinction, of that space and of those distances which have hitherto been supposed unalterably to separate the various nations of the globe', and continues:

> For instance, supposing that railroads, even at our present simmering rate of travelling, were to be suddenly established all over England, the whole population of the country would, speaking metaphorically, at once advance *en masse*, and place their chairs nearer to the fireside of their metropolis by two-thirds of the time which now separates them from it; they would also sit nearer to one another by two-thirds of the time which now respectively alienates them. If the rate were to be sufficiently accelerated, this process would be repeated; our harbours, our dock-yards, our towns, the whole of our rural population, would again not only draw nearer to each other by two-thirds, but all would proportionally approach the national hearth. As distances were thus annihilated, the surface of our country would, as it were, shrivel in size until it became not much bigger than one immense city.[3]

The image of a temporal shrinkage seen as a spatial one appeared in an even more extravagant guise in the work of Constantin Pecqueur, the economist and Saint-Simonian, whose *Economie sociale* received a prize from the Institut de France in 1838. Here, the temporally shrunk transport space is a new geography of France, a geography based on the new conditions of speed, a condensed geography, as it were. The cities of France approached each other while simultaneously advancing on Paris. These changes in location, enumerated in

2. According to H. G. Lewin, *The Railway Mania and its Aftermath, 1845–52* (London, 1936), the average speed, up to 1845, was 'between 20 and 30 miles per hour' (p. 95). The Great Western Express, the fastest English train, reached a speed of 46 mph. Lardner says the speed of the stagecoaches was a little less than 8 mph (*Railway Economy*, p. 36), whereas Lewin claims that the fastest coaches achieved 10 mph. The actual speed of English trains in the 1840s, i.e., their top speed, was, according to Lardner, frequently 60 to 70 mph (*Railway Economy*, p. 170).
3. *Quarterly Review*, vol. 63 (1839), p. 22.

the epigraph to this chapter, are summarized in Pecqueur's statement that it had become possible to see 'the new France as fitting into the space of the *old* Île-de-France, or its equivalent'.

The diminution of transport distances seemed to create a new, reduced, geography, yet it did not actually alter the size of the spaces between the points connected by the new mode of transport. 'Yet by a sort of miracle,' says the *Quarterly Review* article, after describing the shrinking process, 'every man's field would be found not only *where* it always was, but *as large* as ever it was'. Pecqueur expressed the same notion in literary hyperbole: the diminished transport geography of France contained the true geography of France within it in a condensed form: 'Each bit of terrain, each field on this surface would still remain intact; so would every house in a village, the village itself, or the town; every territory with its village in the center would remain a province; on the map of the imagination, all of these would finally be reproduced and reduced down to the infinitely small! As for Louvres, or Pontoise, or Chartres, or Arpajon, etc., it is obvious that they will just get lost in some street of Paris or its suburbs'.[4]

The notion that a French town could fit into a Paris street demonstrates that the alteration of spatial relationships by the speed of the railway train was not simply a process that diminished space, but that it was a dual one: space was both diminished *and* expanded. The dialectic of this process states that this diminution of space (i.e., the shrinking of transport time) caused an expansion of transport space by incorporating new areas into the transport network. The nation's contraction into a metropolis, as described in the *Quarterly Review*, conversely appeared as an expansion of the metropolis: by establishing transport lines to ever more outlying areas, the metropolis tended to incorporate the entire nation. Thus the epoch of the suburbs, of the amoebic proliferation of the formerly contained cities into the surrounding countryside, began with the railroads. This is Lardner in 1851:

> It is not now unusual for persons whose place of business is in the centre of the capital, to reside with their families at a distance of from

4. Constantin Pecqueur, *Économie sociale* (Paris, 1839), vol. 1, p. 26.

> fifteen to twenty miles from that centre. Nevertheless, they are able to arrive at their respective shops, counting-houses, or offices, at an early hour of the morning, and to return without inconvenience to their residence at the usual time in the evening. Hence in all directions round the metropolis in which railways are extended, habitations are multiplied, and a considerable part of the former population of London has been diffused in these quarters.[5]

The notion that the railroad annihilated space and time was not related to that expansion of space that resulted from the incorporation of new spaces into the transport network. What was experienced as being annihilated was the traditional space–time continuum which characterized the old transport technology. Organically embedded in nature as it was, that technology, in its mimetic relationship to the space traversed, permitted the traveler to perceive that space as a living entity. What Bergson called the *durée* (duration, the time spent getting from one place to another on a road) is not an objective mathematical unit, but a subjective perception of space–time. The dependence of this perception on transport technology illustrates Durkheim's notion that a society's space–time perceptions are a function of its social rhythm and its territory.[6] 'What is decisive', says Erwin Straus, discussing the psychology of distances, 'is not the objectively measured distance, but the relation of such distance to potentiality.'[7] Transport technology is the material base of potentiality, and equally the material base of the traveler's space–time perception. If an essential element of a given sociocultural space–time continuum undergoes change, this will affect the entire structure; our perception of space–time will also lose its accustomed orientation. Sorokin, following Durkheim, distinguishes between sociocultural and physico-mathematical notions of space–time, and has described the hypothetical effects of a sudden replacement of customary sociocultural time measures with purely mathematical ones: 'If we try to replace sociocultural time by a purely quantitative time, time becomes devitalized. *It loses its reality, and we find ourselves in an exceedingly difficult position in our efforts to orient ourselves in the time process, to*

5. Op. cit., p. 36.
6. Émile Durkheim, *The Elementary Forms of the Religious Life* (Glencoe, Ill., 1947), pp. 10–11, 440.
7. Erwin Straus, *The Primary World of the Senses* (New York and London, 1963), p. 385.

find out "where we are" and where are the other social phenomena on "the bridge of time"'.[8] (Italics in original.)

Thus, the idea that the railroad annihilated space and time must be seen as the reaction of perceptive powers that, formed by a certain transport technology, find suddenly that technology has been replaced by an entirely new one. Compared to the eotechnical space–time relationship, the one created by the railroad appears abstract and disorientating, because the railroad — in realizing Newton's mechanics — negated all that characterized eotechnical traffic; the railroad did not appear embedded in the space of the landscape the way coach and highway are, but seemed to strike its way through it.

Heinrich Heine captured the disorientation experienced by the traditional space–time consciousness when confronted by the new technology; apropos the opening of railway lines from Paris to Rouen and Orléans in 1843, he wrote of the 'tremendous foreboding such as we always feel when there comes an enormous, an unheard-of event whose consequences are imponderable and incalculable', and called the railroad a 'providential event', comparable to the inventions of gunpowder and printing, 'which swings mankind in a new direction, and changes the color and shape of life'. Heine continues in this vein:

> What changes must now occur, in our way of looking at things, in our notions! Even the elementary concepts of time and space have begun to vacillate. Space is killed by the railways, and we are left with time alone. . . . Now you can travel to Orléans in four and a half hours, and it takes no longer to get to Rouen. Just imagine what will happen when the lines to Belgium and Germany are completed and connected up with their railways! I feel as if the mountains and forests of all countries were advancing on Paris. Even now, I can smell the German linden trees; the North Sea's breakers are rolling against my door.[9]

We have now clearly stated the two contradictory sides of the same process: on one hand, the railroad opened up new spaces that were not as easily accessible before; on the other, it did so by destroying space, namely the space between points. That in-between, or travel space, which it was possible to 'savor'

8. Pitrim A. Sorokin, *Sociocultural Causality, Space, and Time* (Durham, NC, 1943), p. 197.
9. Heine, *Lutezia*, pt 2, lvii, Elster ed., vol. 6, p. 360.

while using the slow, work-intensive eotechnical form of transport, disappeared on the railroads. The railroad knows only points of departure and destination. 'They [the railways] only serve the points of departure, the way-stations, and the terminals, which are mostly at great distances from each other', said a French author in 1840, 'they are of no use whatsoever for the intervening spaces, which they traverse with disdain and provide only with a useless spectacle'.[10]

As the space between the points — the traditional traveling space — was destroyed, those points moved into each other's immediate vicinity: one might say that they collided. They lost their old sense of local identity, formerly determined by the spaces between them. The isolation of localities, which was created by spatial distance, was the very essence of their identity, their self-assured and complacent individuality. Heine's vision of the North Sea breaking on his doorstep in Paris was tinged with 'tremendous foreboding' because both localities — Paris and the North Sea — were still presented in their mutually isolated state, 'worlds apart': thus their collision appeared unfathomable. Thirty years later, as an interlocking network of railroad lines connected all of Europe, that kind of consciousness was no longer realistic. Regardless of their geographical remoteness, the regions appeared as close and as easily accessible as the railways had made them. One generation after Heine, the more privileged inhabitants of Paris had the option of letting themselves be transported, in a matter of hours, to a region that was as distant from their city as Heine's North Sea. The Mediterranean does not extend its shores right up to Parisian thresholds, but it could be reached so much more quickly than before that the journey there was no longer experienced as such. The Parisians who migrated south in the winter saw nothing but blue skies and the sea. As Mallarmé wrote in the winter of 1874/5, in *La Dernière Mode*, the journal he edited, they are 'calm, self-absorbed people, paying no attention to the invisible landscapes of the journey. To leave Paris and to get to where the sky is clear, that is their desire'.[11] They were no longer travelers — rather, as Ruskin puts it, they were human parcels who dis-

10. Charles Dunoyer, *Esprit et méthodes comparés de l'Angleterre et de la France dans les entreprises de travaux publics et en particulier des chemins de fer* (Paris, 1840), p. 104.
11. Stéphane Mallarmé, *Oeuvres complètes*, Pléiade ed. (Paris, 1970), p. 843.

patched themselves to their destination by means of the railway, arriving as they left, untouched by the space traversed.

Even though the railroad was incapable of bringing the remote regions physically to Paris, the speedy and comfortable accessibility of those regions created a consciousness of distance that approximated to Heine's vision of space, but without the sense of foreboding. The region that could be reached by train from Paris realized itself for the Parisians by means of the train. It then appeared as the product or appendage of the railroad, as in a phrase of Mallarmé's: 'Normandy, which, like Brittany, is part of the Western Railway'.[12]

But if Normandy and Brittany, being its destinations, were part of the Western Railway, then the point of departure of that same railway, the station in Paris, became the entrance to those regions. This was a common enough notion in the nineteenth century: it is to be found in every one of Baedeker's travel guides that recommends a certain railroad station as the point of departure for each excursion.

The identification of the railroad station with the traveler's destination, and the relative insignificance of the journey itself, were expressed by Mallarmé in *La Dernière Mode*, under the heading *Gazette et Programme de la Quinzaine*; the following subheadings represented equally important institutions for entertainment: *Les Librairies*, *Les Théâtres*, *Les Gares* (the last sometimes replaced by *Les Voyages*). Thus a railroad journey appeared in no way different from a visit to the theater or the library — the purchase of a train ticket was equivalent to that of a theater ticket.

A generation after Mallarmé, Marcel Proust, in *A la Recherche du temps perdu*, discussed the difference between a journey by train and one in a motorcar:

> The journey was one that would now be made, probably, in a motor-car, which would be supposed to render it more interesting. We shall see too that, accomplished in such a way, it would even be in a sense more genuine, since one would be following more clearly, in a closer intimacy, the various contours by which the surface of the earth is wrinkled. But after all, the special attraction of the journey lies not in our being able to alight at places on the way and to stop

12. Op. cit., p. 774.

> altogether as soon as we grow tired, but in its making the difference between departure and arrival not as imperceptible but as intense as possible, so that we are conscious of it in its totality, intact, as it existed in our mind when imagination bore us from the place in which we were living right to the very heart of a place we longed to see, in a single sweep which seemed miraculous to us not so much because it covered a certain distance as because it united two distinct individualities of the world, took us from one name to another name; and this difference is accentuated (more than in a form of locomotion in which, since one can stop and alight where one chooses, there can scarcely be said to be any point of arrival) by the mysterious operation that is performed in those peculiar places, railway stations, which do not constitute, so to speak, a part of the surrounding town but contain the essence of its personality just as upon their signboards they bear its painted name.[13]

The fate wrought upon the outlaying regions by the railroads affected goods even sooner: as long as production and consumption were strictly regional — which they were until the beginning of modern transportation — goods remained part of the local identity of their place of production. Their route of circulation was to be perceived at a glance. Only when modern transportation created a definite spatial distance between the place of production and the place of consumption did the goods become uprooted commodities. In *Grundrisse,* Marx makes an observation about the relation between spatial distance and the nature of commodities; it tells us a good deal about how modern transportation has affected our perception of goods: 'This locational movement — the bringing of the product to the market, which is a necessary condition of its circulation, except when the point of production is itself a market — could more precisely be regarded as the transformation of the product *into a commodity*'.[14] (Italics in original.)

With the spatial distance that the product covered on its way from its place of production to the market, it also lost its local identity, its spatial presence. Its concretely sensual properties, which were experienced at the place of production as a result of

13. *Remembrance of Things Past,* vol. II, *Within a Budding Grove,* I; transl. by C. K. Scott Moncrieff (New York, 1934, pp. 489–90).
14. Karl Marx, *Grundrisse, Foundations of the Critique of Political Economy* (London, 1973), p. 534.

the labor process (or, in the case of the fruits of the land, as a result of natural growth), appeared quite different in the distant market-place. There the product, now a commodity, could realize its economic value and simultaneously gain new qualities as an object of consumption. No longer was it seen in the context of the original locality of its place of production but in the new locality of the market-place: cherries offered for sale in the Paris market were seen as products of that market, just as Normandy seemed to be a product of the railroad that takes you there. Pecqueur touches on the notion of the unity of the realization of economic value and the biological process, using the example of the ripening of fruit: 'For instance, economically speaking, and for the sake of freshness and price, the cherries of Montmorency really ripen on the uncultivated summits of the Quartier Lafayette; the roses of Fontenay burst into bloom and fragrance in the flower beds of the Jardin du Luxembourg; the peaches of Montreuil in the Parc de Monceaux, and the grapes of Fontainebleau, too, ripen on some hill closer to Paris than the one where the Surênes is still greening'.[15]

The regions, joined to each other and to the metropolis by the railways, and the goods that are torn out of their local relation by modern transportation, shared the fate of losing their inherited place, their traditional spatial–temporal presence or, as Walter Benjamin sums it up in one word, their 'aura'.

The detaching of the remote region from its original isolation, its opening-up by the railroad, can well be defined as the 'loss of its aura', as Benjamin characterizes the aura and its loss in his essay 'The Work of Art in the Age of Mechanical Reproduction'. The notions of spatial–temporal presence and distance were integral parts of Benjamin's concept of the aura. He defined the 'aura of natural objects' as 'the unique phenomenon of a distance, however close it may be'.[16] The aura of a work of art is 'its unique existence at the place where it happens to be'.[17] This spatial–temporal singularity, this 'happening-but-once-ness', this *genuineness* of the object, is, according to Benjamin, destroyed by reproduction. 'The situations into which the product of mechanical reproduction can be brought may not touch the

15. Op. cit., pp. 34–5.
16. Walter Benjamin, *Illuminations*, (New York, 1973), p. 222.
17. Ibid., p. 220.

actual work of art, yet the quality of its presence is always depreciated.'[18] It is tempting to apply this statement to the outlying regions that were made accessible by the railroad: while being opened up to tourism, they remained, initially at least, untouched in their physical actuality, but their easy, comfortable, and inexpensive accessibility robbed them of their previous value as remote and out-of-the-way places. 'The staple of the district is, in fact, its beauty and its character of seclusion and retirement', Wordsworth wrote in 1844, defending the Lake District against the intrusion of the railways.[19] The devaluation of outlying regions by their exploitation for mass tourism, by means of the railroad in the nineteenth century and air traffic in the twentieth, is a familiar occurrence. As soon as the railroad reached the seaside towns of southern England that had been strongholds of the aristocracy far into the nineteenth century, the middle classes took them over. Then the aristocracy retired to remote localities such as Scotland, Ireland, and the Lake District.[20] Contemporary air-line tourism is engaged in further devaluation of formerly exclusive, very remote regions.

The destruction of aura by means of reproduction, of which Benjamin speaks, is an expression of the same trend that brought the masses 'closer' to the outlying regions in the nineteenth century: 'The desire of contemporary masses to bring things "closer" spatially and humanly . . . is just as ardent as their bent toward overcoming the uniqueness of every reality by accepting its reproduction'.[21] The remote regions were made available to the masses by means of tourism: this was merely a prelude, a preparation for making any unique thing available by means of reproduction. When spatial distance is no longer experienced, the differences between original and reproduction diminish. In the filmic perception — i.e., the perception of *montage*, the juxtaposition of the most disparate images into one unit — the new reality of annihilated in-between spaces finds its clearest expression: the film brings things closer to the viewer as well as closer together.

The regions lost their temporal identity in an entirely concrete

18. Ibid., p. 221.
19. William Wordsworth, *The Prose Works*, ed. A. B. Grosart, (London, 1876, vol. 2), p. 326.
20. J. A. R. Pimplott, *The Englishman's Holiday* (London, 1947), p. 118.
21. Benjamin, ibid., p. 223.

sense: the railroads deprived them of their local time. As long as they remained isolated from each other, they had their individual times: London time ran four minutes ahead of time in Reading, seven minutes and thirty seconds ahead of Cirencester time, fourteen minutes ahead of Bridgwater time.[22] This patchwork of varying local times was no problem as long as traffic between the places was so slow that the slight temporal differences really did not matter; but the temporal foreshortening of the distances that was effected by the trains forced the differing local times to confront each other. Under traditional circumstances, a supra-regional schedule would be impossible: times of departure and arrival are valid only for the place whose local time is being used. For the next station, with its own time, that previous time is no longer valid. Regular traffic needs standardized time; this is analogous to the way in which the machine ensemble constituted by rail and carriage undermined individual traffic and brought about the transportation monopoly.

