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The Construction of Railroad Space and Environmental Change

Although this session is about technology and the environment, my focus is going to be somewhat more abstract. I am going to try to understand how certain technologies insert themselves into natural systems and create new kinds of space –in this case railroad space –that can radically reorient larger environmental relations.

In choosing to focus on space, I acknowledge the more immediate environmental consequences of nineteenth-century steam technology. They were profound and important. Railroads consumed forests through their demands for ties, bridge and building materials timber supplies, for instance, and they more inadvertently damaged forests through the fires started by steam locomotives. In both mountain forests and North American grasslands presented abundant new sources of ignition that changed the frequency and timing of wildfires.[1] Without the railroads, too, the final wave of bison hunters would not have had the means to get many of their hides to market nor would the cattle herds that replaced the bison, and overgrazed the Great Plains, have had the market value that led to their rapid increase. Perhaps less well known, railroads extended the range of a variety of wild species, particularly birds, which quite literally road the rails west.[2] And railroads had much to do with the creation and popularization of the present national park system.

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[1] For railroads and timber, See Sherry H. Olson, The Depletion Myth (Cambridge: Harvard University Press, 1971). The correspondence of a road such as the Canadian Pacific was full of accounts of fires and attempts to limit and suppress them.*

[2] Personal communication, Jared Diamond.

In choosing to focus on space, and necessarily, time, I also realize that I am trespassing into the territory of a great book, and certainly the greatest book written on the spatial and cultural ramifications of railroad technology: Wolfgang Schivelbusch's The Railway Journey.[3] My excuse for doing so is mundane. Schivelbusch concentrated on passenger trains and passengers' struggles to comprehend the changed relations of two variables -- space and time. I am dealing predominantly with freight trains, which formed the overwhelming majority of traffic in North America, and three variables: not only time and space but also cost. Railway space was not primarily a creation of a time/space continuum; it was the creation of time, space, and cost, and cost was not simply a function of distance. Railway expenditures, as the author of the leading engineering manual on railroad location wrote, did not vary "in direct ratio, or in anything like direct ratio" with distance.[4]

The creation of railroad space began when workers altered a preexisting landscape by driving a railroad through it. The track created an axis. Looking down the track, engineers could measure a linear space and the length of journeys; looking outward from the tracks surveyors could mark the series of square sections that made up the railroad's land grant. I will call this hybrid railroad space absolute space because it was both geometric and natural. In making it both I want to distinguish it from the abstract space of high modernism that James Scott has done so much to emphasize in his important book Seeing Like A State. Scott is certainly right in emphasizing the way that

[3] Wolfgang Schivelbusch, The Railway Journey: The Industrialization of Time and Space in the 19th Century (: Berkeley: University of California Press, 1986).
[4] Arthur Mellen Wellington, The Economic Theory of the Location of Railways (New York: John Wiley & Sons, 1891), 195- 197

cadastral surveys abstract and simplify the natural and social worlds that they map.[5] But my interests differ from Scott's in two ways. First, I am interested in movement. Railroads are a technology of movement and, as I will discuss in a moment, absolute space is just one marker of railroad space. And second, I am interested in the corporations that increasingly controlled railroad technology in the nineteenth century while Scott is largely interested in the state and state planning as an aspect of high modernism.

If we look at railroads only in terms of absolute space, they both compress and stabilize space. Contemporaries captured the compression immediately in the nineteenth-century cliché later mimicked by the internet: the annihilation of time and space. Margaret Irvein Carrington this initial reaction in 1869 when she wrote that with the transcontinentals and the Atlantic cable " the Christian world and all civilized people [may] rejoice that the islands of the sea and the barbarism of Asia have been brought so near to our homes that with only a single wire to underlie the Pacific, the whole earth will become as a whispering gallery, wherein all nations, by one electric pulsation, may throb in unison, and the continent shall tremble with the rumbling of wheels that swiftly and without interruption or delay transport its gospel and commerce." The Pacific Coast was by 1869 only four days from Omaha, and "[a]n officer of the army recently returned in forty hours over a distance which required a march of sixty-four days in 1866."[6]

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[5] James C. Scott, Seeing Like A State: How Certain Schemes to Improve the Human Condition Have Failed (New Haven: Yale University Press, 1998), 11-52.

