The Theory of Transportation

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CHAPTER I.

MECHANICAL AND GEOMETRICAL NOTIONS.

We think of transportation as a movement of things—masses of any sort—from one place to another. Anything answering this description comes under the idea in its most general form. If we add to this a conception underlying all action directed to an end, namely, that its excellence consists in accomplishing the end with the least possible expenditure of time and force, we have the most general basis possible for the judgment of transportation from a mechanical standpoint. From this standpoint that transportation is best which accomplishes the movement of things with the least force and in the shortest time. Speed, then, is one fundamental test, while economy of force, translated in the light of actual conditions, means cheapness. Speed and cheapness never cease in the most complex development of transportation to be the simplest tests of its efficiency.

We may arrive at some notions not without importance if we consider in their simplest form the geometrical conditions of transportation. Let us suppose a large country, which, instead of being variegated with seas, mountains and rivers, is all level and par-

celled into farms of uniform size. Suppose now the need to arise for a universal system of transportation that should connect every farm with every other. What form would that system take, what would be the plan of the roads? In building roads there is of course always a tendency to take the shortest route. But the literal and absolute application of this principle would require the building of roads from every point to every other; in other words the turning into roads of the whole surface of the earth, with enormous labor and the complete destruction of the farms. It is clear that some sort of a compromise must be made between the principle that calls for directness and the principle that calls for economy of labor and space. To show just what plan of roads would result from this compromise would involve a rather complex mathematical problem; but without going into this it is perhaps sufficiently clear that the solution must be found in a complexly branched system. Each neighborhood would collect what it has to send at some central point whence the movement would proceed by a common road. These central points, again, would stand in the same relation to one another as the farms in a neighborhood; the roads from them would concentrate at other points. And so on until, finally, we should have all the longest movements traversing a few great roads of which a number of the most important would meet at the center of the country. The general effect would be one of complicated radiation, primary, secondary and so on.[1]

[1]It is apparent that there is a general analogy between roads and the arteries of a living body, the veins of a leaf, the trunk, boughs and twigs of a tree, and other channels of biological communication. Some similarities of function and structure will be found

Although this hypothetical case is never realized, yet there is some approach to it in large agricultural areas, as for instance the Mississippi valley in the United States. If one calls to mind how the country roads radiate in all directions from the country towns and then, looking at the map, notices how the railways upon which these towns are situated concentrate at certain points, and further how the whole system converges at a few central points like Chicago, he will perceive a striking illustration of the operation of the principle in question. In other parts of the country, where mountains or lakes interfere, the radial arrangement is obscured or disappears entirely.

The arrangement of streets in cities offers interesting material for the study of the geometrical relations of transportation. We have here two leading prin-

worked out in detail by Spencer in his "Sociology," vol. i, chapter 8. He does not, however, consider the question of geometrical arrangement.

The arrangement of roads spoken of in the text would not, as a matter of fact, be at all like that of the veins of a leaf, or of arteries or boughs. Although these biological systems branch at many points they have, I believe, but one center, but one destination for the movements inward from the circumference—as the heart in the circulatory system. The other parts do not communicate with one another directly, but through the heart. Hence these systems are simple and the only object of their arrangement is ready access to the one center. But social circulation is highly complex and has thousands of centers variously subordinated to one another. Every village is the center of a movement of its own—a little heart by itself. Towns of the second rank do not communicate with one another solely through some great city to which they are tributary; they also communicate directly. So with every part of the system. The result is not a one-centered but a many-centered arrangement, which may yet have a certain unity arising from the subordination of small centers to large ones.

Compare Jenks, "Road Legislation for the American State," 49 *et seq.* [In Publications of the American Economic Association, vol. iv.]

ciples at work in determining the plan of streets,—the branched or radial principle, which is the most convenient from the point of view of transportation, and the rectangular arrangement in blocks, which is the most convenient from the point of view of architecture, building, and the measurement and allotment of land. There are few cities that do not show traces of both principles. The branched plan is seldom carried out in detail, in the arrangement of minor streets, but it often clearly appears in the general plan of the city, in the convergence of important streets at one or more centers.