In the 1840s, the individual English railway companies proceeded to standardize time, but did not coordinate their efforts; each company instituted a new time on its own line. The process was so novel that it was repeated daily, in the most cumbersome manner, as Bagwell describes, apropos of the Grand Junction Company's procedure: 'Each morning an Admiralty messenger carried a watch bearing the correct time to the guard on the down Irish Mail leaving Euston for Holyhead. On arrival at Holyhead the time was passed on to officials on the Kingston boat who carried it over to Dublin. On the return mail to Euston the watch was carried back to the Admiralty messenger at Euston once more'.[23]

When, after the establishment of the Railway Clearing House, the companies decided to cooperate and form a national railroad network, Greenwich Time was introduced as the standard time, valid on all the lines.[24] Yet railroad time was not accepted as

22. Philip S. Bagwell, *The Transportation Revolution from 1770* (London, 1974), p. 124.
23. Op. cit., p. 125.
24. Greenwich time is the time kept at the Royal Observatory in Greenwich, founded in 1675. 'The precise standardization of time measurement dates from the foundation of the Royal Observatory in 1675' according to G. J. Whittow, *The Nature of Time* (London, 1972). Like the later standard time, the original Greenwich time was created to meet the needs of expanding traffic, i.e., shipping, in the seventeenth century. Vessels carried Greenwich time with them on their chronometers, as it was necessary for orientation and navigation. However, it was not used as a generalized norm for the division of the

anything but schedule time until late in the century. As the rail network grew denser, incorporating more and more regions, the retention of local times became untenable: in 1880, railroad time became general standard time in England. In Germany, official recognition came in 1893; as early as 1884, an international conference on time standards, held in Washington, DC, divided the world into time zones.

In the United States, the process was more complicated, as there was no cooperation whatsoever between the private railroad companies. Each company had its own time, in most cases the local time of the company's headquarters. In stations used by several different lines there were clocks showing different times: three of these in Buffalo, six in Pittsburgh.[25] In 1889, the United States was divided into four time zones, essentially unchanged to this day; officially, at first, the times within the zones were regarded only as railroad time; in practice, these became regional standard times, although they were not given legal recognition until 1918.

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day: Greenwich time was still restricted to the walls of the cabinet that contained the chronometer during the voyage.

25. John Stover, *American Railroads* (Chicago, 1961), p. 157.

[4]
Panoramic Travel

> Dreamlike traveling on the railroad. The towns which I pass between Philadelphia and New York make no distinct impression. They are like pictures on a wall. The more, that you can read all the way in a car a French novel.
> — Emerson, *Journals*, 7 February 1843

In Goethe's journal on his trip to Switzerland in 1797, there is the following entry:

> Left Frankfurt shortly after 7:00 A.M. On the Sachsenhausen mountain, many well-kept vineyards; foggy, cloudy, pleasant weather. The highway pavement has been improved with limestone. Woods in back of the watch-tower. A man climbing up the great tall beech trees with a rope and iron cleats on his shoes. What a village! A deadfall by the road, from the hills by Langen. *Sprendlingen*. Basalt in the pavement and on the highway up to Langen; the surface must break very often on this plateau, as near Frankfurt. Sandy, fertile, flat land; a lot of agriculture, but meagre . . .[1]

As Goethe told Eckermann, this journal was 'merely jotted down as given by the moment'. Thus it is no poetic text, but a description of a journey by coach in the late eighteenth century, a record of impressions received on that journey. Goethe's trip from Frankfurt to Heidelberg consisted of a continuous se-

1. *Werke*, East Berlin ed., vol. 15, pp. 348 ff.; the complete journal of the Swiss journey in *Werke*, Sophia ed., vol. 2, sec. 3.

quence of impressions that demonstrate how intense was the experience of traversed space. Not only the villages and towns on the way are noted, not only the formations of the terrain, but even details of the material consistency of the pavement of the highway are incorporated into his perceptions.

The railway put an end to this intensity of travel, which had reached its peak in the eighteenth century and had found its cultural expression in the genre of the 'novel of travels'. The speed and mathematical directness with which the railroad proceeds through the terrain destroy the close relationship between the traveler and the traveled space. The space of *landscape* becomes, to apply Erwin Straus' concept, *geographical* space. 'In a landscape', says Straus, 'we always get to one place from another place; each location is determined only by its relation to the neighboring place within the circle of visibility. But geographical space is closed, and is therefore in its entire structure transparent. Every place in such a space is determined by its position with respect to the whole and ultimately by its relation to the null point of the coordinate system by which this space obtains its order. Geographical space is systematized.'[2] Straus sees the railroad as the essential agent of the transformation of landscape into geographical space:

> The modern forms of traveling in which intervening spaces are, as it were, skipped over or even slept through, strikingly illustrate the systematically closed and constructed character of the geographical space in which we live as human beings. Before the advent of the railroad, geographical connections evolved, for the traveler, from the change in landscape. True, today the traveler also goes from place to place. But now we can get on a French train in the morning, and then, after twelve hours on the train (which is really being nowhere), we can get out in Rome. The old form of traveling provided for a more and better balanced relationship between landscape and geography.[3]

The nineteenth century found a fitting metaphor for this loss of continuity: repeatedly, the train was described as a projectile. First, the projectile metaphor was used to emphasize the train's

2. Erwin Straus, op. cit., p. 319.
3. Op. cit., p. 320.

speed, as in Lardner: a train moving at seventy-five miles an hour 'would have a velocity only four times less than a cannon ball'.[4] Then, as Greenhow points out, there is the cumulative power and impact that turns a speeding train into a missile: 'When a body is moving at very high velocity, it then, to all intents and purposes, becomes a projectile, and is subject to the laws attending projectiles'.[5] In 1889, after the complete cultural assimilation of the railroad, the projectile metaphor was still quite attractive. 'Seventy-five miles an hour', says a technical text published in that year, 'is one hundred and ten feet a second, and the energy of four hundred tons moving at that rate is nearly twice as great as that of a 2,000-pound shot fired from a 100-ton Armstrong gun.'[6]

The train was experienced as a projectile, and traveling on it, as being shot through the landscape — thus losing control of one's senses. 'In travelling on most of the railways . . .', says an anonymous author of the year 1844, 'the face of nature, the beautiful prospects of hill and dale, are lost or distorted to our view. The alternation of high and low ground, the healthful breeze, and all those exhilarating associations connected with "the Road", are lost or changed to doleful cuttings, dismal tunnels, and the noxious effluvia of the screaming engine.'[7] Thus the rails, cuttings, and tunnels appeared as the barrel through which the projectile of the train passes. The traveler who sat inside that projectile ceased to be a traveler and became, as noted in a popular metaphor of the century, a mere parcel.[8] 'It matters not whether you have eyes or are asleep or blind, intelligent or dull', said Ruskin, 'all that you can know, at best, of the country you pass is its geological structure and general

4. D. Lardner, *Railway Economy*, p. 179.
5. C. H. Greenhow, *An Exposition of the Danger and Deficiencies of the Present Mode of Railway Construction* (London, 1846), p. 6.
6. H. G. Prout, 'Safety in Railroad Travel', in *The American Railway*, ed. T. M. Cooley (New York, 1889), p. 187.
7. *Horse-Power Applied to Railways At Higher Rates of Speed than by Ordinary Draught* (London, 1844), p. 48.
8. 'It [the railway] transmutes a man from a traveller into a living parcel.' (Ruskin, *The Complete Works*, vol. 8, p. 159.) Manfred Riedel provides the two following quotes from lesser authors: for Ida Hahn-Hahn, the traveler 'demotes himself to a parcel of goods and relinquishes his senses, his independence' (Manfred Riedel, 'Vom Biedermeier zum Maschinenzeitalter', *Archiv für Kulturgeschichte*, vol. 43, (1961), fascicle 1, p. 119); and, according to Joseph Maria von Radowitz, 'for the duration of such transportation one ceases to be a person and becomes an object, a piece of freight'. (Op. cit., p. 120.)

clothing.'[9]

This loss of landscape affected all the senses. Realizing Newton's mechanics in the realm of transportation, the railroad created conditions that also 'mechanized' the traveler's perceptions. According to Newton, 'size, shape, quantity, and motion' are the only qualities that can be objectively perceived in the physical world. Indeed, those became the only qualities that the railroad traveler was able to observe in the landscape he traveled through. Smells and sounds, not to mention the synesthetic perceptions that were part of travel in Goethe's time simply disappeared.

The change effected in the traveler's relationship to the landscape became most evident in regard to his sense of sight: visual perception is diminished by velocity. George Stephenson testified to this in a statement given at a parliamentary hearing on safety problems on the railways in 1841: when asked for his estimation of the engine-driver's ability to see obstacles, he replied: 'If his attention is drawn to any object before he arrives at the place, he may have a pretty correct view of it; but if he only turns himself round as he is passing, he will see it very imperfectly'.[10]

Unlike the driver, the travelers had a very limited chance to look ahead: thus all they saw was an evanescent landscape. All early descriptions of railroad travel testify to the difficulty of recognizing any but the broadest outlines of the traversed landscape. Victor Hugo described the view from a train window in a letter dated 22 August 1837: 'The flowers by the side of the road are no longer flowers but flecks, or rather streaks, of red or white; there are no longer any points, everything becomes a streak; the grainfields are great shocks of yellow hair; fields of alfalfa, long green tresses; the towns, the steeples, and the trees perform a crazy mingling dance on the horizon; from time to time, a shadow, a shape, a spectre appears and disappears with

9. Ruskin, vol. 36, p. 62; this is essentially echoed by a French medical author: 'He [the traveler] hardly knows the names of the principal cities through which he passes, and only recognizes them, if at all, by the steeples of the best-known cathedrals which appear like trees by some faraway road'. (A. Aulagnier, *L'Union médicale de la Gironde* [Bordeaux, 1857], p. 525.)
10. Great Britain, *Parliamentary Papers*, 'Report from the Select Committee on Railways', vol. 5 of the section 'Transport and Communications' (repr. ed., Shannon, Ireland, 1968), p. 125.

lightning speed behind the window: it's a railway guard'.[11] And Jacob Burckhardt wrote in 1840: 'It is no longer possible to really distinguish the objects closest to one — trees, shacks, and such: as soon as one turns to take a look at them, they already are long gone'.[12] In a text from 1838 we find the statement that it is impossible to 'recognize a person standing by the road while driving past him' at the 'greatest speed',[13] which prompted the following advice: 'He who has good eyesight . . . does well to acquire the habit of observing from a certain distance everything that attracts his attention while traveling: given some power of observation, he will not miss anything at all, not even during the stage of utmost velocity'.[14]

The recommendation to look at things 'from a certain distance' does not seem entirely realistic, in view of the traveler's situation in the train compartment: enclosed in it, the traveler has no way of distancing himself from the objects — all he can do is to ignore them and the portions of the landscape that are closest to him, and to direct his gaze on the more distant objects that seem to pass by more slowly. If he does not modify his old way of observing things while traveling — if he still tries to perceive proximity and distance in equal measure — the result, as noted in 1862 by *The Lancet*, a medical journal, is fatigue:

> The rapidity and variety of the impressions necessarily fatigue both the eye and the brain. The constantly varying distance at which the objects are placed involves an incessant shifting of the adaptive apparatus by which they are focused upon the retina; and the mental effort by which the brain takes cognizance of them is scarcely productive of cerebral wear because it is unconscious; for no fact in physiology is more clearly established than that excessive functional activity always implies destruction of material and organic change of substance.[15]

Increased velocity calls forth a greater number of visual impressions for the sense of sight to deal with. This multiplication

11. Quoted in Baroli, *Le Train dans la Littérature Française*, Paris, 1964, p. 58.
12. From Manfred Riedel, op. cit., p. 112.
13. G. Muhl, *Die westeuropäischen Eisenbahnen in ihrer Gegenwart und Zukunft* (Karlsruhe, 1838), p. 18.
14. Op. cit., p. 19.
15. *The Influence of Railway Travelling on Public Health*, (London, 1862), p. 44 (is a compendium of articles previously published in *The Lancet*).

of visual impressions is an aspect of the process peculiar to modern times that Georg Simmel has called the development of urban perception. He characterizes it as an '*intensification of nervous stimulation* which results from the swift and uninterrupted change of outer and inner stimuli'.[16] (Italics in original.) 'Lasting impressions', Simmel says, 'impressions which take a regular and habitual course and show regular and habitual contrasts — all these use up, so to speak, less consciousness than does the rapid crowding of changing images, the sharp discontinuity in the grasp of a single glance and the unexpectedness of onrushing impressions.'

The difference between the quality of stimuli in the metropolis and those of railroad travel need not concern us here: what is decisive is the quantitative increase of impressions that the perceptual apparatus has to receive and to process. Contemporary texts that compare the new travel experience with the traditional one demonstrate how that stimulus increase produced by increased velocity is experienced as stressful. The speed causes objects to escape from one's gaze, but one nevertheless keeps on trying to grasp them. This is implied in Eichendorff: 'These travels by steam keep on shaking the world — in which there really is nothing left but railway stations — like a kaleidoscope, incessantly, the landscapes speeding by in ever-changing grimaces even before one has been able to perceive any genuine traits of physiognomy; the flying salon presents one with ever new coteries, even before one has been able to really deal with the old ones'.[17]

John Ruskin, whose dislike of the railways created the most sensitive descriptions of the peculiar traits of pre-industrial travel, proposed an almost mathematical negative correlation between the number of objects that are perceived in a given period of time and the quality of that perception: 'I say, first, to be content with as little change as possible. If the attention is awake, and the feelings in proper train, a turn of a country road, with a cottage beside it, which we have not seen before, is as much as we need for refreshment; if we hurry past it, and take two cottages at a time, it is already too much; hence to any

16. *The Sociology of Georg Simmel*, ed. Kurt M. Wolff (Glencoe, Ill., 1950), p. 410.
17. Joseph von Eichendorff, *Werke* (Munich, 1970), vol. 2, p. 895.

person who has all his senses about him, a quiet walk along not more than ten or twelve miles of road a day, is the most amusing of all travelling; and all travelling becomes dull in exact proportion to its rapidity'.[18]

That final statement — traveling becomes dull in exact proportion to its rapidity — represents the evaluation of railroad travel made by all those nineteenth-century travelers who were still accustomed to pre-industrial travel and thus not able to develop modes of perception appropriate to the new form of transportation. Dullness and boredom resulted from attempts to carry the perceptual apparatus of traditional travel, with its intense appreciation of landscape, over to the railway. The inability to acquire a mode of perception adequate to technological travel crossed all political, ideological, and esthetic lines, and appeared among the most disparate personalities of the nineteenth century. Flaubert wrote to a friend in 1864: 'I get so bored on the train that I am about to howl with tedium after five minutes of it. One might think that it's a dog someone has forgotten in the compartment; not at all, it is M. Flaubert, groaning'.[19] Before a railway journey, Flaubert stayed up all night in order to be able to sleep through the journey and not experience it at all: he could do nothing with the vista offered to him by the compartment window.[20] The most diverse sources provide any number of similar complaints. To indicate the width of the spectrum, and its independence from attitudes based on *Weltanschauung*, let us examine one more piece of evidence: the report of a railroad journey in the United States by the politically liberal German-American Francis J. Lieber in 1834:

> From Albany to Schenectady, you travel by rail-road; and the least

18. Ruskin, vol. 5, p. 370. Elsewhere, Ruskin speaks of the travelers 'who once in their necessarily prolonged travel were subjected to an influence, from the silent sky and slumbering fields, more effectual than known or confessed', (Vol. 8, p. 246.)
19. *Correspondence* (Paris, 1929), vol. 5, pp. 153–4.
20. Op. cit., letter dated 30 October 1873, quoted in Baroli, *Le Train*, p. 201. People slept in their train compartments not only out of boredom; an equally strong motivation was the need to escape from the tiring influx of stimuli by means of sleep: 'There are people, hurried by their business, who . . . in the course of one day have to cast their eyes upon the panoramas of several hundreds of places. They arrive at their destination overwhelmed by a previously unknown fatigue. Just ask these victims of velocity to tell you about the locations they have traveled through, to describe the perspectives whose rapid images have imprinted themselves, one after another, on the mirror of their brain. They will not be able to answer you. The agitated mind has called sleep to its rescue, to put an end to its overexcitation'. (Gustave Claudin, *Paris* [Paris, 1867], pp. 71–2.)

exciting of all traveling, it seems to me, is decidedly locomotion by steam on a rail-road. The traveler, whose train of ideas is always influenced by the manner in which he proceeds, thinks in a steam car of nothing else but the place of his destination, for the very reason that he is moving so quickly. Pent up in a narrow space, rolling along on an even plain which seldom offers any objects of curiosity, and which, when it does, you pass by with such rapidity, that your attention is never fixed; together with a number of people who have all the same object in view, and think like you of nothing else, but when they shall arrive at the journey's end — thus situated, *you find nothing to entertain or divert you*, except now and then a spark flying into the window of the car. . . . There is no common conversation, no rondolaugh, nothing but a dead calm, interrupted from time to time, only by some passenger pulling out his watch and uttering a sound of impatience. . . .[21] (Italics in original.)