[6] Wolfgang Schivelbusch, The Railway Journey: The Industrialization of Time and Space in the 19th Century (Berkeley: University of California Press, 1984), 33-84. Ocean to Ocean: Pacific Railroad and Adjoining Territories, with Distances and fares of Travel from American Cities, By the Author of "Absaraka" (Margaret Irvin Carrington) (Philadelphia, J.B. Lippincott, & Co, 1869), 9-10.

Once built, a railroad's absolute space became part of the local geography that was ideally suited for mapping and conventional description in a railroad guidebook. The Pacific Tourist, designed to entertain and inform, provided railroad travelers information about towns, sights, stage connections and a rudimentary history. Its readers encountered a set of maps, anecdotes, descriptions, statistics, and illustrations all set firmly in absolute, three dimensional space. Archer, Wyoming "which is 508 miles from the starting place (Omaha), with an elevation of 6,000 feet above tidewater. This station is a side track with section house nearby." Cheyenne the "Magic City of the Plains," was "516 miles from Omaha, elevation 6,041 feet."[7] The Railroad Gazetteer, "For Gratuitous Distribution on Railways, Steamers and Stages" of the Central Pacific meticulously located for its captive audience of travelers tunnels, snowsheds, and exceptional sights by their distance from San Francisco and their elevation.[8]

But the railroads had changed the nature of the nature that the guidebooks described. What distinguished railroads from the natural geography through which they ran was first, their centrality (everything else was measured in relation to the tracks), second, their human constructedness, and, finally, their ability to transform everything around them.

How a railroad transformed the environment around it had much to do with where it was built. How to build a railroad was widely studied, but, as Arthur Wellington put it, "the larger questions of where to build and when to build, and whether to build them at

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[7] The Pacific Tourist: An Illustrated Guide to Pacific R.R., California and Pleasure Resorts across the Continent , H.T. Williams Editor (New York, Adams & Bishop, 1879), 61,64

[8] Railroad Gazetteer, November (1871), no. 27 (25 in pencil)"For Gratuitous Distribution on Railways, Steamers and Stages. Monthly Edition, 1200 (H.S. Crocker & Co., Sacramento, 1871)Newberry Graff, 923.

all" had been neglected.[9] To distinguish good from bad, Wellington gathered statistics and compared roads.

Now working only in the medium of absolute space, a railroad corporation, particularly ones like the Canadian Pacific, Central Pacific, and Union Pacific that were subsidized and supported by the state, had immense power to control the transform the natural environment in ways that James Scott has emphasized. Such power was real.

Looking out the window of a Canadian Pacific Railroad car as it rolled across Manitoba and Saskatchewan in the mid-1880s was a tutorial on the construction of space and the fine points of railroad building. Mile after mile of grasslands rolled by, and every eight miles it was punctuated by a railroad station. Passengers could chart their progress by counting stations and multiplying by eight. Why eight? Apparently eight miles was the maximum distance at which a farmer could make a roundtrip with a wagon load of grain on level terrain in a single day. A farmer along the line halfway between stations would still be able to make his journey and be back by dark. At every second station there would be "depots, section-houses, and water tanks. At each of these alternate stations is provided a crossing track 2000 feet in length and a business track of 1000 feet and each intermediate station has a track 2000 feet long." And roughly every 100 miles, the train would reach a divisional point with railroad shops and yards, which inevitably meant jobs and larger towns. The CPR was imposing a pattern here that would determine the movements, routines and opportunities of people not yet in the country. [10]

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[9] Wellington, Railway Location, 1, 2, 6, 7

[10] Van Horne to E.T. Talbot "Railway Age", Nov. 26, 1883, Letterbook 3:666-684, MG 28 III 20, vol. 1, C.P.R. Van Horne Letterbook #3, pt. 2, Oct.-Dec. 1883. John Hudson, Plains Country Towns (Minneapolis: University of Minnesota Press, 1985), 54-55, 58.; Van Horne to E.T. Talbot "Railway Age", Nov. 26, 1883, Letterbook 3:666-684, MG 28 III 20, vo. 1, C.P.R. Van Horne Letterbook #3, pt. 2, Oct.-Dec. 1883.