There is a marked difference in plan between old cities of slow and natural growth and the quickly made cities of our western states. In the former the radial principle predominates, in the latter the rectangular. Thus the older part of Boston, whose streets are said to have been laid out by the cows, offers an almost perfect example of radial arrangement. It is unjust to the cows to imagine that these streets have no plan; they have one, but it is not the one to which we are most accustomed. In Chicago, on the other hand, the only trace of radial arrangement is found in a few streets and avenues that cut diagonally through the otherwise rectangular plan. These avenues seem to mark the site of country roads that existed before the city, as it now is, was laid out. European cities show in nearly all cases a decidedly radial plan of streets. In some it is obscured by various causes, as, for example, a hilly site, a river traversing the city in an irregular manner, the existence of several centers instead of one. But even in those cases where a first glance seems to show only confusion, closer scrutiny reveals a marked con-

vergence toward one or more central points. Among great capitals Paris and Vienna offer in their general plans excellent illustrations of radial arrangement.

A like difference in plan can usually be seen where old cities have been enlarged by the building of modern suburbs. The newer quarters can almost always be distinguished from the old merely by looking at the map and noting where an irregular branched arrangement prevails and where, on the other hand, there are square corners and regular blocks. Newly built suburbs of European cities are usually as rectangular as Chicago.

The cause for this variety in arrangement, this difference between old cities and new as to the degree in which the geometrical requirements of transportation are met, is not far to seek. Where growth is gradual and arrangement unpremeditated, where paths gradually become roads and roads after a long course of time develop into city streets, where, in other words, the city is laid out without regard to the requirements of building and convenient allotment, the natural arrangement prevails. On the other hand, when the arrangement is planned beforehand the rectangular arrangement is chosen as the more convenient. The city of Washington offers an excellent example of the deliberate and scientific reconciliation of the two ideas. To a plan generally rectangular is added a system of diagonal avenues having their principal point of convergence at the national Capitol.[1]

The most general and permanent classification of the mechanism of transportation is that of way, ve-

[1] It is not unlikely that the convenience with which radial streets may be swept by cannon planted at their center was considered in the planning of Washington. But not all of the diagonal streets lead to the Capitol.

hicle, and motive force. These elements are very generally present in all transportation, though strictly speaking the last is the only one absolutely essential. Movement cannot be conceived as taking place without the application of force. But if we mean by way a specialized path over which the resistance to movement is artificially diminished, it is clear that it is not an indispensable element in transportation. Maritime commerce, for example, can hardly be said to make use of a way in this sense, except as it uses artificial channels and harbors. So with the movement of caravans across the desert. On the other hand, the way may take such a form as entirely to absorb the vehicle and leave the latter no separate existence. Thus an aqueduct, or a pipe-line for the conveyance of oil, requires no distinct vehicle whatever.

The Way grows out of the necessary relation of transportation to the surface of the earth, and by the varying nature of that surface its character at any particular time and the course of its development are very largely determined. From this underlying relation comes the close connection between the study of transportation and that of physical geography. One cannot hope to understand transportation without at the same time understanding the geographical facts that condition it. And as these geographical facts are permanent, relatively at least to the social facts which the study of transportation must also embrace, a theory of their influence forms the groundwork of the theory of transportation.

This geographical relation suggests a third general test of the efficiency of transportation in addition to the tests of speed and economy already mentioned. This is the degree of independence of natural fea-

tures attained in the location of the way. The matter is one not only of quicker and more economical movement, but of making speed and economy available in new places. A great part of the mechanical progress of transportation is in extending it to portions of the earth's surface before comparatively inaccessible.

Vehicle and Motive Force may be looked upon as the instruments by which force, drawn from one or other of those primary sources to which man has access, is organized and made to serve the uses of transportation. In the earlier development of conveyance the force employed is that supplied by nature in some immediate and obvious form—man's own physical strength, the strength of beasts of burden, the force of tides, currents and winds. Progress, from this point of view, consists chiefly in the employment of greater forces and in utilizing them more economically. Especially does progress consist in the economy of the forces of man himself and in an increasing use of other agents. On this side the study of transportation is closely connected with that of technical development in general.