While the consciousness molded by traditional travel found itself in a mounting crisis, another kind of perception started to develope, one which did not try to fight the effects of the new technology of travel but, on the contrary, assimilated them entirely. For such a pair of eyes staring out of the compartment window, all the things that the old consciousness experienced as losses became sources of enrichment. The velocity and linearity with which the train traversed the landscape did not destroy it — not at all; only under such conditions was it possible to fully appreciate that landscape. Thus, a description of a trip from Manchester to Liverpool in the year 1830:

The passenger by this new line of route having to traverse the deepest recesses where the natural surface of the ground is the *highest*, and being mounted on the loftiest ridges and highest embankments, riding above the tops of the trees, and overlooking the surrounding country, where the natural surface of the ground is the *lowest* — this peculiarity and this variety being occasioned by that essential requisite in a well-constructed Railway — a level line — imposing the necessity of cutting through the high lands and embanking across the low; thus in effect, presenting to the traveller all the variety of mountain and ravine in pleasing succession, whilst in reality he is moving almost on a level plane and while the natural face of the country scarcely exhibits even those slight undulations which

21. Francis Lieber, *The Stranger in America* (London, 1834), vol. 2, pp. 1–2.

are necessary to relieve it from tameness and insipidity.[22]

That is not a picturesque landscape destroyed by the railroad; on the contrary, it is an intrinsically monotonous landscape brought into an esthetically pleasing perspective by the railroad. The railroad has created a new landscape. The velocity that atomized the objects of Ruskin's perception, and thus deprived them of their contemplative value, became a stimulus for the new perception. It is the velocity that made the objects of the visible world attractive. Let us compare the following passage with Ruskin's comments, and we shall see how differently velocity and evanescence can be experienced during the same period of time: 'The beauties of England', an American traveler wrote in 1853, 'being those of a dream, should be as fleeting':

> They never appear so charming as when dashing on after a locomotive at forty miles an hour. Nothing by the way requires study, or demands meditation, and though objects immediately at hand seem tearing wildly by, yet the distant fields and scattered trees, are not so bent on eluding observation, but dwell long enough in the eye to leave their undying impression. Every thing is so quiet, so fresh, so full of home, and destitute of prominent objects to detain the eye, or distract the attention from the charming whole, that I love to dream through these placid beauties whilst sailing in the air, quick, as if astride a tornado.[23]

To Benjamin Gastineau, whose newspaper essays on travel were collected in 1861 in book form as *La Vie en chemin de fer*, the motion of the train through the landscape appeared as the motion of the landscape itself. The railroad choreographed the landscape. The motion of the train shrank space, and thus displayed in immediate succession objects and pieces of scenery that in their original spatiality belonged to separate realms. The traveler who gazed through the compartment window at such successive scenes, acquired a novel ability that Gastineau calls 'la philosophie synthétique du coup d'oeil' ('the synthetic philosophy of the glance'). It was the ability to perceive the discrete, as

22. Henry Booth, *An Account of the Liverpool and Manchester Railway* (Liverpool, 1830), pp. 47–8.
23. Matthew E. Ward, *English Items; or, Microcosmic Views of England and Englishmen* (New York, 1853), pp. 71–2.

it rolls past the window, indiscriminately. The scenery that the railroad presents in rapid motion appeared in Gastineau's text as a panorama, without being explicitly referred to as such:

> Devouring distance at the rate of fifteen leagues an hour, the steam engine, that powerful stage manager, throws the switches, changes the decor, and shifts the point of view every moment; in quick succession it presents the astonished traveler with happy scenes, sad scenes, burlesque interludes, brilliant fireworks, all visions that disappear as soon as they are seen; it sets in motion nature clad in all its light and dark costumes, showing us skeletons and lovers, clouds and rays of light, happy vistas and sombre views, nuptials, baptisms, and cemeteries.[24]

In another, roughly contemporary, French text we find all three essential characteristics of the panorama described. Jules Clarétie, a Parisian journalist and publicist, characterized the view from the train window as an evanescent landscape whose rapid motion made it possible to grasp the whole, to get an overview; defining the process, he made specific use of the concept of panorama: 'In a few hours, it [the railway] shows you all of France, and before your eyes it unrolls its infinite panorama, a vast succession of charming tableaux, of novel surprises. Of a landscape it shows you only the great outlines, being an artist versed in the ways of the masters. Don't ask it for details, but for the living whole. Then, after having charmed you thus with its painterly skills, it suddenly stops and quite simply lets you get off where you wanted to go'.[25]

What, exactly, did this new perception that we are referring to as 'panoramic' consist of? Dolf Sternberger uses this concept of the panorama and the panoramic to describe European modes of perception in the nineteenth century — the tendency to see the discrete indiscriminately. 'The views from the windows of Europe', Sternberger says, 'have entirely lost their dimension of depth and have become mere particles of one and the same panoramic world that stretches all around and is, at each and every point, merely a painted surface.'[26] In Sternberger's view,

24. Benjamin Gastineau, *La Vie en chemin de fer* (Paris, 1861), p. 31.
25. Jules Clarétie, *Voyages d'un parisien* (Paris, 1865), p. 4.
26. Dolf Sternberger, *Panorama, oder Ansichten vom 19. Jahrhundert*, 3rd ed. (Hamburg, 1955), p. 57.

modern transportation, the railroad first and foremost, is the main cause for such panoramization of the world: 'The railroad transformed the world of lands and seas into a panorama that could be experienced. Not only did it join previously distant localities by eliminating all resistance, difference, and adventure from the journey: now that traveling had become so comfortable and common, it turned the travelers' eyes outward and offered them the opulent nourishment of ever changing images that were the only possible thing that could be experienced during the journey'.[27]

What the opening of major railroads provided in reality — the easy accessibility of distant places — was attempted in illusion, in the decades immediately preceding that opening, by the 'panoramic' and 'dioramic' shows and gadgets. These were designed to provide, by showing views of distant landscapes, cities, and exotic scenes, 'a substitute for those still expensive and onerous journeys'.[28] A newspaper of the year 1843 described the Parisian public 'reclining on well-upholstered seats and letting the five continents roll by at its pleasure without having to leave the city and without having to risk bad weather, thirst, hunger, cold, heat, or any danger whatsoever'.[29] That the diorama fad died out in Paris around 1840,[30] more or less at the same time that the first great railways were opened (lines from Paris to Orléans and Rouen appearing in 1843) would seem corroborative evidence for the presumed connection. The simultaneous rise of photography provides more support for the thesis. According to Buddemeier, the public became fascinated, at first:

> Not by the taking of a picture of any specific object, but by the way in which any random object could be made to appear on the photographic plate. This was something of such unheard-of novelty that the photographer was delighted by each and every shot he took, and it awakened unknown and overwhelming emotions in him, as Gaudin points out. . . . Indeed, the question arises: why did the exact

27. Op. cit., p. 50.
28. Hans Buddemeier, *Panorama, Diorama, Photographie: Entstehung und Wirkung neuer Medien im 19. Jahrhundert (Origin and Effect of New Media in the Nineteenth Century)* Munich, 1970, p. 41.
29. Ibid., p. 45.
30. Ibid., p. 48.

> repetition of reality excite people more than the reality itself? Gaudin hints at an answer: he describes how intensely the first photographs were scrutinized, and what people were mostly looking for. For instance: looking at a picture of the building across the street from one's own window, one first started counting the roof shingles and the bricks out of which the chimney was constructed. It was a delight to be able to observe how the mason had applied the mortar between the individual stones. Similar instances occur in other texts dealing with photographs. Tiny, until then unnoticed details are stressed continuously: paving stones, scattered leaves, the shape of a branch, the traces of rain on the wall.[31]

Thus the intensive experience of the sensuous world, terminated by the industrial revolution, underwent a resurrection in the new institution of photography. Since immediacy, close-ups and foreground had been lost in reality, they appeared particularly attractive in the new medium.

Sternberger observes that the vistas seen from Europe's windows had lost their dimension of depth; this happened first with the vistas seen from the train compartment window. There the depth perception of pre-industrial consciousness was, literally, lost: velocity blurs all foreground objects, which means that there no longer is a foreground — exactly the range in which most of the experience of pre-industrial travel was located. The foreground enabled the traveler to relate to the landscape through which he was moving. He saw himself as part of the foreground, and that perception *joined* him to the landscape, included him in it, regardless of all further distant views that the landscape presented. Now velocity dissolved the foreground, and the traveler lost that aspect. He was removed from that 'total space' which combined proximity and distance: he became separated from the landscape he saw by what Richard Lucae, speaking of ferro-vitreous architecture, has called an 'almost immaterial barrier'. The glass separated the interior space of the Crystal Palace from the natural space outside without actually changing the atmospheric quality of the latter in any visible manner, just as the train's speed separated the traveler from the space that he had previously been a part of. As the traveler stepped out of that space, it became a stage setting, or a series of

31. Ibid., p. 78.

such pictures or scenes created by the continuously changing perspective. Panoramic perception, in contrast to traditional perception, no longer belonged to the same space as the perceived objects: the traveler saw the objects, landscapes, etc. *through* the apparatus which moved him through the world. That machine and the motion it created became integrated into his visual perception: thus he could only see things in motion. That mobility of vision — for a traditionally orientated sensorium, such as Ruskin's, an agent for the dissolution of reality — became a prerequisite for the 'normality' of panoramic vision. This vision no longer experienced evanescence: evanescent reality had become the new reality.

While the railroad caused the foreground to disappear, it also replaced looking at the landscape with a new practice that had not existed previously. Reading while traveling became almost obligatory. The dissolution of reality and its resurrection as panorama thus became agents for the total emancipation from the traversed landscape: the traveler's gaze could then move into an imaginary surrogate landscape, that of his book. By the mid-nineteenth century, reading while traveling had become an established custom. The following observation is found in the minutes of an 1860 congress of French physicians: 'Practically everybody passes the time reading while traveling on the train. This is so common that one rarely sees members of a certain social class embark on a journey without first purchasing the means by which they can enjoy this pastime'.[32]

The idea of reading while traveling on trains is as old as the railroad itself. An article in the *Quarterly Review* of 1830 noted that the journey is 'so easy, that a passenger might read a newspaper with perfect comfort'.[33] A German text of 1833 made a connection between the dissolution of the outer world by means of velocity, and the opportunity to compensate for this by developing an activity within the train compartment that will engage one's attention. Lips spoke of 'a speed at which the objects outside rush past the eye without color or contour, and thus cannot be recognized anymore', and continued: 'And yet, the motion of such a steam-car is so imperceptible, smooth, and

32. *Congrès médical de France, troisième session tenue à Bordeaux* (Paris, 1866), p. 828.
33. *Quarterly Review*, vol. 42 (1830), p. 384.

comfortable, that it is not only possible to *read* but even to *write* in it with the greatest ease; thus, a great number of people, such as scholars, officials, merchants, etc., need no longer rest or interrupt their regular routine while traveling, but can pursue it while sitting in the steam-car'.[34] (Italics in original.)

In the late 1840s, English booksellers established stalls in railway stations, as well as a peculiar kind of lending library, to meet the general demand for things to read while traveling. John W. Dodds describes this development:

> The development of railways encouraged the sale of books of all kinds. Until 1848 no systematic attempt had been made to supply passengers with either books or papers at the railway stations. In that year W. H. Smith got the exclusive right to sell books and papers on the Birmingham Railway. His first bookstall was at Euston Station. Shortly he had the franchise for the entire London and Northwestern System. By 1849, the station library at Paddington terminus contained one thousand volumes, chiefly works of fiction. Here, for the charge of one penny, a passenger had free access to the use of the library while waiting for trains, and for slightly more could take a volume with him on his journey, turning it in at his destination. To meet this new demand Routledge launched his *Railway Library* — novels by Cooper, James, Hawthorne, James Grant, Dumas, and others. Murray advertised his 'Literature for the Rail — works of sound information and innocent amusement'.[35]

In 1852 Louis Hachette emulated the English model in France: in a communication to the French railroad companies he proposed a 'large-scale operation of bookselling that apart from its advantages for the companies would also be both useful and pleasing to the public'. The monotony and boredom of travel by rail, mentioned in so many contemporary descriptions, reappears here as a commercial argument for the establishment of railroad bookstalls:

> The traveler finds himself condemned to idleness as soon as he enters the carriage. The monotony of the trip soon takes effect: boredom arrives, and, what is worse, impatience engulfs the unfor-

34. Michael Alexander Lips, *Die Unanwendbarkeit der englischen Eisenbahnen auf Deutschland und deren Ersatz durch Dampffuhrwerk auf verbesserten Chausseen . . .* (Marburg, 1833), p. 4.
35. John W. Dodds, *The Age of Paradox* (New York and Toronto, 1952), p. 374.

> tunate traveler, pulled along by the machine like a piece of baggage.... L. Hachette and Company have come up with an idea for turning the enforced leisure and the boredom of a long trip to the enjoyment and instruction of all. They have thought of establishing a railway library that will provide only interesting volumes in a handy format and at a moderate price.[36]

Only two years after the opening of the first railway bookstall in France, of whose income the rail companies received 30 per cent, Hachette operated sixty branches in the whole of France. In 1864, the income exceeded for the first time one million francs, and the sale of books was still greater than that of newspapers. A little later that ratio is reversed: in 1866 the income from the sale of newspapers was 969,000 francs, that from the sale of books, 527,000 francs.[37]

A glance at the offerings of the English and French railway bookstalls shows that the reading public was almost exclusively bourgeois. An English survey of 1851 showed that, in contrast to the supply of trashy mass literature in the regular bookstores, the railway bookstalls and lending libraries in London carried highly respectable non-fiction, fiction, travel guides, etc.[38] Hachette's catalogue had the following categories: travel guides, books about travel, French literature, classics, agriculture and industry, children's books.[39]

Reading while traveling was an exclusively bourgeois occupation. The lower classes who used the railroad did not read, not only because they could not afford to but also because they had no desire to do so. Their traveling situation was quite different from that of the more privileged strata. The carriages of the third and fourth class were not divided into compartments: they had no formal resemblance to the traditional means of travel, while the compartments of the first and second class did. The lower classes, who really joined the ranks of travelers only after the advent of the railroad, were unencumbered by memories of previous forms of travel: thus the new forms were not as strange to them as they were to those classes who had to abandon their private coaches for the train. The primitive,

36. Jean Mistler, *La Librairie Hachette de 1826 à nos jours* (Paris, 1964), p. 123.
37. Op. cit., p. 299.
38. Dodds, pp. 374–5.
39. Mistler, p. 124.

spacious third- and fourth-class carriages into which the proletarian traveling public was crowded characteristically promoted continuous communication: in the compartments of the bourgeois first- and second-class carriages, such communication had died out, at least by the end of the nineteenth century. 'How often . . . I have . . ., while traveling alone or with people with whom it was impossible to start a conversation, envied the travelers of the third and fourth class, from whose heavily populated carriages merry conversation and laughter rang all the way into the boredom of my isolation cell', says P. D. Fischer.[40]

The emergence of the habit of reading while traveling was not only a result of the dissolution and panoramization of the outside landscape due to velocity, but also a result of the situation inside the train compartment. The railroad disrupted the travelers' relationships to each other as it disrupted their relationship to the traversed landscape. Constantin Pecqueur explains the phenomenon of dissolution, dispersal, and trivialization of perception and communication, by the greater number of objects and persons with which the travelers' power of attention (which have remained constant) were forced to deal:

> In these great halls, and in the cheerful caravans of the trains and steamships, one's affections tend to go out to a greater number of objects and individuals, and consequently become less intense or durable in each case. This encourages inconstancy and creates excitement over variety; life and affections are seen to lose in depth what they gain in range; the social and general sentiments, on the other hand, find this to be a most pleasing state; while the private sentiments, the familial ones, would seem to suffer from it.[41]

Travelers of the eighteenth century, prior to the railroads, formed small groups that, for the duration of the journey, were characterized by intensive conversation and interaction: the travel novels of the period testify to this quite eloquently. The travelers in the train compartment did not know what to do with each other, and reading became a surrogate for the communication that no longer took place. This connection between

40. P. D. Fischer, *Betrachtungen eines in Deutschland reisenden Deutschen* (Berlin, 1895), p. 31.
41. Constantine Pecqueur, *Economie Sociale*, vol. 1, p. 349.

reading and the alienation of railroad travelers from one another was made by all authors dealing with the subject of travel reading. It appears in the following contribution to the medical congress of 1866, in which travel reading is cited as the general and sole activity of travelers:

> Nowadays one travels so fast and sees, if the journey is of any duration, such a succession of new faces, that one frequently arrives at the destination without having said a single word. Conversation no longer takes place except among people who know each other, at least not beyond the exchange of mere generalities; any attempt to go beyond these often lapses due to the indifference of some travelers. Thus one might say that the railroads have in this respect, too, completely changed our habits. Whenever, in the past, one knew that one was going to pass several hours, sometimes several days, in the company of others, one tried to establish a rapport with one's companions that often lasted beyond the duration of the journey. Today we no longer think about anything but the impatiently awaited and soon reached destination. The traveler one takes one's leave from may get off at the next station where he will be replaced by another. Thus reading becomes a necessity.[42]

The effects of reading while traveling were discussed generally in medical circles in the 1860s. The debate as to whether it was harmful or beneficial related the practice to the special stresses put on the optical sense by rail travel, and to visual perception in general. According to one side of the argument, reading while traveling was harmful to the eye because 'when the traveler sets himself to read, he imposes yet further labour on the eye in tracing the shifting characters of his book or newspaper, and also on the brain'.[43] The traveler who *concentrated* on his reading behaved in just as old-fashioned a manner as the traveler who, accustomed to the pace of the stagecoach,

42. Op. cit., p. 830.
43. *The Influence of Railway Travelling on Public Health*, p. 44. A French author even posited a connection between mental affliction and travel reading, claiming that the latter caused a 'congestion of the retina': 'An eminent Parisian alienist, with whom I recently discussed this pernicious influence of reading while traveling on trains, told me that he not only admitted it to be true, but that an English physician, the head of a great private hospital, had told him that he had treated several patients suffering from general paralysis whose initial phenomenon, or determining cause, had been cerebral congestion brought about by those conditions that I have described.' (Legrand, de Saulle, in *Bulletin de la Societé de Médecine pratique*, (1863), p. 9.)

attempted to fix his stare on the objects flitting past the compartment window. In both cases, the result was exhaustion of the senses and of the mind. To adapt to the conditions of rail travel, a process of deconcentration, or dispersal of attention, took place in reading as well as in the traveler's perception of the landscape outside: Hachette's rising sales of newspapers and falling sales of books attest to that. The afore-mentioned contribution to the medical congress of 1866 stated that travel reading may have had deleterious effects on eyesight, but adds that it would be impossible to curtail it: 'Nevertheless, no matter what one says or does, reading will remain the most natural occupation of railway travelers, in this new form of locomotion that has so profoundly altered the traveler's relations to each other'.[44]

44. Op. cit., p. 830.

[5]
The Compartment

Cette boite ambulante où j'ai dû me cloîtrer. Je n'en puis plus sortir, mais nul n'y peut entrer.