Only the state could structure space on the transcontinentals' grand scale. Together the Canadian and American land surveys and railroads marked out the shapes of what was to come. It was as if Manitoba, Alberta and Saskatchewan, and all the places like them across half a continent were a child's coloring book with the patterns pre-sketched. Farmers could add color and variety, but the lines of their fields, the locations of their roads, the places where they would take their crops and buy their supplies, all of these had been determined first by the survey grid and then later elaborated by the railroads. How businessmen would ship their goods, where and what time they would travel to do their business, whether they could return home in a day or have to spend the night someplace else, all these things were shaped by the railroads construction of space.[11]

Absolute space, however, was only one part of railroad space. The building of a railroad and the marking off of land grants were, in effect, the hardware of the railroad network. But as critical was the software—the time schedules and tariffs or rates that managed movement of people and things through space –and the administrative apparatus that kept track of railroad cars, determined routes, and set prices. These were the heart of a second kind of railroad space that I will call relational space and which was at the heart of railroad politics that had much to do with shaping the environment.

Relational space came into being only when the geometrical measures of absolute space, calculated in inches, feet, or miles, were related to other abstract measures such as time and, particularly, cost. Relational space was the railroad space of movement. It occurred when humans calculated their journeys in hours and minutes or dollars and

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[11] For an example of schedules and band business travel, see A.N. Towne to Hopkins, Nov. 13, 1876, Towne to Crocker, Nov. 21, 1876, v. 12: 169, Hopkins Correspondence, Timothy Hopkins Transportation Collection, Stanford Archives, M97. Hudson, Plains Country Towns, 68-69.

cents. Railroad distance measured in miles between two points was stable; distance measured in time or money was often radically unstable and a matter of bitter dispute. It formed the heart of railroad politics and the entire railroad enterprise.

The time of a railroad journey mattered, but it mattered far less for most freight than it did for passengers; what mattered more was cost. Just as the timetable translated space into time so the tariff list translated distance into money. This was a relatively simple translation in the case of passengers. It depended largely on the class of travel, but it was a much more complicated translation in the case of commodities. The cost of shipping a commodity varied from commodity to commodity and was always changing. Here is where relational space grew most important. When the price of movement between two places fell, then those places drew closer together. When it rose, they became farther apart. Since the prices, or tariffs, the railroads charged fell as a whole throughout the late nineteenth-century, space had shrunk. Margaret Carrington was right about this. The average rate per ton mile on freight declined fairly steadily on both the Central Pacific and Union Pacific between 1870 and 1885, with the rates in 1885 roughly 1/3 of what they had been fifteen years earlier.[12] Things were, however, more complicated than they seemed.

The overall decline in freight rates and comparisons between American and European freight rates became something of a stock answer to complaints about American railroad tariffs, but they were not answers that stood up well to scrutiny. In 1897 the president of the Atchison, Topeka, and Santa Fe would inform the Kansas legislature that the average rate charged per ton mile by his system had fallen 55%

[12] "Freight Rates on Central Pacific and Union Pacific Railroads." PRC 5: 2585. The average rates per ton/mile were $5.95 on the C.P and $4.26 on the U.P. in 1870. In 1885 the rates were $1.83 and $1.49 respectively.