The immediate object of transportation with reference to the physical features of the earth's surface is, then, to overcome natural obstacles by making use of natural forces. These obstacles and forces, as its deepest-seated and most permanent conditions, form a basis for the various kinds of conveyance actually met with in history. The division into land and water movement, and the classification of obstacles by land and water are fundamental to the study of the subject, while the investigation of the various forces that have been utilized and the manner of their utili-

zation in overcoming obstacles, is equivalent to studying the mechanical development of transportation.

In the three chapters following I propose to offer the outline of a theory of this mechanical development.

CHAPTER II.

THE RELATION OF LAND TRANSPORTATION TO PHYSICAL CONDITIONS.

In speaking of the obstacles to movement, we have to remember that the question whether any particular feature is an obstacle or not is purely a relative one. In going down hill, a level place in the road is an obstacle ; so is a stretch of still water to a boat floating with the current. An obstacle is simply something that offers more resistance to movement than other parts of the surface that are compared with it. In this sense the chief obstacles to movement by land are the following:

Mountains, mountain ranges, hills, and all inequalities of the surface. Generally speaking, the higher, the steeper, the sharper at their summits, and the more extensive and continuous these mountains, hills and inequalities are, the more formidable obstacles they make.

Forests, thickets, and other vegetable growth large enough to hinder movement.

Marshes, bogs, mud, or other softening of the surface by water, whether permanent or existing only at

seasons of rain or inundation: also, sandy or other yielding surfaces not caused by water.

Rivers, streams, lakes, estuaries, etc.

Unfavorable climate, extreme heat or cold, dangerous storms, lack of water, of pasturage, or of other supplies.

Looking at the same facts from another point of view, we may class many natural features as facilities for transportation. They rank as such, of course, relatively to the obstacles enumerated. Thus:

A dry surface and climate—provided the dryness of the surface does not go so far as to make a sandy desert, nor the dryness of the climate become so great as to cut off supplies of food and water. A dry climate is favorable to transportation in its early development, not only because of freedom from mud and marshes, but also—and still more—for the following indirect results: It diminishes the number and size of streams; it hinders the formation of gullies and other lesser and sharper inequalities of the surface due to the action of the water; it renders impossible the growth of large vegetation.

Steppes and other treeless regions, however caused, and whether level or not.

In northern regions the formation of ice and snow facilitates movement.

These natural obstacles and these natural facilities are the basis of the development of roads in respect both to construction and to location and direction.

Herbert Spencer, in his "Descriptive Sociology," presents, among a great number of important and well arranged facts, some interesting details respecting road-making among savage and barbarous peoples.[1] We see here that, even under the

[1] No. 5, p. 49; no. 4, p. 39; no. 6, p. 46.

most primitive conditions, the existence of streams, bogs, mountains and thickets leads to the devising and construction of artificial ways. We have modern appliances represented by their prototypes. Of bridges, the two chief types—the girder and the suspended bridge—are represented, the former by the single log felled across the stream, the latter by a great variety of swinging devices constructed of bamboos, creeping plants, etc. Some of these latter are of surprising length. So, in northern India, and doubtless elsewhere, bridges are built on the balanced or cantilever principle.[1] Swamps are passed at first by paths made of branches strewn upon the surface, or by logs laid either end to end or crosswise; later, or perhaps in more open or stony regions, rude stone causeways are employed; openings are cut through the jungle, and the convenience of zigzag paths in surmounting steep mountain sides is well understood.

In the location of ways we see the same intimate dependence upon natural conditions. Mountain passes, for example, must always be important elements in land transportation. There are certain passes in Central Asia[2] which have always exercised a controlling influence in that quarter, from the remote period when the Asiatic land trade was the most important commerce in the world down to the present time. So, to take a recent instance, the Allegheny range did much to determine the course of railway development in the United States, particularly in delaying the building of lines west of that range and in causing the earliest route to

[1] Powell, "Punjab Manufactures," 333.