[This ambulatory box in which I have had to enclose myself:/I can't get out of it, but nothing can come in, either.]

— Eugène Manuel, 1881

To adherents of progressive thought in the first half of the nineteenth century, the railroad appeared as the technical guarantor of democracy, harmony between nations, peace and progress. According to them, the railroad brought people together both spatially and socially. This current of European thought found its most emphatic expression in the followers of Saint-Simon: the intellectual generation that appeared on the French political and economic stage around 1825, the year Saint-Simon died, projected all the egalitarian hopes left unfulfilled by Revolution and Empire onto industry and its spectacular spearhead, the railroad: to them it was the material force that would realize the equality and fraternity of 1789 more effectively than any merely formal political emancipation.

Pecqueur formulated the belief that the railroad, as a part of industry, works for human emancipation:

> The communal journeys on trains and steamships, and the great gatherings of workers in the factories, inspire, to a great degree, the sentiment and habits of equality and liberty. By causing all classes of society to travel together and thus juxtaposing them into a kind of

> living mosaic of all the fortunes, positions, characters, manners, customs, and modes of dress that each and every nation has to offer, the railroads quite prodigiously advance the reign of truly fraternal social relations and do more for the sentiments of equality than the most exalted sermons of the tribunes of democracy. To thus foreshorten for everyone the distances that separate localities from each other, is to equally diminish the distances that separate men from one another.[1]

If Pecqueur was convinced that trains and steamers 'truly are the chariots of equality, freedom, and civilization', he did, on the other hand, recognize the possibility that old privileges and inequalities might reappear in the creations of industry, even though their essential nature was egalitarian and democratic. The equality and democracy of industry in general and the railroad in particular had to be safeguarded by 'a certain degree of preexisting equality between the diverse classes or races that constitute the nation: without this, we might end up creating subdivisions in the railway carriages and thus a separation and distinction between social and economic ranks analogous to *stagecoaches, private vehicles for rent,* and *livery stable*'.[2] (Italics in original.)

Pecqueur regarded the division of rail carriages into classes as a baleful possibility. At the time of the writing of his *Economie sociale* that division did not exist in France, simply because the railroads had not instituted a passenger service. Until the early 1840s, apart from one short line, the railroad existed in France only in the form of descriptions of the railways in England and Belgium. In those two countries, however, the railways' division into classes was a fact from the start. Yet the progressives of the early nineteenth century, especially the Saint-Simonian proponents of industry, paid hardly any attention to that fact, being dazzled by the overwhelming fascination exerted by steam power. In the face of the unheard-of energy and productivity made possible by the railroad, the traditional social privileges seemed to be so hopelessly outdated that it appeared hardly worthwhile to deal with them. Even though Pecqueur did not entirely discount the possibility of a survival of inequality, he

1. *Économie sociale*, vol. 1, pp. 335–6.
2. Op. cit., p. 338.

regarded the ultimate victory of equality based on technology as certain. The travelers in a train, he argued, are all equal because they find themselves in a situation of technological equality: 'It is the *same convoy*, the *same power* that carries the great and the small, the rich and the poor; thus, the railroads most generally provide a continuous lesson in equality and fraternity'.[3] (Italics in original.)

But the continuing history of the railroad, manifesting separation of classes even on French trains, exploded (along with many other Saint-Simonian hopes) the notion that social equality would result from the technically equal situation of the travelers. Yet that history had shown that Pecqueur's idea had a core of truth in it, although it was very different from what Pecqueur believed. The fact that the members of different classes traveled on the same train, moved by the same power, did not render them social equals, but it was ever present in their minds. Travel by rail, being pulled by the power of steam, was experienced as participation in an industrial process. For the lower classes this experience was quite immediate: in England they were transported in open boxcars on freight trains, up to the 1840s. They were regarded not as recipients of passenger service but as freight goods. The Gladstone Act of 1844 required the carriages of the third and fourth class to be covered, yet they still looked more like covered boxcars than passenger cars. The traveling situation of the more privileged classes was entirely different: their carriages looked like coaches mounted on rails. Not only was this design forgetful of the industrial origin and nature of the railroad, it was a literal attempt to repress awareness of them. The compartment, an almost unaltered version of the coach chamber, was designed to reassure the first-class traveler (and, to a lesser degree, the second-class traveler as well) that he was still moving along just as he did in his coach, only at less expense and greater speed. Its effect was the exact opposite of the one desired. Precisely because the compartment was so closely linked to traditional pre-industrial travel — imbued with its spirit as it were — the new industrial mode of transportation was experienced as even more traumatic. Bourgeois first-class travelers complained that they no longer felt like travelers but like

3. Op. cit., p. 338.

mere parcels: this rendered their subjective experience of travel just as industrial as was the objective experience of the lower classes. Yet the bourgeois experience was only subjective to the extent that it actually occured in a well-upholstered and outfitted compartment instead of the boxcar-like traveling space of the lower classes: it was equally objective in its realization that the traveler was the object of an industrial process — all the upholstery in the world could not make him forget it.

The End of Conversation while Traveling

Transplanted from the coach to the railroad train, the compartment lost some of its functions. What was functional in the time of pre-industrial travel now became redundant. The essential social function of the coach chamber arose out of its form, namely, the seating arrangement: in the U-shaped coach chamber the travelers faced each other, and such an arrangement encouraged conversation while traveling. The historical genesis of the coach as a means of travel justified the classification of that communicative form of seating as a specifically bourgeois idea; a brief digression should make this clear.

In the Middle Ages, people traveled almost exclusively on foot or on horseback, depending on their class. The custom of traveling in coaches arose at the beginning of the Early Modern period, concurrently with a great number of other practices that arose from the processes of defeudalization and urbanization of Western European life. Thus Werner Sombart describes the origin of coach travel:

> In the course of the sixteenth century, presumably due to the improvement of the roads, travel by horse-drawn carriage became more common. True, we encounter the merchants of the sixteenth with increasing frequency in their 'coaches': but as late as in the mid-seventeenth century we find resistance against coach travel on the grounds that it is detrimental to the welfare of the nation — it makes the people too soft, it ruins horse-breeding, etc. By the end of the seventeenth century travel by coach had finally established itself as equally acceptable as travel on horseback.[4]

4. *Moderner Kapitalismus*, vol. 2, p. 262.

According to Jackman,[5] the coach found its first mass propagation at the beginning of the seventeeth century in and around London — a region where Europe's urbanization had progressed farthest.

The form and seating arrangement of the coach harks back to another specifically urban vehicle for the transportation of individuals, the sedan chair.[6] One might say that the coach consists of two frontally joined sedan chairs. The creation of this curious arrangement during the same period that saw the rise of other bourgeois institutions of communication, such as coffee-houses, clubs, newspapers, and theaters, indicates that the coach must be seen as part of that larger configuration.

Travel in the coach was characterized not only by the travelers' intensive relationship to the world outside, the traversed landscape, but also by their lively communication with each other. Coach travelers were talkative folk, providing material for numerous novels published in the eighteenth and early nineteenth centuries. The railroad put an end to all that. As a Frenchman reminisced in 1857: 'In the coach, conversation got off to an easy start after a few moments of preliminary study of one's companions; at the moment of parting, one oftentimes regretted the brevity of the journey, having almost made friends. How different it is on the train. . . !'[7]

The face-to-face arrangement that had once institutionalized an existing need for communication now became unbearable because there no longer was a reason for such communication. The seating in the railroad compartment forced the travelers into a relationship based no longer on living need but an embarrassment. Georg Simmel's explanation of the way in which modern perception both orientates itself and is disorientated by the optical sense refers to modern transportation as one of the agents of that development:

Generally speaking, what we *see* of a person is interpreted by what

5. Op. cit., pp. 110ff.
6. G. A. Thrupp, *The History of Coaches* (London, 1877), p. 48: 'Sedan chairs came into fashion in England in 1634, and were in general use by the middle of the century. The alteration in the form of the coach, from the long barge shape of Charles I's time to that of Charles II was, no doubt, suggested by the shape of the sedan chair, in London as well as in Germany.'
7. *L'Union médicale de Gironde* (Bordeaux, 1857), pp. 524–5.

we *hear* of him, the reverse being a much rarer case. Therefore one who sees without hearing is far more confused, undecided, upset than one who hears without seeing. This must have an important bearing on the sociology of the big city. Compared to the traffic in the small town, the traffic in the city creates an infinitely greater proportion of cases of seeing rather than hearing others; this is so not only because a great proportion of encounters on a small-town street involve either acquaintances with whom we exchange a few words or those whose appearance allows us to reproduce their entire personality, not only the visible part, but, above all, because of the fact of public transportation in the big city. *Before the development of buses, trains and streetcars in the nineteenth century, people were quite unable to look at each other for minutes or hours at a time, or to be forced to do so, without talking to each other.* Modern traffic increasingly reduces the majority of sensory relations between human beings to mere sight, and this must create entirely new premises for their general sociological feelings.[8] (Italics in long passage added.)

What Simmel describes as a feeling of being confused, undecided, and upset may be described simply as the embarrassment of people facing each other in silence in the train compartment. As we have seen, the perusal of reading matter is an attempt to replace the coversation that is no longer possible. Fixing one's eyes on a book or a newspaper, one is able to avoid the stare of the person sitting across the aisle. The embarrassing nature of this silent situation remains largely unconscious: any insight into it will therefore appear only in hidden terms, hinted at 'between the lines'. We find one example of such hidden implication in M. M. von Weber's railroad handbook of 1857, in

8. Georg Simmel, *Soziologie* (Leipzig, 1908), pp. 650–1. This passage is partially quoted in Walter Benjamin, 'On Some Motifs in Baudelaire', in *Illuminations*, ed. Hannah Arendt, transl. Harry Zohn (New York, 1969), p. 191. Erving Goffman defines visual contact between persons unknown to each other as a disruption of the 'territory of the self', i.e., one's 'personal space'. Goffman proceeds, interestingly enough, to give an example of a situation on a train journey: 'This is nicely illustrated in Eastern seaboard parlor cars designed with a wide, longitudinal aisle and single seats at intervals on either side, the seats arranged to swivel. When there is crowding, travelers maximize their "comfort" by turning their seats to exactly that direction that will allow the eyes, when oriented in the direction of the trunk, to gaze upon the least amount of passenger flesh. . . . In ordinary railway or bus seating in America, passengers who feel overcrowded may be able to send their eyes out the window, thereby vicariously extending their personal space'. (*Relations in Public* [New York, 1972], p. 30.) It would obviously be useful to know if and to what extent average 'personal space' has changed in the last 150 years, i.e., whether it has grown larger or smaller. It would be equally interesting to determine the national and cultural differences between Europe and the United States with regard to 'personal space'.

which the author considered the pros and cons of the European compartment versus the American car. (The American standard carriage differs, as we shall see in the next chapter, from the European in that the seats have not been arranged in compartments and facing each other, but in a long car and facing one way.) Weber believed that the American type would be unsuitable for European conditions. He championed the compartment system and then stated that he felt a particular fondness for the half compartments (*bâtard-coupés*) 'which, placed at both ends of the car, have the advantage that *the passengers have no one facing them*, while being able to look outside through the windows that open out to three sides of the compartment'.[9]

One of the few open criticisms of the compartmental seating arrangement can be found in an 1838 issue of the *Railway Times*. A letter to the editor, signed with irony 'An Enemy to Imprisonment for Debt and in Travelling', suggests an alternative:

> With reference to the interior arrangement of Railway Carriages . . ., I beg to suggest . . . to the public, whether their comfort could not be promoted, by having some of them, in each train, fitted up, so that the passengers should sit back to back, and look out upon the country, from a range of windows the whole length of the carriage. By this plan, a man going to and from Southampton or Bristol might, by taking opposite sides of the carriage, on each journey, see all the country within view of both sides of the road; and, surely, *this would be pleasanter than a three or four hours' study of physiognomy at a stretch, for want of any better occupation.*[10] (Italics added.)

Only the privileged classes underwent this experience of no longer speaking to each other and being increasingly embarrassed by their companions. In the carriages of the third and fourth class, which mostly had not been divided into compartments but consisted of one large space, there was neither embarrassed silence nor general perusal of reading matter. On the contrary, the sounds emanating from these carriages could be overheard in the compartments of the privileged: 'merry conversation and laughter rang all the way into the boredom of my isolation cell', remarks P. D. Fischer in a previously quoted

9. Max Maria von Weber, *Schule des Eisenbahnwesens* (Leipzig, 1857), p. 178.
10. *The Railway Times*, vol. 1 (1838), p. 46.

passage. The French novelist Alphonse Daudet gave his impression of the lively goings-on in the proletarian carriages in the following vivid sketch that is reminiscent of Honoré Daumier's caricatures of train scenes: 'I'll never forget my trip to Paris in a third-class carriage . . . in the midst of drunken sailors singing, big fat peasants sleeping with their mouths open like those of dead fish, little old ladies with their baskets, children, fleas, wet-nurses, the whole paraphernalia of the carriage of the poor with its odor of pipe smoke, brandy, garlic sausage and wet straw. I think I'm still there'.[11]

Isolation

There were occasions when the first-class traveler found himself untrammelled by the displeasing presence of fellow travelers. Being alone in the compartment was an ambivalent situation. This solitude could be experienced as a state of satisfaction, of safety, of happiness. 'Alone in the compartment', said Taine in his *Carnet de voyage*, 'I have spent three of the sweetest hours I have experienced in a long time.'[12] Another passage in the *Carnet* gives concreteness to this state of serenity: 'I was alone in my carriage . . . the wheels rolled on indefatigably, with a uniform noise like that of a prolonged roaring note played on an organ. All mundane and social ideas faded from my mind. No longer did I see anything but the sun and the countryside, in bloom, smiling, all green and with a greenness so various and illuminated by that gentle rain of warm beams that caressed it'.[13]

It is tempting to give a psychoanalytic explanation for that pleasurable feeling of self-forgetfulness which was brought on by the isolation of the ego in the compartment and the powerful mechanical motion of the train. Freud and Karl Abraham have indicated the connection between mechanical agitation and sexual arousal and have called the railroad the most powerful agent of that arousal.[14] The joy of riding trains found its counterpart,

11. 'La petite chose' (1866), quoted in Baroli, p. 151.
12. Ibid., p. 153.
13. Ibid., p. 152.
14. Freud: 'The shaking produced by driving in carriages and later by railway-travel exercises such a fascinating effect upon older children that every boy, at any rate, has at one time or other in his life wanted to be an engine driver or a coachman. It is a puzzling

as soon as there is repression, in what Freud termed 'fear of trains', Karl Abraham interprets the fear experienced by neurotics in the face of accelerating or uncontrollable motion as the fear of their own sexuality going out of control: 'Their fear is related to the danger of finding themselves in a kind of unstoppable motion that they can no longer control. The same patients generally exhibit fear of locomotion in any vehicle they cannot bring to a halt themselves at any time'.[15]

The travelers themselves experienced that fear of the independence of their own sexuality as a fear of derailment. The fear of derailment was ever present on train journeys in the early days. The greater the ease and speed with which the train 'flew' (a typical nineteenth-century term for rail travel)[16] the more acute the fear of catastrophe became: we have already quoted Thomas Creevy's statement made in 1829, that the railroad journey was 'really flying, and it is impossible to divest yourself of the notion of instant death to all upon the least accident happening'. A German text of 1845 speaks of 'a certain constriction of the spirit that never quite leaves one no matter how comfortable the rail journeys have become'. It was the fear of derailment, of catastrophe, of 'not being able to influence the motion of the carriages in any way'.[17]

The fear of derailment was in fact a feeling of impotence due to one's being confined in a fast-moving piece of machinery without being able to influence it in the least. The isolation of the compartment that enclosed the passenger intensified this

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fact that boys take such an extraordinarily intense interest in things connected with railways, and, at the age at which the production of phantasies is most active (shortly before puberty), use those things as the nucleus of a symbolism that is peculiarly sexual. A compulsive link of this kind between railway-travel and sexuality is clearly derived from the pleasurable character of the sensations of movement. In the event of repression, which turns so many childish preferences into their opposite, these same individuals, when they are adolescents or adults, will react to rocking or swinging with a feeling of nausea, will be terribly exhausted by a railway journey, or will be subject to attacks of anxiety on the journey and will protect themselves against a repetition of the painful experience by a dread of railway-travel'. Sigmund Freud, *The Complete Psychological Work*, op. cit., vol. 7, p. 202.