between 1882 and 1896.[13] And it may have, but this was a period of deflation and prices were falling generally, and the average rate per ton mile told little about the fall in prices for particular commodities. Because railroads charged more for short hauls than long hauls and because they discriminated between commodities (charging less for bulk goods like coal or wheat than for luxury goods like coffee or tea) a change in the length of the haul or an increase in the amount of lower classifications of freight would produce a decline in the average rate per ton mile. The expansion of the Santa Fe after 1882 and the rise in Kansas coal and wheat production would in and of themselves have gone far to reduce average rates. An American Statistical Association forum in 1897 concluded that "the low average freight rates per ton mile in this country are due chiefly to the enormous amount of long distance freight traffic."[14] Such reductions did not answer what C.E. Prevey later called the "ethical question regarding the fairness of rates." Prevey wonder whether "the reduction in average rates per ton mile [has] been at the expense of the railroad companies and a direct gain to the public, or does it consist in merely doing less work for less money?"[15]

Falling prices, no matter how calculated, was not the issue; comparative prices were the issue. Because prices did not fall evenly, distance did not shrink evenly, and this gave rise to the chronic discontent of those who used the railroads. It did not matter to wholesalers in Spokane, for example, if they grew closer to Chicago as their rates decreased over time if the rates to ship to and from Seattle fell even faster. In such a case, they were at a disadvantage. They were in comparison to Seattle growing farther

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[13] Henry H. Swain, "Comparative Statistics of Railroad Rates," Publications of the American Statistical Association, N.S., volume 6, no. 43 (September 1898), 116

[14] For a discussion and debate of these issues see Swain, "Comparative Statistics of Railroad Rates," 115-132, quote 132.

[15] Swain, "Comparative Statistics of Railroad Rates," 130-132.

away from Chicago even though they were far closer in terms of miles. Similarly, because of the special rates granted to Winnipeg, that city grew far closer to eastern Canada than any other place on the Canadian prairies.[16] Cities did not wish to lose advantages, and the disadvantaged wished to gain. The giving of advantage and the taking away of advantage was in part a matter of railroad building, since competitive points with two or more railroads had a great advantage over places with one, but it was also a matter of railroad management. Shippers, consumers, and anti-monopolists all assailed railroad managers whom they made into calculating devils, but they were as often mercurial, passionate, inept and quite foolish devils.

I will not here tax you with the intricacies of railroad rates in the nineteenth century. Albert Fink knew more about railroad rates than any other nineteenth-century North American. He studied railroads the way Darwin studied evolution, but where Darwin found a simple rule, Fink watched his rules fly apart. He could find no uniform rule for rate making.[17] Fink opposed legislating rates since "transportation tariffs cannot be established by simple arithmetical or mathematical rules; they require the application of quite a number of principles all correct in themselves, and this to a great variety of ever changing facts."[18] Each kind of freight needed its own calculation to determine what rate the traffic could bear, hence the multiplicity of rates and categories of freight involved in moving things through space. This was a task that demanded experts.[19] The

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[16] Gerald Friesen, The Canadian Prairies: History (Toronto: University of Toronto Press, 1987), 208-09

[17] Albert Fink, Cost of Railroad Transportation: Railroad Accounts and Governmental Regulation of Railroad Tariffs (Louisville: John P. Morton and Company, 1875)

[18] Albert Fink, "Argument Before the Committee on Commerce . . . on the Reagan Bill . . .," Washington, January 14, 15, 16,1880 (New York: Russell Brothers Printers, 1880), 7. For an account of the making of the Potter Law, perhaps the most famous Granger Law, see Miller, Railroads and Granger Laws, 140-160.

[19] Ripley, Railroads: Rates and Regulation is the classic contemporary account of the making of rates.

task proved beyond the capacity of experts; rate setting was corrupt, mysterious, volatile and unpredictable.

Focusing on rates means turning away from absolute space to the software and relational space that determined the details of how the railroads ran and could determine which producers and cities prospered and which did not. Charles Francis Adams admitted that he did not see how anyone could "enter upon any manufacturing industry on the line of a railroad corporation which makes a plaything of its tariffs," and he thought the Union Pacific had played with its rates far too much.[20] All western railroads did.