[2] As that leading from Bokhara eastward into the Gobi region.

take a northerly and comparatively indirect route westward. And roads of all kinds, in all periods, have shown a marked tendency to follow the valleys of rivers and streams, as offering the best natural pathway among the inequalities of the surface.

We may find in natural conditions a reason for the early and splendid development of land commerce in Asia. If one considers the obstacles and facilities above enumerated, he must perceive that a dry climate and a treeless surface, not entirely destitute of pasturage and water, are conditions peculiarly favorable. These conditions exist in a remarkable degree over a great part of western Asia. The whole region, excepting a few fertile river valleys, is arid, and, therefore, treeless. Yet it is by no means uninhabitable. Though there are vast areas of absolute desert, there are areas still vaster that afford sufficient water and pasturage to supply the small needs of the camel, or even to support horses and oxen. These steppes, then, or arid pasture land, and the borders of the desert, were the highways of a primitive commerce, employed for this purpose earlier, apparently, than the sea, and certainly exhibiting a development of land conveyance greater than any that existed elsewhere until recent times.[1] The natural aptitude of the surface for transportation appears to be one of the reasons why this region of the globe was the seat of the earliest civilizations.

[1] Heeren's well-known work, "Researches into the Politics, Intercourse and Trade of Ancient Nations," is still, I believe, the most complete and satisfactory treatment of ancient commerce and transportation. It is certainly the most interesting that I have been able to find. He holds [Introduction] that the Asiatic land trade remained the most important commerce in the world down to the discovery of America. References are to the translation published at Oxford in 1833.

It is not proposed to trace the technical history of roads from these beginnings, or to show in detail the manner in which their location and construction have been determined by natural conditions. This important and little-explored field of study is much too wide for this essay; what I shall offer in this connection will be based rather upon an analysis of motive forces.

If we look at land transportation from the point of view of the natural forces utilized in overcoming natural obstacles we may perceive certain steps in development succeeding one another in a natural order that would probably be found to correspond to the historical order did history go back far enough to reveal the latter. The first force employed is the physical strength of man himself, the second is the physical strength of the beasts that he subjects to his service. This is first utilized directly by placing burdens on the back, and later, indirectly, by means of wheeled or sliding vehicles. And finally we have the use of the chemical forces stored up in coal and changed over into mechanical power through the mediation of steam, electricity, etc. The successive use of these various forces indicates in a general way the mechanical progress of transportation.

An instance of the general use of human strength for the purposes of land transportation is that afforded by the American continent at the time of its discovery by Europeans. The natives were for the most part quite ignorant of the use of beasts of burden; indeed, the fauna of the continent was almost without species suitable for such a use. The Peruvians alone, it appears, possessed a burden-bearing animal—the llama, a sort of dwarf camel, hardly larger than a sheep.

The best example of a high development in this sort of transportation is that of ancient Mexico.[1] Mexico was an empire not only populous, powerful and of wide extent, but distinctly commercial in character, much more so, certainly, than Peru. This fact is the more notable as it is not to be explained by the existence of any great amount of transportation by water. There was, indeed, a very active movement of small craft on the lake of Mexico and about the canals of the important cities built upon its shore. Fuel and building materials for the use of the capital were brought in this way, as well as most of its food supply. But there was also an extensive land commerce, the most extensive, probably, that has ever been carried on without the use of beasts of burden or the more modern appliances that have partly superseded them. The most primitive form of land transportation is here seen in its highest historical development. The Mexican merchants traveled about the country with large numbers of porters who formed a separate class or guild and served as soldiers when occasion demanded that the interests of trade be advanced by force. Their load was fifty or sixty pounds and they traveled about fifteen miles a day. As all readers of Prescott will remember, the lagoons and low ground about the city of Mexico were crossed by long causeways. These appear to have been the beginning of substantial foot roads that connected the various provinces of the empire with the capital. These main roads were repaired yearly and were provided with many wooden bridges and some stone ones.

[1]See the extracts from various writers collected in "Descriptive Sociology," no. 2, pp. 54, 60, etc.