15. *Psychoanalytische Studien*, vol. 2, p. 102.
16. The flying metaphor has received its pictorial expression in the symbol of the winged wheel, adopted by numerous European railway companies as their trademark. The descriptions of rail travel in terms of 'flying' are too copious to enable one to make a sensible selection.
17. *Zeitung für Eisenbahnwesen, Dampfschiffahrt und Maschinenkunde*, vol. 1 (1845), pp. 114–15.

feeling of helpless passivity. While the compartment facilitated the pleasurable experience of mechanical motion, it became, in equal measure, a locus of trauma. Its enclosed nature hid whatever happened in it from outside glances: once the traveler had seated himself in it, he was alone with himself or with fellow travelers for the duration of the journey, or at least for the time taken to travel from one station to the next. There were no channels of communication to the outside world, and there were actual risks involved in that. Peter Lecount, an English engineer, wrote in 1839: 'In road travelling, a passenger suddenly taken ill, or from any other cause, has nothing to do but to put his head out of the coach window and make his wants known; the coach can be stopped, and he can receive the necessary assistance. But how different is the case in railway travelling! There, unless he has by accident a seat just under the guard, he might exert his voice in vain and could by no possibility receive the least help if he was dying; in fact, the more he wanted it, the less able he would be to endeavour to obtain it'.[18]

The compartment's total optical and acoustical isolation from the rest of the train and its inaccessibility during the journey (until the 1860s, even the compartments of express trains could be entered only from outside: there was no communication between them) caused the travelers' interrelationships to change from mere embarrassment at silence to fear of potential mutual threat. The train compartment became a scene of crime — a crime that could take place unheard and unseen by the travelers in adjoining compartments. This novel danger captivated the nineteenth-century imagination: 'The loudest screams are swallowed up by the roar of the rapidly revolving wheels, and murder, or violence worse than murder, may go on to the accompaniment of a train flying along at sixty miles an hour. When it stops in due course, and not till then, the ticket collector coming up may find a second-class carriage converted into a "shambles". We are not romancing'.[19]

18. Peter Lecount, *A Practical Treatise on Railways, Explaining Their Construction and Management* (Edinburgh, 1839), p. 196.
19. 'The Globe' (1863), quoted in Ivor Smullen, *Taken for a Ride* (London, 1968), p. 131.

Drama in the Compartment

In the issue of the *Annales d'Hygiène Publique* of January 1861, we find the headline 'Dangers Run by Travelers on Trains' and the following description:

> On the sixth of December last year, the train from Mulhouse entered the Paris station at a quarter past three in the morning. The passengers made haste to leave their compartments; as the door of one of them remained closed, a railway employee went to open it. How great was his surprise when he perceived the shape of a man lying between the seats! He then asked the man to get out, but received no answer. He found it difficult to see clearly in the uncertain light of the fixture in the compartment that was further dimmed by the black silk shade designed to make it more agreeable; he reached out, and upon withdrawing his hand, found it covered in blood. He notified the stationmaster and the police commissioner, and it was soon ascertained that the man was nothing but a cadaver bathed in a pool of blood.[20]

The dead man was Chief Justice Poinsot. The ensuing investigation revealed that he shared his compartment with a single fellow passenger, his murderer. No trace of the latter was found. The case aroused unusual interest. 'The painful interest excited in Paris by the dreadful death of M. Poinsot has been extraordinarily great', *Galignani's Messenger*, an English-language newspaper published in Paris, reported on 9 December, 'and a certain feeling of uneasiness has arisen at the idea of the extreme facility with which the crime appears to have been perpetrated.'

'What is so strange, so inexplicable', said an article in the *Journal des Débats* of 8 December that expressed the general public's fearful interest in the case, 'is that the travelers who were in the compartment next to M. Poinsot's had not heard a single shot: without being able to affirm this in any certain manner, they thought that they had heard a shout, but only one.'

In the days following the discovery of the crime, the columnists of the Parisian press published pieces whose satirical

20. *Annales d'hygiène publique et de médecine légale*, vol. 15 (1861), p. 224.

surface was a transparent attempt to conceal the deeper fears that this murder had stirred. In the *Figaro* of 20 December we find this suggestion: 'In every well-arranged train we find a carriage reserved for smokers and another one for ladies who desire to travel by themselves. Why not provide a carriage with the legend: *compartment reserved for assassins*? But we know those gentlemen well: they are perhaps too shy to want to attract attention'. (Italics in original.)

On 25 December *Figaro* published a satirical description of the atmosphere of anxiety that pervaded railroad travel:

> M. Poinsot's assassination still has the privilege of being a matter of concern to the public. . . . There is a great deal of egotism in that general preoccupation. Everyone feels menaced in his mortal condition as a traveler. For the employees of the railroad, the affair has become a comedy. We now see well-known millionaires boarding third-class carriages. Others have started traveling in the company of their valet, their coachman, and their cook. Those whom fortune has not blessed with such accessories remain prey to terrible perplexities.

This was followed by a satirical demonstration of such perplexities, a fictitious dialogue between two unaccompanied passengers in one compartment:

> Not too long ago, the train from Brussels carried to Paris, in a compartment of the first class, two voyagers who were hermetically sealed in their topcoats and scarves. After a very defiant study of their respective physiognomies, one of the two passengers decided to speak to his traveling companion.
>
> 'Monsieur', he said, 'one really is lucky to find an honest man traveling first-class these days. I congratulate myself on the stroke of luck that has joined us here, seeing as I might have fallen upon a villain. By the way, I am a cautious man. I do not carry any money, nor a watch, nor any jewelry. I'm wearing an old pair of trousers in order not to excite anyone's greed, and as for my topcoat, a rag-dealer refused to give me forty sous for it. Besides, anyone who dares to attack me will find himself out of luck. I have here a Catalan dagger, two saddle pistols, and a revolver that has as many barrels as one of M. Alexandre's organs has pipes. In this game bag I carry bullets and gunpowder. I have more than a hundred and ten shots that I can fire before surrendering. . . .'

'Well, that's just like me, Monsieur', replied the other traveler. 'I've been pretending to sleep, just pretending. But I'm never more formidable than when I seem to be snoring. You see, I know how to take care of myself. . . . I can take you into my confidence, since you seem to be such an honest man. At the very moment when some scoundrel thinks he can assassinate me, I can riddle his chest with holes. . . .'

'By what means, Monsieur?'

'Look, Monsieur, it's very simple. I told M. Godillot of the travelers' outfitters to make me a breastplate armored with thirty bayonet points. See, it's very ingenious. . . . I only have to embrace my adversary heartily in order to turn him into a sieve'.

Reassured by their reciprocal confidences the two travelers fell asleep with one eye open, clutching their pistols.

A look at entirely non-satirical official reports and technical works that appeared a few years later demonstrates how realistic that satirical sketch of the new attitudes of first-class passengers toward one another was. When another compartment murder occurred in England in 1864, it received both official and satirical comment. A series of *Punch* cartoons dealt with the mutual distrust of first-class passengers, and an official report described the same phenomenon as follows: 'There has been, indeed, a panic amongst railway passengers. Ladies, unable, of course, to discriminate at the moment between those whom they should avoid and those who should be their protectors, shun all alike; and gentlemen passengers, as well as railway officers of all classes, constantly refuse to travel singly with a stranger of the weaker sex, under the belief that it is only common prudence to avoid in this manner all risk of being accused, for purposes of extortion, of insult, or assault'.[21]

The above is from the report prepared by a committee of experts for the House of Commons in 1865: the committee's task was to find out what technical possibilities there were for the creation of means of communication between train compartments, so that further compartment murders could be averted. Similar deliberations took place in France and Germany. The feverish search for ways to end the isolation of the compartment was based on the nightmarish vision of the compartment as

21. 'Report of Captain Tyler', House of Commons, *Sessional Papers*, vol. 50 (1865), p. 6. An entire series of *Punch* cartoons renders similar situations.

such being a provocation to murder.[22] That fantasy recurs even in purely technical dissertations, such as *Le matériel roulant de chemins de fer au point de vue du comfort et de la sécurité des voyageurs* (*The rolling stock of the railroads from the point of view of the passengers' comfort and security*) by Ernest Dapples: 'If one is not alone in the compartment, one has one or several fellow passengers on the journey. If there is only one of them, and this is often impossible to avoid . . ., one may be exposed, by that solitary fellow passenger, to all kinds of disagreeable things, possibly even robbery and murder, as has been shown, unfortunately, by certain well-known events'.[23]

As late as 1870 we find this in the *Handbuch für spezielle Eisenbahntechnik* (*Handbook for special railway technology*): 'The passenger is so pleased when he finds a vacant compartment; but he is not so fortunate when he acquires a fellow passenger who robs him in his sleep, or perhaps even murders him, and then ejects his body from the compartment piecemeal, without attracting the train personnel's attention'.[24]

The Compartment as a Problem

After the Poinsot murder in France in 1860 and the Briggs murder in England in 1864, two traumatic experiences for Europeans, the search was begun for ways to end the isolation of the compartment. That only two cases of murder, occurring four years apart and in two different countries, were able to trigger a collective psychosis tells us as much about the compartment's significance for the nineteenth-century European psyche as does the fact that it took so long to become conscious of the compartment's dysfunctionality. The surprising aspect of the history of the train compartment is, indeed, that it remained unchanged for so long, and that it has, in fact, survived to the present day in modified form, despite the drawbacks that were so plain from the very beginning. While the railroad itself was

22. Baroli points to the murder in Gide's 'Les Caves du Vatican', where 'isolation in the compartment almost provokes the crime'. (Baroli, p. 450).
23. Ernest Dapples, *Le matériel roulant* . . . (Lausanne, 1866), p. 8.
24. Heusinger von Waldegg, ed., *Handbuch für spezielle Eisenbahn-Technik* (Leipzig, 1870), vol. 2, p. 298.

recognized to be fundamentally different from the highway from the very beginning,[25] the form of the passenger carriage moving on it was kept strictly imitative of the traditional form of the coach. As far as I know, in Europe there were no attempts to create a passenger car that would be compatible in its form with the modern technology of the railroad — i.e., one that would no longer have anything to do with the coach-derived compartment. The closest thing to such a Utopian carriage is a proposal published by the Scots journalist MacLaren in 1825. It appears to be entirely free of any formal reminiscences of the stagecoach: MacLaren proposed a ship-like space, 'a form analogous to that of the steam-boat and track boat would be the best'. Nevertheless, another arrangement slipped in covertly and it can be easily recognized as the familiar compartment system: 'It might, for instance, consist of a gallery seven feet high, eight wide, and one hundred feet in length, *formed into ten separate chambers* ten feet long each, connected with each other by joints working horizontally, to allow the train to bend where the road turned. A narrow covered footway, suspended on the outside over the wheels on one side, would serve as a common means of communication for the whole'.[26] (Italics added.) Thus we get, on the one hand, the idea of a large room on wheels, a ship on land as it were (not long after, a similar proposal was made in America),[27] and, on the other, the subdivision of that large room into a row of smaller, compartment like spaces. Admittedly, these had the advantage of being connected with each other — an innovation predictive of the one realized forty years later.

MacLaren's proposal remained on paper. The carriage consisting of a series of unconnected compartments — as it had been first introduced on the Manchester–Liverpool line — remained, in spite of all obvious shortcomings and dangers, the European standard for half a century thereafter. This persistent survival of an impractical form appears even less explicable

25. This has to be qualified: initial attempts were made to transfer the principle of individual traffic to the railroads, before the transportation monopolies became established. Yet the contemporary realization that the railroad differed from the old highways is reflected in the fact that the Canal Acts, not the Turnpike Acts, were chosen as the organizational model for railroad law.
26. Charles MacLaren, *Railways Compared with Canals and Common Roads . . .* (Edinburgh, 1825), pp. 45–6.
27. Morgan in *The American Traveller*, vol. 4 (1829), no. 83. We will also deal with the subject extensively in the next chapter of the present work.

considering that Europe became cognizant, around 1840, of a technically functional type of carriage — the American car. This type had all the advantages its European counterpart lacks. Due to the open spatial arrangements, problems such as heating and toilets,[28] insurmountable in the compartment system, were easily solved; nor did the traveler in the American car fear for his life, being at all times in communication with a great number of other passengers.

In the public discussion to which the compartment system became subjected in the 1860s, the American car appeared as an alternative. With a few marginal exceptions, [29] the European rail companies rejected its adoption. The psychology of the European traveling public was an important reason for this: the English and French commissions appointed to study the problems of the compartment all agreed that the European rail passenger actually *wished* to be left alone while traveling. 'The passengers', Dapples said in summing up the French Commission's report, 'would complain if they were obliged to spend a long time in public carriages, subjected to all the noises, vulnerable to all eyes and all ears. . . .'[30]

The proposals for ways to improve communication between the compartments that come up in the 1860s, in the wake of the Poinsot and Briggs murder cases, all took the 'desire to be left alone' into account. In them, the compartment remained essentially unchanged. There was talk of various alarm systems which would enable passengers to transmit calls of help when they found themselves in acute danger: these included a speaking tube running the entire length of the train; a cord that could be pulled to activate an alarm bell; an arrangement of mirrors that enabled the train personnel to see into the compartments; and an electric alarm system. The French commission, ap-

28. For a long time, toilets did not exist on trains. As soon as the train was in motion, the travelers had to curb their bladders. As soon as it pulled into a station, they could race each other to the facilities. Perdonnet's handbook (*Traité élémentaire des chemins de fer* [Paris, 1855–6], vol. 2, p. 34) states that 'especially on the arrival platforms we have to install urinals of large dimensions'. Commenting on the later on-train toilets, Waldegg's handbook says that these 'have the drawback that the traveler using them has to remain in them from one station to the next, and this, at least in the case of express trains, can be a more or less unpleasant experience'. (*Handbuch für spezielle Eisenbahn-Technik*, vol. 2, p. 342.)

29. In Württemberg, in Switzerland and in Austria, on short-distance lines there was a kind of overland bus traffic.

30. Dapples, op. cit., p. 11.

pointed in 1861 after the Poinsot murder, suggested that the simplest and most effective solution would be to open up small peephole windows in the dividing walls between compartments:

> The dormer window placed in the upper part of the compartment wall offers, in its modest way, some of the advantages of communication between the compartments. In certain cases it could be of useful assistance to the passengers, inspire a healthy fear in wrongdoers, and thus be a material and moral deterrent. It has no detrimental effect whatever on the comfort or privacy of the passengers, as these would always be at liberty to cover it up should they think this advisable. It could also be introduced at very small expense. It does not transmit, from one compartment to the next, words spoken by the travellers, nor draughts, nor tobacco smoke.[31]

This peephole was actually introduced on numerous lines, and it soon became a subject of caricature.[32] It assuaged the immediate cause of the compartment controversy, i.e., the fear of murder. It did not, however, solve the problem of actual physical communication; for that, mobility between compartments and carriages would be absolutely necessary. (This mobility was also a prerequisite for toilets, heating installations, dining and sleeping cars, and ticket control during the journey.)

The most primitive form of physical communication between the compartments was a footboard mounted on the outside of the carriage and running its entire length. The French commission recommended this, in addition to the peephole, for general adoption. The peephole facilitated optical communication between adjoining compartments; the footboard was designed to enable the train personnel to gain access to the compartments during the journey. Passengers, obviously, were not supposed to avail themselves of the daredevil contraption which caused numerous deaths every year.