The American West, like the Canadian West and the Mexican north, in the nineteenth-century was a center of commodity of production, and this commodity production depended in part on nature: humans had not created prairie soil, western forests, copper, silver, gold, or the grasslands.[21] But railroads did not ship raw nature. Most western commodities needed processing of one kind of another before they reached their final markets: wheat had to be milled into flour, timber had to be processed through sawmills, ore had to be smelted, cattle and sheep had to be slaughtered and turned into meat and by products. Where businessmen located mills, stockyards, and smelters, and thus whose wheat, cattle, and ore they processed-- often depended on the intricacies of railroad rates. When railroads charged higher rates for hauling wheat than for hauling flour, they were encouraging the growth of mills near the site of production. When they charged higher rates for flour than for wheat, they encouraged millers located near the sites of consumption. When they raised prices on dressed beef so that that a refrigerated

[20] Adams to S.R. Callaway, U.P., P.O., O.C. Callaway, v. 30, ser. 2, r. 27.
[21] William Cronon, Nature's Metropolis.

carload of forty slaughtered carcasses cost as much to ship as a carload of twenty live animals, even when the cost of the refrigerated car was only 1/3 more, they favored Chicago as against more westerly stockyards and slaughterhouses.[22]

Concentrating on absolute space –the construction of the railroad and the operation of steam technology—tell us important things about how national and global economies annex space, but it does not tell us much about how the consequences play out. If we want to move beyond generalities to more refined understandings about how development shaped the natural world, then we need to move into the complexities of space and particularly the complexities of movement. Railroad lines alone meant little. It was the trains that moved along them that mattered, and what those trains carried was in large part a function of what they charged and how often, as well as where, they ran.

As historians we have gotten much better at incorporating space. The old charge that we wrote as if history took place on the head of a pin no longer applies. But too often we still do write as if space is static and that it can be captured by maps. People and things move, and it is in something as simple –and as complicated –as movement that many of the environmental changes brought by steam and other technologies originate.

[22] Ripley, Railroads: Rates and Regulation, 135-39; Thomas Sturgis's Statement, Report of the Senate Select Committee on Interstate Commerce, forty-ninety Congress, First Session, Submitted to the Senate, Jan. 18, 1886 (Washington: GPO, 1886), Appendix, 159-60.

Railway space was a creation of railroad technology, but it was railroad technology set within a natural environment. And it was a complicated space

I have never been very good at keeping categories distinct. The Organic Machine was about, well, dams as organic machines—hybrids in which the natural and the mechanical, those thing that exist independently of humans and those things that are human artifacts are not so easily disentangled. That book relies on ideas that first came to me in reading Emerson and in thinking about Leo Marx's The Machine in the Garden, particularly Emerson's discussion of the nature intrinsic to steam technology. And it would be easy enough for me to continue that line of discussion in my current work of railroads. And I will pick up one strand of it in considering technology, labor and nature, but much of my current thinking about such things goes to the relation between technology, nature, and capital because it seems to me impossible to think systematically about the effects of technology upon nature at least in the nineteenth-century without thinking about capital which so influenced what technology was deployed, how it was

deployed, and in what context. Change the relations of capital to technology and by and large you change the relations of technology to nature.

I use the word nature here quite advisedly. By it I mean not only environment—that which is outside of us –but our own bodies, our human nature –that what is inside of us—our blood and guts.

The Senate Select Committee on Interstate Commerce reproduced this orthodox vision when it reasoned that a mechanic in Massachusetts had only to work a single day to pay the cost of transporting the food he would eat for a year 1,000 miles from the western prairies. "If the mechanic will give up one holiday a year . . . he is placed alongside of the prairie, and distance is eliminated from his condition."[23] Such calculations, however, emphasized long term declines rather than shorter term fluctuations in costs and differences in costs between one destination and other. When rates rose, or when they sank faster for one place than another, seemingly fixed places grew not closer but more distant. This was relational space.

[23] Report of the U.S. Senate Select Committee on Interstate Commerce, 49th Congress, First Session (Washington, GPO, 1886), 10.