The lesser roads were probably mere paths with few bridges. The greatest attainment in the matter of speed was that of the imperial post, which is thus described by Clavigero:[1] "* * * there were upon all the highways of the kingdom certain little towers about six miles distant from each other, where carriers were always waiting in readiness to set out with despatches. As soon as the first courier was sent off he ran as swiftly as he could to the first stage or little tower, where he communicated to another his intelligence, and delivered to him the paintings which represented the news * * * The second courier posted without delay to the next stage or little tower, and thus by a continuous and uninterrupted speed of conveyance, intelligence was carried so rapidly from place to place, that sometimes, according to the affirmations made by several writers, it reached the distance of three hundred miles in one day." Commodities as well as news were sometimes carried in this way, as fresh fish, brought from the gulf of Mexico for the emperor's table.

There was a similar but even more elaborate postal system in Peru;[2] indeed there are also examples of a foot post of this general type in the early history of the nations of the eastern hemisphere.[3]

The point chiefly to be noted here is that the lack of natural species suitable to burden-bearing was an unfavorable condition of the greatest moment in the development of transportation among the primitive races of what we call the new world. No one can

[1] "History," bk. vii, chap. 12.

[2] "Descriptive Sociology," no. 2, p. 54.

[3] Marco Polo's "Travels," Yule's ed. i, 421-424; Kaempfer's "History of Japan," bk. v, chap. 4.

say whether their history might not have been quite different had nature supplied them with servants as well suited to the western country as the camel or the horse was to the eastern.

A second chapter in the mechanical development of land transportation opens with the subjugation and use of the beasts of burden. It describes a state intermediate between that just spoken of and the one that comes in with the general use of wheeled vehicles. The use of pack animals means, generally speaking, a great advance in transportation as measured by efficiency in the matters of speed, economy of force or cheapness, and mastery of natural obstacles. Their possession is a favoring circumstance which, though not of itself sufficient to raise a people from savagery, is yet an incalculable advantage in the development of transportation and of the other forms of social progress dependent upon it. The fact that the Mexicans did so well without this advantage, and even arrived at a considerable land commerce, is a phenomenon as unique as it is interesting.

The natural forces that are now exploited are those of certain beasts of burden—the camel, the horse, the ass, the ox, the elephant, the reindeer, etc.—animals which were the servants of man in the eastern hemisphere for untold ages before the opening of history. They represent a natural or biological specialization of energy with particular reference to the overcoming of natural obstacles to movement. Thus the camel, which occupies the most conspicuous and honorable position of all in the primitive development of land transportation, has peculiar adaptations to that part of the earth's surface where trade first

arose. He is supposed to have been a native of the deserts of southwestern Asia, where he doubtless acquired these adaptations by the unremitting operation of the principle of the survival of the fittest. He has, for example, certain pouches in his stomach in which a reserve supply of water is stored, one or more fatty humps on his back which serve in some measure as a reservoir of food, a broad, elastic pad on the foot to prevent his sinking in the sand, and nostrils that he can close at will against the sandstorm. He is also a frugal animal, supporting himself at need on the dry vegetation of the desert. By virtue of these various special capacities he serves as a means of conveyance across long reaches of absolute desert, and can readily go three days at a time under burden without water, maintaining his ordinary speed of twenty-five miles a day.

The importance of the camel, regarded as a motive force for transportation, was great indeed during the rise of the earliest civilizations. He and he alone made his native plains and deserts the highway of international commerce, and their borders the earliest seat of commercial civilization. It is obvious, without going into the subject in detail, that the other animals mentioned have also forces adapted in a peculiar manner to the surmounting of natural obstacles. The camel may serve as example, since during the period when the sort of transportation under discussion was more important than any other he was the chief means by which it was carried on.