Effective, safe and comfortable communication between compartments and carriages could be established only by means of a passageway in the interior of the carriage: this meant at least

31. 'Report of Captain Tyler', p. 12.
32. In England, these were soon called 'Muller's Windows', after the name of Brigg's murderer. See cartoons in *Punch*, e.g., issue of 25 November 1865.

partial adoption of the American system. At the beginning of the 1860s, the Swiss Northeast Line introduced a type of carriage that represented a first step in that direction. The carriage remained divided into compartments, but these were connected by means of doors in the dividing partitions. The arrangement did, however, meet with the same line of criticism that prevented the introduction of the American system. It was said that the compartment's privacy and quiet was disturbed by the traffic through it. Heusinger von Waldegg, the man who finally came up with the definitive solution to the compartment problem, summarized that criticism:

> As essential as are the advantages gained by these various means of intercommunication, it cannot be denied that the main argument against the American system, that of the continuous disturbance of the travelers due to the passage through the middle, was not resolved even in the compartmental arrangement of the first and second class, and that such disturbance is most annoying to travelers, particularly in the night-time. The only way to avoid it would be to either provide sliding doors or curtains between the two sides of the compartment and the passageway, or to move the latter . . . to the side of the carriage.[33]

Heusinger von Waldegg's solution was to move the corridor to one side and to separate it from the compartments by sliding doors. Now the compartments could no longer be entered from the outside but only indirectly, through the corridor. The carriage had entrances at both ends, similar to the American system. This remains the current arrangement of European passenger carriages. The compartment has been preserved as an intimate, enclosed traveling space. Intercommunication does not take place by movement *through* but *past* the compartment. The side corridor is not regarded as part of the actual traveling space: it is merely a compromise with technical necessity to establish communication; it is not an offshoot of the compartment but of the footboard. This became apparent from the first publication of Waldegg's proposal.[34] For the European public, the essential

33. *Handbuch . . .*, vol. 2, p. 303.
34. Initially, Waldegg did not discuss a side corridor, but a gallery mounted on the *outside* of the carriage. (*Zeitung des Vereins Deutscher Eisenbahn-Verwaltungen*, No. 25 (1863), p. 354.)

traveling space was and is the compartment: in order to preserve its quiet and isolation, experienced as both pleasurable and frightening, the nineteenth century had to come up with Von Waldegg's monstrous spatial design. The entirely different development of the railroad and the railroad carriage in the United States demonstrates to what a great degree the compartment is an expression of European traditions and class relationships, and how far it is from being the 'natural' form of railroad travel.

[6]
The American Railroad

Un train de chemin de fer est dans ce pays-là considéré comme une voiture ordinaire. On est habitué à s'en garder comme nous nous gardons d'un cabriolet qui passe dans la rue.

[In that country, a railroad train is just another vehicle. People are accustomed to watch out for it the way we watch out so as not to be knocked over by a buggy in the street.]

— French travel account, 1848

The history of the railroad in the United States differs from its history in Europe in that the American railroad was not the industrial successor to a fully-fledged pre-industrial transportation system: in America, the railroad served to open up, for the first time, vast regions of previously unsettled wilderness. 'With the construction of railroads, American culture *began* what European culture completed with them', says Max Maria von Weber; '*before* the humble footpath, before the cattle road, the railroad stretched itself through the wild savannah and primeval forest. In *Europe*, the railroad system *facilitates* traffic; in America, it creates it.'[1] (Italics in original.)

That difference has to do with the specific nature of the industrial revolution in America, where it did not begin with manufacturing, but with agriculture and transportation. In England the transport revolution was a consequence of the prior development of industrial production, and of the textile industry, first and foremost. The prime mover in the construction of

1. *Vom rollenden Flügelrade* (Berlin, 1882), p. 66.

the first railroad between Manchester and Liverpool was the increased need for transportation between Liverpool, the main cotton port, and Manchester, the main center of the textile industry. In England, the increased productivity of the transport system was felt throughout the entire economy and gave it a tremendous boost, but this does not alter the initial order of events — first came the industrial revolution in manufacturing, then the transport revolution.[2]

Weber has indicated the reason for the reversal of that order in the United States. The first prerequisite for opening up the wilderness to civilization and economic utilization was the creation of an effective transport system. W. W. Rostow has said of the American railroad system between 1850 and 1875 that it was 'the instrument for launching the American industrial revolution';[3] this is true from the very beginning, and applies equally to the railroad's predecessor, the river steamboat, and to the mechanization of agriculture.

In order to understand the American relationship to machinery, mechanization and industrialization, one must bear in mind the initial application of machinery in transportation and agriculture. While Europe experienced mechanization and industrialization as largely destructive, replacing as they did a highly developed artisan culture and an equally highly developed travel culture, the case of America is the exact opposite. At the beginning of the nineteenth century, when steam power was first introduced, there was no developed American culture of artisanship or of travel. The American situation was characterized by enormous and practically worthless (because unutilized) natural resources on the one hand and a chronic shortage of labor on the other. As it did not cause unemployment, every form of mechanization was experienced as creative. The mech-

2. 'The revolution in the mode of production of industry and agriculture specifically required another revolution in the general conditions of the social production process, i.e., in the means of communication and transportation.' (Marx, *Capital*, pp. 404–5.)
3. *The Process of Economic Growth* (New York, 1962), p. 262. George R. Taylor: 'The American economy of the early nineteenth century might best be described as extractive-commercial in character. It is true that the beginnings of industrial growth were already discernible. But in this land of continental expanses only revolutionary developments in the techniques of transportation and communication would make possible that almost explosive rush of industrial expansion which characterized the later decades of the century.' (*The Transportation Revolution, 1815–1860* [New York, 1968], p. 3.)

anization of transportation was not seen, as in Europe, as the destruction of a traditional culture, but as a means of gaining a new civilization from a hitherto worthless (because inaccessible) wilderness. As the transport system did not merely take over pre-existing traffic but opened up new territories for traffic, it appeared productive to a degree unimaginable to Europeans. This productivity found its clearest expression in the policy of land grants.[4] The mechanized transportation system became, as it were, a producer of territories, in the same way that mechanized agriculture became a producer of goods. Since American history really began with the industrial revolution (all else being colonial pre-history), that revolution is a constituent part of American national and cultural identity to a far greater degree than it is in Europe. Steam power was perceived as a guarantor of national unity,[5] since the latter was as impossible without it as would be the extraction of wealth from the vast, seemingly endless land by means of mechanized transportation, agriculture, and industry.

In the United States the industrial revolution was seen as a natural development, not only because it appeared right at the beginning of American history, but also because it happened first in agriculture and transportation, and was thus related directly to nature. The main instruments of American industry in the early-nineteenth century were not machines in factories, as in England, but river steamboats, railroad trains, sawmills, harvesting combines. This immediate relation with (or embed-

4. 'The lands were unoccupied, and so valueless. By the building of the railroads a market would be created, and by the doubling of the price of the sections reserved the government would be reimbursed for the amount given away. The grant would therefore assume the nature of a commission from the government to the railroads as agents for placing the unoccupied lands upon the market.' (*Railroad Promotion and Capitalization in the United States* [1st ed., 1909; rep. ed., New York, 1966], p. 246.)
5. Henry Nash Smith, *Virgin Land* (Cambridge, Mass., 1973), pp. 158, 162. A typical example can be found in Charles Fraser's article 'The moral influence of steam' (*Hunt's Merchant Magazine*, vol. 14 [1846], p. 509): 'Without the steamboat, ages might have passed without such a development of her [America's] resources as is now exhibited. The enterprises and industry of the West would have been unrewarded; the progress of civilization would have been slow; the trees of the forest would have still overshadowed the sites of flourishing villages; silence and solitude would have prevailed, where now the busy hum of men resounds, and the inheritance of the hardy pioneer would have been ignorance and barbarism'. Henry Adams: '. . . while the United States were commercial allies of England, and needed steam neither for mines nor for manufactures, but their need was still extreme. Every American knew that if steam could be successfully applied to navigation, it must produce an immediate increase of wealth'. (*History of the United States* [1st ed., 1891–6; rep. ed., New York, 1962], vol. 1, p. 66.)

ding in) nature provided the material base for the American notion, classically described by Leo Marx, of machinery and industry as forces that do not destroy nature but actually realize its potential by cultivating it. Paraphrasing Emerson, Marx says that the industrial revolution appeared as a 'railway journey in the direction of nature'.[6]

In nineteenth-century American thought, the machine appeared to be closely linked to nature and simultaneously, the American landscape was seen as closely linked to the machine.[7] The material foundation for those perceptions lay in the peculiarity of American economic life in the nineteenth century; Habakkuk has formulated this as the 'substitution of natural resources for capital'.[8] The shortage of capital and labor in the United States led to new forms of raw material production, to an uninhibited exploitation of seemingly inexhaustible natural resources; the lack of restraint was merely a form and expression of the low investment of capital and shortage of labor. The application of the same principle to transportation led to entirely different results: here, there was no unrestrained exploitation of nature, but a practically mimetic utilization of the existing natural routes, i.e., the waterways. 'The inland routes which required the least capital to utilize in a primitive way were the rivers', explained Cleveland and Powell,[9] discussing early transportation in the United States, which was indeed based almost exclusively on the natural waterways. The motivation to utilize the waterways was the same one that led to extensive and heedless exploitation of resources ('substitution of natural resources for capital'). The results differed: the first left nature intact, the second led to its destruction. In both cases, however, nature was experienced at a closer range and with greater immediacy than in Europe. The history of American transportation in general and of its railroads in particular can only be understood in terms of an immediate relationship to nature which is not aesthetic but economic.

6. *The Machine in the Garden* (London, Oxford and New York, 1972), p. 238.
7. Leo Marx, op. cit., especially chap. 5.
8. H. J. Habakkuk, *American and British Technology in the Nineteenth Century* (Cambridge, 1967), p. 32.
9. *Railroad Promotion and Capitalization* (New York, 1909), p. 28.

Transportation Before the Railroad

At the beginning of the nineteenth century, the United States did not possess a network of roads and highways comparable to those of Europe. Only in New England and between the cities of Boston, New York, Philadelphia, Baltimore and Washington was there a genuine highway system traveled by regular stagecoach traffic. In the rest of the country, the roads were 'unbelievably poor',[10] being of merely local importance, and functioning as service connections to the waterways. The latter constituted the essential transportation system. Settlement proceeded along the natural waterways,[11] and these were, long into the nineteenth century, the main routes of traffic for goods as well as persons. We can still note to what an extent water traffic has

10. G. R. Taylor, op. cit., pp. 15–16.
11. In the colonial period, settlement occurred along the Atlantic Coast and the nearby river estuaries. 'A study of the spread of settlement up to 1775 shows that the immigrant population ran up the river valleys as far as the fall-line, and there generally stopped.' (Balthasar Henry Meyer, ed., *History of Transportation in the United States before 1860* [1st ed., 1917; rep. ed., Washington, DC, 1948] p. 4.) After the waterways that connected directly with the Atlantic had been opened, the settlement expanded by leaps and bounds: big pockets appeared by the Great Lakes and in the Ohio Valley, and these were no longer directly connected to the ocean. That connection was then created either artificially (Erie Canal — Great Lakes) or by using natural detours (Ohio River — Mississippi River — Gulf of Mexico — Atlantic Ocean). The same process repeated itself on a grand scale in California, where settlement began along the Pacific Coast, and traffic proceeded mainly via Cape Horn or the Isthmus of Panama until the completion of the trans-continental railroad. The development of settlement and transportation in the US was not unique in its initial reliance on waterways — in fact, colonization always begins from these — but it was unique in terms of the brief and concentrated span of time in which that settlement took place. The settlement of Europe also began by the water (Mediterranean Sea, great rivers), but in the course of the millennia an infrastructure of European overland routes developed which obscured the initial pattern of aquatic connections. In the US the foreshortening of that process to less than a century leads to a prolongation in consciousness of the initial settlement and traffic phase (i.e., the one based on waterways): in other words, American traffic consciousness in the nineteenth century still bore the imprint of the categories established by the waterways. We find a good example of this in Henry Nash Smith's discussion of the plan for a trans-continental waterway connection proposed by Thomas Hart Benton as late as 1846, after the railroad had been firmly established as a means of overland transportation in the US: 'The reason why Benton showed such a monumental inability to understand the revolution in transport that was under way was that he thought in terms of a tradition, a century of preoccupation with the network of natural waterways overspreading the Mississippi Valley'. (*Virgin Land*, pp. 30–1.) One of the essential differences between the European railway and the American railroad is that they establish connections of a different nature. In Europe, these connections were mainly between cities; in America, the railroad connected entire areas of settlement that could previously be reached only by means of great detours on the natural waterways. Thus the American railroad first appeared as a complement to the waterway network. The first explicit recognition of this appears in an article in the *North American Review* in 1829 dealing with the projected Baltimore and Ohio Railroad: 'Not only do our great rivers

shaped the American consciousness of transportation in the common American usage of the verb 'to ship' for all forms of transport, whether on dry land or across water.[12] In marked contrast to Europe, the abundance of waterways made it possible for them to gain paramount importance. Contemporary travel journals testified to this as, for example, G. T. Poussin, in 1836: 'One of the most curious circumstances is, no doubt, the abundance of its [America's] vast and navigable rivers, its great bays, straits, and lakes, all of which contribute to a coherent interior navigation system incomparable to that of any other continent'.[13] Thus passenger travel used these waterways in the absence of highways. From the eighteenth century on (at the latest), the dominant form of travel in Europe was over land, by stagecoach or on horseback; Kitchener's *The Traveller's Oracle*, an English handbook of 1827, lists travel on foot, on horseback and by coach with no mention of travel by water, this apparently being seen strictly as a form of transoceanic travel. The American situation was exactly the reverse; one traveled by water wherever possible. Thus, for instance, the Englishman W. Bullock, who traveled through the United States from south to north using only the waterways, wrote in 1827: 'On my return from Mexico to England, in the spring of the present year, I was induced, by the representation of an American friend, to pass through the United States by way of New Orleans, up the Mississippi and Ohio, by Lake Erie, the Falls of Niagara, the Erie Canal, and Hudson River, to New York . . .; nearly the whole

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and lakes already afford to the vast surface which they drain, an extensive carriage of their products to some market or other, but it is found that, by means of the frequent connection of their headstreams, this advantage may be very greatly increased and diffused'. (Pp. 166–7.) The customary notion that the American railroads struck straight out into the wilderness is not entirely correct; they were, indeed, built through extensive wilderness areas, but in order to reach another, already existing, region of settlement that could previously be reached only by water.

12. C. W. Ernst, 'Boston and Transportation' (*Proceedings of the Bostonian Society* [January, 1888], pp. 22–3, cites a few more concepts borrowed from nautical terminology. See also the concept of 'land navigation', a term which Daniel Webster coined for the railroad (*The Writings and Speeches* [Boston, 1903], vol. 4, p. 113).
13. G. T. Poussin, *Amerikanische Eisenbahnen* (Regensburg, 1837), p. 13. David Stevenson provides a typical example of the European travelers' astonishment at finding a waterway culture of almost maritime dimensions in the middle of the continent. He describes the view of the Ohio River at Pittsburgh: 'Here, in the very heart of the continent of North America, the appearance of a large shipping port, containing a fleet of thirty or forty steamers moored in the river, cannot fail to surprise him' (*Sketch of the Civil Engineering of North America* [London, 1838], p. 76).

journey being now performed by commodious steam and tow boats on the rivers, lakes and canals in the interior of the states'.[14]

The technical innovation that enabled water traffic to gain such prominence was the river steamboat. Henry Adams called it 'the most efficient instrument yet conceived for developing such a country'.[15] The development of the American riverboat may be called the first transport revolution, even preceding the railroad. Only by means of steam power did the Mississippi and Ohio rivers become navigable in both directions. Freight rates were reduced to such a degree that the railroad, when it appeared later, did not provide further economy but merely extended freight traffic into regions that were not accessible to waterways.[16] The great numbers of riverboats also indicate their importance: until the mid-nineteenth century, the tonnage of riverboats navigating on the 'Western Waters' (the Mississippi and the Ohio) alone was equal to that of the entire British steamship fleet traveling the high seas.[17] Louis C. Hunter, the historiographer of the American river steamboat, sums up its importance as follows: 'The steamboat was not America's first contribution to the technology of the Industrial Revolution, but in scale and complexity of mechanisms as well as in range of social and economic influence it was in many ways the most notable achievement of our industrial infancy. Before the railroad age it was the chief technological means by which the wilderness was conquered and the frontier advanced, and the principal instrument by which steam power was introduced and spread in the United States'.[18]

The Construction of the Railroad

The American railroad continued what the river steamboat began. This applies, as we shall see, even to the design of its carriages

14. 'A Sketch of a Journey through the Western States of North America' (1827), quoted in Reuben Gold Thwaites, ed., *Early Western Travels, 1748–1846* (Cleveland, 1905), vol. 19.
15. *History of the United States*, vol. 9, p. 173.
16. J. Mark and G. Walton, 'Steamboats and the Great Productivity Surge in River Productivity', *Journal of Economic History*, vol. 32 (1972), pp. 619–40.
17. Louis C. Hunter, *Steamboats on the Western Rivers* (New York, 1969), p. 33.
18. Ibid., p. 61.

and, in equal degree, to the design of the railroad lines themselves. In England such a line was built to be as straight as possible, partly because railroad technology favored this, partly for economic reasons. Labor was cheap and land expensive. Thus it paid to construct tunnels, embankments and cuttings in order to make the rails proceed in a straight line, at a minimum of land cost. The diametrically opposed American conditions produced opposite results. Labor was expensive, land practically worthless. In accordance with the principle of 'substitution of natural resources for capital', the American railroad did not proceed in a straight line through natural obstacles, but ran around them like a river. An article published in 1858 in the *Atlantic Monthly* observed that the English railroad engineer 'defies all opposition from river and mountain, maintains his line straight and level, fights Nature at every point, cares neither for height nor depth, rock nor torrent. . . . On the other hand, the American engineer, always respectful (though none the less determined) in the presence of natural obstacles to his progress, bows politely to the opposing mountain-range . . . '.[19] The American engineer proceeded in this manner not so much out of a respect for nature as out of the wish to build the line as cheaply as possible. As Von Gerstner, one of the first European railroad experts to visit America in the 1830s, noted, 'a great deal of earthwork is avoided' by building the line around natural obstacles. Indeed, the cost per mile of the American lines was only a fraction of that of the English, even though the rails were imported from England at considerable expense. According to Von Gerstner, the building of one mile of American railroad cost only one-tenth of what it would in England;[20] according to a report presented to the House of Commons in 1857, the cost was roughly a third — and this would seem closer to the truth.[21]

19. *Atlantic Monthly*, vol. 2 (1858), pp. 644–5.
20. Franz Anton Ritter von Gerstner, *Berichte aus den Vereinigten Staaten von Nord-Amerika, ihrer Eisenbahnen, Dampfschiffahrten, Banken, und andere öffentliche Unternehmungen* (Leipzig, 1839), pp. 15, 60. The figures relate to the Liverpool–Manchester Line and include not only the actual expenditure for constructing the line itself, but also expenditures for buildings, rolling stock, and administration.
21. Captain Douglas Galton's 'Report to the Lords of the Committee of Privy Council for Trade on the Railways of the United States' (London, 1857; p. 11), gives £10,000 to £12,000 versus £35,000. Towards the end of the century, Arthur T. Hadley quotes the following figures: $204,000 per mile in England versus $61,000 in the US (*Railroad Transportation* [New York and London, 1897], p. 260.)