Following the division already suggested we may say that the use of wheeled vehicles as a means of economizing the strength of domestic animals, changing them from beasts of burden to beasts of

draft, marks another period in the mechanical development of transportation. This change took place on the longer and more important routes only in modern times, and in many cases was never accomplished; carriage upon pack-saddles either continuing down to the present time, as on many important lines of trade in Asia, or ceasing only upon the construction of railways. The reason for this tardiness is not to be found in the backwardness of invention or mechanical skill, as might be supposed. The ancient Egyptians were excellent wheelwrights and constructed war chariots with such skill and nicety that although strong enough for the purposes of war they were so light as easily to be carried by a single man.[1] The difficulty lay rather in the construction of roads, in the great labor required to build over mountain ranges and other natural impediments a track wide and level enough for the convenient use of wheeled vehicles. Given a suitable road and the wheeled vehicle effects a great economy of energy; without such a road it is worse than useless. For this reason, apparently, carts and wagons came into use for local conveyance in level countries long before they were employed for those longer movements which must in most cases traverse mountain ranges and other formidable obstacles. Egypt, India, China, have known the use of carts from great antiquity;[2] while the ancient Scythians or Tartars pitched their tents upon ponderous wagons, one of which sometimes required over twenty oxen to draw it.[3] But the use of the pack-saddle was universal

[1] Wilkinson's "Manners and Customs of the Ancient Egyptians," Birch's ed. i, p. 227 *et seq.*

[2] Compare Wilkinson's "Ancient Egyptians," i, 249.

[3] Herodotus, bk. iv, chap. 46, Rawlinson's ed.; Marco Polo's "Travels," Yule's ed., i. 245 *et seq.*

upon the longer routes of land transportation from the earliest times down to a period, beginning in the seventeenth century and continuing into the nineteenth, during which the nations of western Europe developed a system of good roads. This building of good roads made possible the rapid improvement in vehicles and the rest of the technique of transportation which accompanied and followed it.

The fourth or modern period need not to be dwelt upon at length in this connection. Its fundamental characteristic is the employment of a new natural force, the chemical energy stored up by the sun in coal. The situation of coal mines now enters among the important natural factors in the development of transportation. Mountain ranges and rivers have not lost their significance as natural obstacles, but that significance is greatly diminished. Speed, economy and independence of the irregularities of the earth's surface have within a brief period made such progress as to cause all previous attainment to appear insignificant. Those natural obstacles and forces that once dominated all movement by land are now of secondary importance.

CHAPTER III.

WATER CARRIAGE AS RELATED TO PHYSICAL CONDITIONS.

Although the water presents none of those permanent inequalities of surface that are such important elements in all movement by land, it yet offers a natural diversity which results in obstacles and

facilities of another sort. Among conditions which may seriously impede movement by water are the following:

Currents, whether caused by the regular flow of rivers, by tides, or by the movements of the deep sea; winds, waves, rocks, shallows, isthmuses, islands, etc.; the lack of food, water and other supplies at sea, and the difficulty of guidance.

There is a distinction between these obstacles and those by land in the fact that while the latter remain obstacles at all stages of development, although their importance may greatly diminish, the former are in great part natural forces—winds and currents—which may be converted into facilities under favorable circumstances. Rocks, shallows and other projections of the land into the water always, however, remain serious hindrances to water movement, except in so far as they may help to form harbors. The dredging of rivers and harbor channels, the cutting of canals across isthmuses and the like, the placing of beacons, light-houses and buoys to mark the site of rocks, have always made an important part of the technique of water transportation. So waves, considered apart from the winds that cause them, are a distinctly unfavorable condition, while the fact that the sea cannot be depended on for food, drinking water, or fuel, now as always imposes conditions and limitations upon conveyance by water. Winds and currents, on the other hand, serve as motive forces as well as obstacles, and the technical progress of water transportation is indicated in some measure by the skill with which they are utilized.

In marking off steps in the development of water transportation the following is a convenient division: First, the period of river transportation; second, that of the navigation of coasts; third, of the open sea by sailing vessels; fourth, the modern period of steam propulsion. These correspond in a general way to a different utilization of natural forces. Thus while navigation was confined to rivers, men made use chiefly of currents, river or tidal, and of their own strength put forth by means of paddles and the like, though the use of sails was not unknown.[1] When they ventured out along the sea-coast and traversed pretty freely such enclosed waters as the Mediterranean sea, sailing became very important, but the skill attained was not such as to enable the navigator to sail to windward and thus turn the wind against itself. Oars retained their importance, and sails were set only when the wind was in a favorable direction. But with voyaging on the high seas came the development of scientific navigation and the abandonment of human strength as a direct means of propulsion. And in the latest stage we have the utilization of the energy confined in coal.