All European observers noted how the American railroad lines proceeded by curves rather than straight lines: from the very beginning, this was the main characteristic of American railroads. As early as 1827, when the first reports of the English railroad experiments inspired the proposal for the first American railroad (the Baltimore and Ohio), one of its promoters, Minus Ward, stated that the English innovation would have to be modified to suit American conditions: among other things, he mentioned 'the necessity of departing from the transatlantic system of straight rail-roads'.[22] In a survey report for the Baltimore and Ohio Company, S. H. Long concluded in 1830 that the English mode of construction would be uneconomical in American circumstances. He expressed his preference for a line with numerous curves, justifying it by the observation 'that . . . the expense of avoiding a hill or valley, by a prolongation of the route, in a manner to maintain a uniformity in its vertical direction, is less than that of *cutting* and *filling*'.[23] (Italics in

22. Minus Ward, *Remarks, Propositions and Calculations, Relative to a Rail-Road and Locomotive Engines . . . from Baltimore to the Ohio River* (Baltimore, 1827), pp. iv–v.
23. Stephen H. Long, 'On the Principles Which Should Govern the Location and Construction of Rail-Roads', *Journal of the Franklin Institute*, vol. 6 (1830), p. 183. The construction of curving stretches of rail, an adaptation to natural obstacles, merely presented a possibility of capital savings. As European experts unanimously noted, and American engineers openly admitted, the railroads were built as cheaply as possible, i.e., in a very primitive manner. This was justified by the initial necessity to establish transport connections, which could be improved later on. Galton: ' . . . as in a new country it is impossible to foresee at the opening of a railway where the main centres of traffic will eventually be, it would have been a mere waste to invest more capital in the construction of a railway than would render it efficient for the work immediately before it'. (Op. cit., p. 10.) This 'predisposition toward impermanence' (Marvin Fisher, *Workshops in the Wilderness* [New York, 1967], p. 71) was a characteristic trait of American industrial development and one that was recognized early on. 'At first view, one is struck with the temporary and apparently unfinished state of many of the American works', observed David Stevenson in 1838, 'and is very apt, before inquiring into the subject to impute to want of ability what turns out, on investigation, to be a judicious and ingenious arrangement to suit the circumstances of a new climate . . .'. (*Sketches of Civil Engineering of North America* [London, 1838], p. 192) In the US, industrial machinery was exploited according to the same principle, 'substitution of nature for capital', as were natural resources. It was constructed inexpensively, quickly, and in accordance with the latest technological developments; later it was scrapped with equal speed. Habakkuk says that 'American manufacturers were readier than the English to scrap existing equipment and replace it by new, and they therefore had more opportunities of taking advantage of technological progress and acquiring know-how'; his remark that 'the English inclination was to repair rather than to scrap' indicates that America's and England's differing attitudes towards machinery may be explained, not only by the obvious economic motivations, but also in terms of differing traditions: on the one hand, Europe's still-active heritage of careful craftsmanship; on the other, the American vision of an infinitely disposable nature, which even included the machines. (Habakkuk, pp. 56ff.)

original.) To what extent the curving route appeared to be both economical and sensible to the American engineers can be realized from their incomprehension of the English mode of construction. Thus an American text of 1844 fails to grasp the reason for the English engineer's method: 'To approximate to an air-line and a dead level . . ., recourse has been had to cuts, embankments, and tunnels, involving great expense and an immense annual outlay for repairs, which might have been easily avoided by waving the line, increasing the gradients, and conforming to the surface of the country'.[24]

In this somewhat condescending evaluation, tinged with pity, the American commentator showed his ignorance of the fact that the English straight-line manner of construction was based not on esthetics but on purely technical considerations. The rigid axles of the English rolling stock required a line that was as straight as possible: English rolling-stock would inevitably derail in the attempt to take a sharp curve.

Let us now look at the reason why the American railroads with their abundance of curving lines did not have that technical problem.

The New Type of Carriage

In rigid-axle construction, the sharper the curves of a railroad line, the closer together the axles of a carriage need to be placed to avoid derailment. From a technical viewpoint, the frequently curving American route would require so short a distance between the axles that an economically-sized carriage would be an utter impossibility. Thus the innovation of the curving route required a complementary technological innovation, that of a carriage capable of dealing with those curves. The mechanical solution of the problem required a synthesis of contradictory requirements: both rigidity and mobility of the individual axle, and simultaneity of a long and a short distance between the axles. In 1834, Ross Winans provided the solution in his patented invention, which became the basis for the development of the specifically American type of railroad car: Winans sug-

24. Elias Derby, *Two Months Abroad* (Boston, 1844), p. 8.

gested a new design for the undercarriage — the 'bogie'. It fulfilled the seemingly contradictory requirements. Two rigid axles were combined in an undercarriage, with an extremely short distance between them: this guaranteed that wheels and rails would remain parallel even on the sharpest curve. Mobility was added to this rigid component by attaching it to the body of the car by means of a swivelling pivot. One of these double-axled bogies was at each end of the car. In his patent application Winans said: 'I construct two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it. . . . The two wheels on either side of these carriages are to be placed very near to each other: the spaces between their flanges need to be no greater than is necessary to prevent their contact with each other'.[25]

This constituted a breakthrough from the earlier prevalent principle of technical unity between undercarriage and car body. That unity was dissolved into two mutually independent technical complexes, an achievement that coincided, more or less, with Colt's and Whitney's development of the technology of interchangeable parts.

Technically emancipated from the rails, the car was now capable of being extended in length, virtually *ad infinitum*. Winans modestly proposed cars that would be only twice as large: 'The body of the passenger or other car I make is double the ordinary length of those which run on four wheels, and capable of carrying double their load'.

This is an elegant example of the thesis that a technological innovation becomes a historically significant one only when there is an actual economic demand for it: Winan's bearing carriage was, in fact, the *second* discovery of the same idea that had been developed twenty years earlier in England. In 1812 William Chapman had patented the same technical principle of a four-wheeled bearing carriage in England.[26] No real need for it then existed because the straight line appeared as 'natural' and economically sensible to the English — due to high real estate

25. 'Letters Patent of Ross Winans' (1 October 1834), Library of the Association of American Railroads, Washington DC.
26. C. F. Dendy Marshall, *A History of Railway Locomotives down to the Year 1831* (London, 1953), pp. 62ff.

costs and low wages, and also the Newtonian tradition — as the curving track seemed in the United States.[27]

The timing of Winans' patent and its quick adoption by the American lines in the 1830s and early 1840s is revealing. At first, at the beginning of the 1830s, the compartment design of the English railroad had been adopted along with the rest of the technology. As the curving tracks of America demanded an extremely short distance between axles, it was found to be impossible to place three compartments in a series on one bearing carriage: there was room for only one.[28] This cultural lag between the already-Americanized (curving) mode of construction of the road and the still-European type of car lasted for a few years. Only after the bogie had solved the technical problem of how to build a car suited to the American routes was it possible to develop an entirely new *form* of car.

That form, the long car without compartments, quite devoid of reminiscences of the stagecoach, became the standard in America from the 1840s on. A report on the American railroads, commissioned by and presented to the British House of Commons in 1857, contains the following description:

> The bodies of the passenger cars are from thirty to forty-five, and even sixty, feet in length. . . . On lines of four feet eight and one half inches gauge the cars are about nine feet, and on the New York and Erie, ten feet wide, and from six feet to seven feet six inches high. . . . The interior of the car forms a large room, with a passage, of from one foot nine inches to two feet wide, down the centre, upon each side of which cross seats are arranged. These seats are intended for two passengers each; they are from three feet three inches to three feet six inches long, about one foot six inches wide, and one foot apart. The back is arranged to be turned, so that the passenger may sit with his face in either direction. . . . In winter the cars are warmed by means of an iron stove in the centre; and they are lighted at night by lamps placed at the sides. In a certain proportion of the

27. Unlike the American type of car, the bogie gained instant recognition by European railway experts. Lardner called it 'a simple and effectual arrangement'. (*Railway Economy*, p. 338.) Gerstner noted: 'There is considerably less wear and tear on both rails and carriages, and the repair costs of both carriages and locomotives are far lower than in Europe'. (*Berichte*, p. 19.) Towards the end of the nineteenth century, as European long-distance trains equipped with Waldegg's side corridor achieved American dimensions, the bogie was introduced there as well.
28. August Mencken, *The Railroad Passenger Car* (Baltimore, 1957), pp. 9ff.

passenger cars, a portion, about seven feet long, three feet six inches wide, is partitioned off, in which is a small room for the convenience of ladies nursing, and a watercloset.[29]

How different this type of car was from the compartmentalized one becomes apparent merely by a glance at scale specifications. The first-class compartment of the London–Birmingham line in the 1830s was six feet six inches wide, five feet six inches long, six feet high.[30] The different spatial dimensions were an expression as well as a cause of different attitudes toward travel. Travel in the compartment was characterized by immobility, whereas in the American car there was a great deal of mobility during the trip. A situation of embarrassed sedentary confrontation such as the one Simmel describes was unthinkable in the American car, simply because the seats had not been arranged to face each other (their backrests could be reversed), but also because of the possibilities for general communication and mobility in the American car. Poussin stressed this autonomy of movement during the journey and went on to say: ' . . . in this manner, a traveler is free to go and sit down next to whoever he likes, and also to change places again. An American would not much care for our way of traveling in a fixed seat, in a cramped carriage, under lock and key; he would sense a lack of air, of suffocation'.[31] Americans traveling in European trains did indeed mention 'confinement in a small, locked-up compartment',[32] and found it an unpleasant experience to be unable to move freely through the cars and the entire train during the journey,[33] and to have either inaccessible sanitary facilities or none at all — a

29. Galton, p. 15.
30. C. Hamilton Ellis, *Railway Carriages in the British Isles from 1830 to 1914* (London, 1965), p. 22.
31. *De la puissance Américaine* (Paris, 1845), vol. 1, p. 157. Similarly L. Simonin thirty years later: 'A day spent on the railroad in one of these cars . . . passes quickly and effortlessly because the traveler enjoys a great number of comforts and is not imprisoned in it. He is able to move at will . . . to come and go anywhere throughout the train. . . .' (*Le Monde Américain* [Paris, 1875], p. 366. The adjustability of backrests, Simonin notes, makes it possible to have various seating arrangements, depending on the situation: 'If three or four people are traveling together, they can face each other in a kind of relative privacy' (p. 364). This statement tacitly implies that solitary travelers or those in pairs usually adjusted their seats so that they did *not* face anybody; thus there was no inevitable 'confrontation', as there was in the European compartment.
32. E. B. Dorsey, 'English and American Railroads Compared', *Transactions of the American Society of Civil Engineers*, vol. 15, (1887), p. 1.
33. Robert S. Minot, *Railway Travel in Europe and America* (Boston, 1882), pp. 11–12.

problem that persisted on European trains for a long time. The European evaluation of the American car was, as we have already seen, somewhat ambivalent. There were many statements of approval, particularly during the compartment hysteria of the 1860s. 'There is no danger of robbery, murder, or other outrage, as in the small, locked, and inaccessible compartments of European roads', wrote an English author on America, in 1864.[34]

As the history of the compartment demonstrates, the obvious advantages of the American car did not, however, seem sufficient reason to abandon the quiet and immobility of the European train compartment. Thus Captain Tyler in his report to the House of Commons: ' . . . as regards the American arrangement, it is obvious that it is so opposed to the social habits of the English, and would interfere so much with the privacy and comfort which they now enjoy, that these considerations, apart from others, nearly as important, would forbid its adoption in this country'.[35] M. Couche, a member of the French commission appointed after Poinsot's murder, was even more explicit: he said that the American car was suited to American conditions but not for those that prevailed in Europe, since Europeans were not accustomed to move around during the journey, and there was thus no advantage in mobility: 'The traveler is not, in actual fact, free to move around beyond the compartment that he occupies'.[36]

The explanation for the American railroad car's particular interior form is not as uncomplicated as the compartment's derivation from the coach chamber. There is, in fact, a whole series of explanations, all of which apply. We have mentioned the invention of the undercarriage (bogie, truck) that permitted the construction of virtually endless cars. The American car can also be described as the simplest and cheapest type of passenger car: just as the lack of capital in the United States during the early- and mid-nineteenth century had led to the cheapest mode of railroad construction, it also resulted in the least expensive kind of passenger car. That purely economic state of affairs was,

34. Thomas L. Nichols, *Forty Years of American Life* (1st ed., 1864; rep. ed., New York, 1969), vol. 2, p. 8.
35. Great Britain, *Sessional Papers* (House of Commons), vol. 50 (1865), p. 6.
36. *Voie, matériel roulant, et exploitation technique des chemins de fer* (Paris, 1873), vol. 2, p. 17.

however, closely related to the indigenous American democracy of the nineteenth century as described by Tocqueville and Chevalier. The classless open car was economically, politically, psychologically and culturally the appropriate travel container for a democratic pioneer society, while the compartment car, on the other hand, expressed the social conditions prevailing in Europe.

These general explanations are not entirely satisfactory. It obviously would have been possible to simply build a cheaper and more primitive kind of compartment car. We get closer to the core of the question of why Americans preferred to travel in a large room and Europeans in a tiny cell if we consider the remarkable difference between average travel distances in Europe and the United States. The first American lines on the East Coast were still relatively short, although they did bridge larger distances than the first European connections between cities. With the westward expansion the American lines grew ever longer. By the 1830s, when European train journeys were merely a matter of hours and were undertaken only in the daytime, the first sleeping cars appeared in the United States.[37]

Couche refers to the development of new forms of travel due to longer distances. While a train journey in Europe took place in the surrounding environment of stations and their installations — such as buffets, toilets, etc., — America boasted very few of these. Thus, Couche argues, the American traveler had to find those facilities in the train itself. 'A train has to be self-sufficient. The travelers have to be able to find all that is necessary on board, as would be the case on a steamship that puts into port only rarely and briefly'.[38]

The steamship, mentioned by Couche as a convenient analogy, does indeed upon closer scrutiny yield many clues to the rise of a certain type of car on American railroads.

River Steamboat and Canal Packet as Models for the American Railroad Car

Noting that the American train car differed from European

37. Mencken, pp. 5ff.
38. Couche, p. 25.

compartment cars in its spaciousness and ease of communication, some contemporary authors claimed that this type of car reminded them more of the interior of a seagoing vessel than of a stagecoach. Von Waldegg was reminded of the 'cabin of a ship'.[39] Galton, in the report to the House of Commons in 1857: 'In designing their rolling stock, the Americans appear to have taken their ideas more from a ship than from an ordinary carriage'.[40] The French railroad engineers Lavoinne and Pontzen found that the opportunity to move around during the journey was 'analogous to what is possible on board a ship, instead of the immobility imposed on European travelers'.[41]

In the literature (sparse, and more popular than scientific)[42] dealing with the development of design on the railroads, we do not find that anyone has pursued this obvious resemblance between American railroad car and ship design. The only mention known to me of their analogous form, in the framework of a serious study, occurs in John Gloag's *Victorian Comfort*. Gloag speaks of the extreme importance of the river steamboats in American travel before the railroad era and concludes: 'The design of these river steamers had a permanent effect on American standards of comfort and travel'. He then conjectures: 'The long and spacious saloons may well have been the prototypes for the American railroad cars'.[43] In corroboration, he presents side by side illustrations of a riverboat saloon and a Pullman car interior. The similarity of these spaces seems even less accidental when considering what a dominating role the river steamers played in American transportation, and thus in American transportation consciousness, during the early part of the nineteenth century. In other words, the riverboat became for the American railroad train what the stagecoach had been for the European: a means and form of travel that was representative of the period before

39. *Handbuch . . .*, vol. 2, p. 5.
40. Galton, p. 16.
41. E. Lavoinne and E. Pontzen, *Les chemins de fer en Amérique* (Paris, 1882), vol. 2, p. 1.
42. Ellis' monograph on the English railway carriage, and Mencken's on the American, range from the anecdotal to the technically detailed, with Mencken stressing the latter, Ellis the former aspect. In addition, there are scattered essays of a semi-scientific, almost folkloristic nature, such as E. G. Young, 'The Development of the American Railway Passenger Car' (*The Railway and Locomotive Historical Society Bulletin*, no. 32 [1933]), as well as more or less accessible pictorial volumes with varying amounts of text, such as Lucius Beebe, *Mr. Pullman's Elegant Palace Car* (New York, 1961), which mentions the river steamboat as the model of the Pullman car (pp. 279 seq.).
43. *Victorian Comfort: A Social History of Design from 1830–1900*, (New York, 1973, p. 139, 142).

the introduction of railroads, and thus one upon which the railroad modeled itself.

There is one singularly striking piece of proof for that formal influence which otherwise manifested itself indirectly, becoming evident only by means of historical reconstruction: it is Morgan's never-realized design for a railroad car, published in the Boston journal *The American Traveler* in 1829, when the first American railroad had not yet been built. As the designer himself noted, what was proposed and illustrated was not so much a carriage as rather 'what may be emphatically termed a *Land Barge*, and to the Traveler will furnish an idea of all the convenience and comfort which belong to the best steam boats'. (Italics in original.) The spatial divisions corresponded exactly to those of a steamer: 'It is constructed with a cabin, berths, etc. below; a promenade deck, awning, seats, etc. above' — with 'below' and 'above' referring to the two decks of the car, similar to those of a steamer. Final proof for the immediacy with which steamboat concepts were transferred to the railroad in this proposal is the fact that the locomotive was not expected to pull several of these novel cars (in other words, a train), but just one.

This proposal, together with a considerable number of similar ones that were published in the nineteenth century,[44] was never realized, but that does not diminish its validity as proof of the persistence of the image of the steamship in American transportation consciousness. It is precisely Morgan's eccentrically literal transposition of the steamer design that casts light on the steamship's formal influence on the American railroad car, the influence being less immediately recognizable in the standardized car. Different spatial dimensions prevented the envisaged total adoption of steam forms. 'Obviously the difference in clearances and functional organization of railroad cars inhibited their designers from taking a leaf bodily from the book of the river steamers', says Beebe, 'but that they looked at them with longing eye and appropriated what they could is abundantly evident in the record'.[45]

44. Benjamin Dearborn's proposal of 1819 for a ship-like rail carriage; General James Semple's illustrated proposal for a 'Prairie Steam-Car', a vehicle that looked like a river steamboat and locomoted across the plains on rollers, not on rails. (*The Scientific American*, 12 March 1846.)

45. *Mr. Pullman's Elegant Palace Car*, p. 280.

What the railroad car was unable to adopt from the riverboat, due to different spatial relations, it copied from another model, the canal packet, which played a far greater role in passenger traffic in the United States than it ever did in Europe, although it did not gain the spectacular eminence of the steamer. In the American Northeast, on the much-traveled stretches of the Erie Canal and on the canal network connecting Philadelphia and Pittsburgh, the packet was an integral part of the traveling experience. On the Philadelphia–Pittsburgh Canal, which was actually a combination of canal and railroad, the canal packet and the train entered into a curious symbiosis. During the journey the packets, with their passengers on board, were mounted on bearing carriages and hauled to the next stretch of canal — a combination that one can well imagine to have been part of the inspiration for Winans' car, which made its appearance shortly thereafter.[46]

The canal packet of the 1820s and 1830s provided a good model for the railroad car due to its compatible form and dimensions. Its saloon consisted of a long rectangle with windows on the sides and entrances at both ends. Contemporary representations of both its exterior and interior demonstrate a similarity to the later railroad car that a comparison of dimensions corroborates with almost mathematical precision. In 1838, an English engineer stated that the main saloon cabin of a canal packet was forty feet long and eleven wide;[47] by the 1850s the standard railroad car was thirty to forty-five feet long and nine to ten feet wide.[48]

As we have seen, the difficulty in reconstructing the genesis of the American railroad car is based on the fact that there was no single model to be found among prior means of transportation, such as the European coach, but two models that had to be

46. In Ezra Reed's patent application of 6 April 1833, the sectional canal boat was described as follows: 'This canal boat is to be built in parts, or sections, each having its four sides, and bottom. Of these sections there may be six, or more; the two forming the stem and the stern may differ in shape from the others, which may be nearly, or quite, alike. The separate parts are to be united by two pieces of plank on each side, extending from stem to stern, fastened by spikes, or bolts, to the bow and stern sections; the intermediate ones to be kept in their place by chains'. (*Journal of the Franklin Institute*, vol. 12 [1833], p. 235.) In this separation and reassembly of interchangeable parts we recognize, once again, the Colt–Whitney principle characteristic of American technology and also expressed in the bogie.
47. D. Stevenson, *Sketches* . . ., p. 197.
48. Galton, p. 15; Mencken, pp. 12 seq.

synthesized to produce the final result. Whatever the particulars of that synthetic process, it is quite obvious that the result was of a different form, and even a different mode of travel than that of the European railway compartment.

Sea Voyage on Rails

The basic situation of travel in the European compartment, the immobility of the passenger, harked back to the situation in the stagecoach, which was the means of travel that put its stamp upon West European travel culture in the late eighteenth and early nineteenth centuries. This ascendancy of the stagecoach became possible because of the reasonably well developed highway network then existing in Western Europe.

The characteristics of the American transport situation at the beginning of the nineteenth century were under-developed traffic by land, but highly developed traffic on the inland waterways. In American travel, the river steamer was a far more important factor than the stagecoach. 'The innumerable steam boats . . . are the stage coaches and fly wagons of this land of lakes and rivers', wrote Frances Trollope in 1832, and this impression of American travel recurs in contemporary reports by European visitors.[49]

Being the second mechanized means of transportation, the railroad became closely linked with the steamer in American transportation development and consciousness. These links were reinforced, on the one hand by the American notion of steam power as the force that joined the parts of the country into a living nation and, on the other, by the reality of an under-developed highway system; highway building continued to be neglected after the arrival of the railroads, until the beginning of the twentieth century and the arrival of the automobile.[50] 'The Americans', wrote a French author discussing the situation in the mid-nineteenth century, 'seem to have been so entirely

49. *Domestic Manners of the Americans* (1st ed., 1832; rep. ed., New York, 1949), p. 15. On the ubiquitousness of ships even in the heart of the country: 'I hardly remember a single town where vessels of some description or other may not constantly be seen in full activity' (op. cit., p. 303).

50. 'The great development of traffic [in America] skipped the era of highways and began, in contrast to all European countries, immediately with the construction of the most

predestined to the exclusive use of steamboats and railroads that they have no taste for the use of carriages nor for the construction of the great roads necessary for such carriages'.[51]

The social relations of the river steamer, as described by L. C. Hunter, were the very opposite of those of the class-stratified European train:

> A 'world in miniature' was the phrase with which literary travellers were wont to describe the western steamboat, and such in truth it was. Here all the essential processes of living went on, keyed to a higher pitch than in the ordinary course of land-bound existence. Here people laboured, ate, slept, amused themselves, suffered illness and hardship, and, not infrequently, died. Here luxury and poverty, overindulgence and deprivation, freedom and bondage were found in close proximity. Here all ranks and classes were represented: proletarian and chattel slave, frontiersman and emigrant, merchant and manufacturer, farmer and planter. Here was a society with a distinctive life and folkways of its own. Here was a freedom of intercourse among persons of different rank and from different walks of life which impressed foreign observers as symbolic

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rapid and profitable means of transport, the railroad. Especially after the union of all the states it became necessary to master the enormous space they covered. Only the railroad could answer this need. Thus the promising beginnings of a highway network, particularly in New England and in the vicinity of great cities, were inhibited or even thwarted. Thus a gap was created in the development of overland traffic that remained open until the beginning of the twentieth century. Only then, after the introduction of the automobile, that gap was slowly closed,' (Hans Kicia, 'Die Landstrassen in den Vereinigten Staaten von Nordamerika', *Zeitschrift für Verkehrswissenschaft*, vol. 6 [1928], p. 109). Discussing the development of highways in the latter half of the nineteenth century, an American publication of the year 1896 goes so far as to state that, due to the exclusive attention paid to the railroads, the highways were 'in a poorer state than they were fifty years ago'. (N. S. Shaler, *American Highways* [New York, 1896], p. 242.) The early-nineteenth century's neglect of the highways is only one side of the matter. After the automobile became the mode of mass transportation, highways were built again, but their mode of construction broke away from its own ancient tradition and acquired a new orientation based on the railroad. The German *Autobahnen* (highways) of the 1920s and 1930s were associated with the *Eisenbahn* (railroad), not only in name, but were even administered by the national railway corporation. The highway constructed exclusively for automotive traffic no longer integrated urban and rural traffic, stationary and moving traffic, but, like the railroad, served only *moving* traffic. Benton MacKay, proponent of the 'limited access highway', justified his demand for an exclusively automotive highway that no longer ran through the cities by stating that the automobile was, in fact, a locomotive. By a similar transfer we have until recently looked upon the motor road as a fitting frontage for our home lot, instead of regarding it realistically as a causeway, as much to be shunned as a railroad. Once these conventional prejudices are abolished, we see that the motor road is a new kind of railroad. . . .' (Benton, MacKay, *The New Exploration* [Urbana, Ill., 1962], p. 231.)

51. 'L'Illustration', *Journal Universel*, 22 July 1848, p. 316.

of the egalitarian quality of American life.[52]

Quite apart from the democratic aspect, Europe did not have anything comparable to these 'Floating Palaces' and 'Moving Hotels':[53] the European counterparts of these boats were modest by comparison. 'The model of this steamer is beautiful', said one American reporting on a steamer trip down the Rhine in 1844, 'but the room is extremely limited'.[54]

European visitors, on the other hand, found the American river steamer alien in form (for Charles Dickens, 'these Western vessels are . . . foreign to all ideas we are accustomed to entertain of boats') and singular in their roominess and the attendant conviviality. Thus David Stevenson, in 1839, on the doings in the main saloon: 'The scene resembles much more the coffee-room of some great hotel than the cabin of a floating vessel'.[55] Or Charles Sealsfield (Friedrich Gerstäcker) in 1827, when the river steamer had a virtual monopoly on American travel:

> No one is more at home when traveling than the American, particularly when traveling in his own country. He regards the steamboat as a hostelry in which he is staying, as his temporary property, and acts quite accordingly. The citizen of the United States travels so extensively and his journeys are of such great duration that they do not present him with the notions of discomfort or fear that the European might have. His traveling facilities (I am speaking of travel by water) are far more comfortable and better equipped than those of any other nation, not excluding the English.[56]

In our discussion of the development of design we have seen how the spaciousness of the riverboat was regarded as a desideratum for the railroad car. The earliest record of this can be found in Benjamin Dearborn's proposal of 1819, which suggested that the passenger cars of the future railroad be furnished 'with accommodations for passengers to take their meals and their rest during the passage, as in packets; that they be suf-

52. L. C. Hunter, p. 391.
53. 'Floating Palace' and 'Moving Hotel' are popular nicknames for the steamboats on the Ohio and Mississippi rivers. (See Hunter, p. 390.)
54. Derby, *Two Months . . .*, p. 32.
55. *Sketches . . .*, p. 136.
56. Charles Sealsfield, *Die Vereinigten Staaten von Nord Amerika* (*The United States of North America*), Stuttgart and Tübingen, 1827, 2 vols., vol. 2, p. 136).

ficiently high for persons to walk without stooping, and so capacious as to accommodate twenty, thirty, or more passengers, with their baggage'.[57]

Thus it was not only the motive power they shared (steam) that caused river steamer and railroad to be seen as two manifestations of one and the same thing, but also their capacity to provide the same form of travel with ample space and mobility during the journey. 'We have moving palaces on the water and the land', gushed an article in the 1840 *Merchant's Magazine and Commercial Review*, reflecting the popular notion of 'saloons with gilded columns, carpeted with the costly fabrics of foreign looms, adorned with mirrors and paintings and rich tapestry . . .'.[58]

The only strange thing about this text is its date: by 1840, the spacious car was firmly established on American railroads, but in a very sober, plain, almost primitive form not easily compared with 'steamboat gothic'.[59] That the figure of speech about 'moving palaces on the water and the land' could nevertheless become so popular, despite the obvious differences, demonstrates how deeply anchored the analogy of steamer and train had become in popular consciousness.

Although the similarity between the interiors of river steamers and railroad trains was merely a figment of the imagination in 1840, it became a reality twenty years later. From 1859 on, Pullman built cars that openly allude to the model of the 'floating palace' steamer in their very name of 'palace cars': as contemporary illustrations show, their interiors were hard to distinguish from the luxury saloon of a riverboat.

These Pullman cars reflected the nation's wealth, which became increasingly apparent after the end of the Civil War in 1865. With them, a 'first class' was introduced into the until then classless American railroad system.[60] Otherwise they were merely a further development of the arrangement and the func-

57. 'Report of the Committee on Commerce and Manufactures', quoted in William M. Brown, *The History of the First Locomotives in America* (New York, 1874), p. 73.
58. Lanman, in *Merchant's Magazine and Commercial Review*, vol. 3 (1840), p. 274.
59. 'Steamboat gothic' is the popular term for what became a stylistic concept in the nineteenth century. For a detailed description, see Hunter, pp. 396ff.
60. Pullman cars had a dual function, transportation and comfort. They permitted the passengers to stay in the car while it was being shunted from one line to another and, as the railroad network expanded, such shunting became increasingly frequent. They were operated by the Pullman company, which entered into cooperative contracts with the individual lines. The travelers using these cars paid an additional fare.

tions that have been characteristic of the American railroad car from the beginning. As the railroads reached the West Coast, American rail journeys became even longer than before. The need for mobility and communication during the journey increased in direct proportion to the traveled distance: although the need was always typical of American travel, new distances and new wealth added fresh quality to it. The train consisting of Pullman cars looked like a steamer on rails: 'Baths, both tub and shower, barbershops, manicures, lady's maids, valet service, news tickers, libraries, current periodicals and hotel and railroad directories, smokers' accessories and, of course, the fullest possible facilities for sluicing and gentling the patrons with wines and strong waters were taken for granted on all luxury trains of the era'.[61] For a while, the Union Pacific Railroad published a newspaper on its transcontinental run,[62] according to which two organs had been installed on the train so that passengers were able to attend religious services and musical performances while on board.[63]

With the image of that Pullman train traversing the Western plains like a steamship on rails we end our consideration of the American railroad: without doubt, that was its finest hour. This image of a ship on land, crossing the prairie so frequently described by travelers as an ocean of land,[64] gave the American railroad's nautical associations vivid confirmation.

The American railroad's original and fundamental task was to create transportation where no natural waterways existed. This function became more obvious than ever on journeys through the vast dry reaches of the Great Plains: if, until then, the railroad had been merely reminiscent of the waterway it was a surrogate for, the train that then ran on it now became a ship on dry land in a concrete sense. In 1846, Thomas Hart Benton suggested that the two coasts of the American continent should

61. Beebe, p. 285.
62. The paper was called the *Trans-Continental*. It appeared for the first time in May 1870, on the occasion of a special trip arranged by the Union Pacific for a group of Boston businessmen. I do not know if further issues appeared.
63. *Trans-Continental*, 26 and 30 May 1870.
64. Thus, Charles Dickens calls the prairie 'a tranquil sea or lake without water' (quoted in D. A. Dondore, *The Prairie and the Making of Middle America* [Cedar Rapids, Iowa, 1926], p. 290). An 1871 German text remarks: 'No land in sight. As far as one can see, this ocean. . . .' (Alexander F. von Hübner, *Ein Spaziergang um die Welt* [Leipzig, 1882], p. 53.)

be joined not by a railroad but by a system of waterways.[65] Although this notion, born out of the tradition of water travel, never stood a chance against the technically superior railroad, the latter was to pay its respects to that same tradition by crossing the continent like a steamship engaged in what Daniel Webster once called 'land navigation'.[66]

Postscript

The question as to why the traveling situation in the American railroad car provided so much more mobility than did its European counterpart cannot be answered entirely satisfactorily by reference to that general mobility which, since Tocqueville at least, has been regarded as an American national characteristic. One may assume that the 'passion for locomotion' that Michel Chevalier and countless other European visitors observed in the nineteenth century applied not only to general commercial and technological dynamics in America but was also characteristic of individual American bodies. Chevalier has a passage that seems to demonstrate why Americans did not travel in a state of compartmentalized immobility: he says that the American

> is always in the mood to move on, always ready to start in the first steamer that comes along from the place where he had just now landed. He is devoured with a passion for movement, he cannot stay in one place; he must go and come, he must stretch his limbs and keep his muscles in play. When his feet are not in motion, his fingers must be in action; he must be whittling a piece of wood, cutting the back of his chair, or notching the edge of the table, or his jaws must be at work grinding tobacco. . . . He always has something to do, he is always in a terrible hurry. He is fit for all sorts of work except those which require a careful slowness. Those fill him with horror; it is his idea of hell.[67]

65. See n. 11 above.
66. *The Writings and Speeches* (Boston, 1903), vol. 4, p. 113. A curious similarity between railroad train and steamboat was apparent in their relative speeds at the time. According to Gerstner, the steamers reached 12 mph, the trains 12–15 mph (*Berichte . . .*, p. 44). Even later on, American rail velocities differed considerably from the European ones. In 1864, the average speed of American express trains was 32 mph (*Appleton's Railway Guide*, quoted in John H. White, *American Locomotives, 1830–1880* [Baltimore, 1968], p. 74). English trains had reached that figure by the 1840s.
67. *Society, Manners, and Politics in the United States* (Ithaca, New York, 1961), p. 270.