As an open, pastoral country offers the most favorable natural conditions for primitive land conveyance, so a river whose current is not too swift nor broken by many rapids or waterfalls favors the beginnings of water transportation. Such early movements of trade as were not in pastoral countries appear to have been determined by the course of rivers. Thus Egypt and Babylonia were

[1]For primitive boats see the various volumes of "Descriptive Sociology" under "implements."

on great rivers; so were the civilizations of India, while the magnificent rivers of China probably presented until the present century the spectacle of the greatest river traffic in the world. It would be vain, I think, to look for an early example of any considerable progress in civilization in an inland, forest-bearing region off the course of large rivers. Such regions, which occupy a great part of the earth's surface, must await the development of modern means of land movement.

Rafts and similar appliances for floating loads downward with the current were without doubt the first vehicles of water transportation. Where currents are very swift or where, as in the case of lumber, floating is peculiarly convenient, this sort of transportation long remains important. The building of canoes—dug out from logs by fire or tools, or formed of bark or skins stretched over a frame—is a great advance and implies the ability to make way against the current. To these succeed larger river boats such as have been in use for thousands of years on the Nile, the Ganges, and the Chinese rivers.[1]

At the points where rivers join the sea there are conditions which encourage in an especial manner the progress of water conveyance. In the estuaries and often for a long distance up the river there are commonly currents each way caused by the tides. Thus commodities may be moved both ways by the current alone. The mouths of rivers also offer the natural starting points whence river trade gradually spreads out and becomes coasting trade. These estuaries form a natural school for instruction in

[1]See Wilkinson's "Manners and Customs of the Ancient Egyptians," ii, 205 *et seq.*; Gray's "China," ii, chap. xxix.

maritime arts and maritime enterprise, a school whence men are graduated to the navigation of larger waters.

It is clear that the existence of a great inland sea such as the Mediterranean, with many islands and harbors and not particularly stormy, offers natural conditions excellently adapted to the early growth of water transportation. As a matter of fact this sea was the principal scene of the movements of vessels from the earliest times to the discovery of America.

Another favorable natural condition, and one that had great influence upon early trade, is the existence of periodical winds, especially those winds that blow one way at one season and the opposite way at another. The monsoons, which have this peculiarity, offer advantages much like those of tidal currents near the mouths of rivers. If, as seems almost certain, the earliest ships that ever braved the ocean were those that traded along the Asiatic coast from the mouth of the Indus to the ports of the Persian gulf,[1] one reason for this priority is to be found in the monsoons that blow along that coast.

That mastery over natural conditions implied in the free navigation of the open sea required larger and better built vessels both to resist the fiercer storms of the ocean and to carry ampler supplies of food and water; but the more difficult requirements were, first, to find some force that should enable vessels to make way against adverse winds on a course where there were no harbors, and, second, some means

[1]Heeren's "Researches," Introduction, xciii *et seq.;* Duncker, "History of Antiquity," iv, 15; Yeats, "Growth and Vicissitudes of Commerce," 18.

of guidance across the trackless water when the stars were obscured. The introduction of the compass and the improvement of the art of sailing seem the two indispensable technical conditions to the rise of maritime as distinguished from inland and coasting transportation.

The final period in the progress of water transportation sees the casting aside of winds and currents as the chief means of propulsion and the introduction of an entirely new force that renders movement by water, both in direction and in its times and seasons, nearly independent of natural obstacles. Winds, waves and currents are overcome, or, if favorable, accepted as minor aids.

CHAPTER IV.

GENERAL OBSERVATIONS ON THE RELATION OF TRANSPORTATION TO NATURAL CONDITIONS.

Throughout this struggle of the agents of transportation to overcome natural obstacles and make the best use of natural forces, the general result has been a continuous if not steady advance in the fundamental mechanical requirements—speed, economy and independence of natural obstacles. Fully to develop the ideas above suggested would be to write the technical history of transportation. Every change in the construction of the way, from the primitive track through the jungle to the most elaborate of

modern systems of railway construction, has its definite relation to physical conditions and arises out of the interaction between these conditions and the need for various sorts of transportation. So with the different motive forces and all the technique of their use, from the direct application of human strength, which characterizes the beginnings both of land and water transport, to the steam engine which unites them again in their latest attainment; and so with all that relates to vehicles.

A fact characteristic of all this development is that progress in one sort of transportation depends in some measure upon that in others; that there is a general interdependence. The construction of wheels, as we have seen, was well known in antiquity, but they did not come into general use for land transportation until modern times, and then only in certain countries; the use of wheels had to await better roads. So in railways, the roads are fitted to the vehicle, the vehicle to the roads, and both to the motive power. No one of these can develop independently. Different kinds of land transportation depend upon one another; the traffic of city streets and country roads could not be maintained without railroads, nor railroads without it. In a less but very marked degree, land and water transport are mutually dependent. Steamship conveyance would probably have amounted to little without the contemporary development of railroads, and railroad conveyance certainly could not be what it is without steamships.

Another fact, familiar in experience and characteristic of the whole progress of transportation, is that the newer and better method does not entirely supplant the old, but relegates it to a certain limited

field. Speaking somewhat broadly, all the varieties of transportation that ever flourished may still be found at the present day. Human strength, both on land and water, still serves very important purposes of conveyance; porters, row-boats, canoes and the like are not, and probably never will be, dispensed with. So with sailing, in all stages of its development, from the single square sail of woven rushes to the full-rigged ship. Carriage on the backs of beasts of burden is still much in use, and transportation on common roads in wagons and the like is as important in its way as that of railroads. The case is analogous to the familiar fact of biology that numerous stages and types of development, from the one-celled animal or plant up to the highest forms, are represented by surviving species.

Among the permanent differences between the functions of land and water carriage, an important one is that which arises from the fact that men, speaking generally, do not live upon the water; it can support no permanent population upon its surface. Water transportation is therefore always a means of connecting land with land. There is on the water none of that peculiar radial development of local transportation that is so marked upon land. Moreover, since as a rule no permanent roads can be made upon the water, there can be no marked tendency to take indirect routes simply because they have already been used. Another difference that remains constant throughout the history of transportation is that movement by water is, from a purely mechanical point of view, always the more economical of the two. That is to say, leaving aside the questions of speed or convenience, the movement of a given

weight or bulk for a given distance has always required less force by water than by land. In other words, whenever there has been a choice between the two, water transportation has been, as it still is, the cheaper. The land offers far greater resistance to movement. Its rough and refractory surface must be subdued at great expense. If at any period land movement has had precedence it must have been because it was swifter, or because waterways were not at hand, or for some other advantage that prevailed over its greater expense of force.

The question whether land or water transport was the more important at various epochs is difficult or impossible to answer, not only because the facts are somewhat obscure, but still more because there is no simple test of relative importance. Thus land transportation might be the swifter and carry the greater value of goods while water movement was cheaper and carried the greater bulk. Moreover the real, that is, the social efficiency of transportation, as distinguished from the mechanical, is relative to social conditions and not easily subject to measurement.

The weight of facts seems to show that river transportation and land carriage upon camels and other beasts were the earliest means of international trade, and that maritime commerce, even along the coasts, did not arise until a much later period. For the belief that caravan commerce arose before the coasting trade the chief grounds of probability are the relatively advanced condition of the arts implied in shipbuilding, the very favorable conditions offered for the development of international communication by the migratory life of pastoral nations, and other

considerations of a similar character.[1] History does not answer the question, since its very dawn saw the areas separating the civilizations then existing, whether waters or arid plains, traversed by the vehicles of transportation—the gulfs, seas and rivers by vessels, the deserts and steppes by caravans of freighted camels.

The caravan movement of the east continued to rival in importance the movement by water until the discovery of America; and if we regard the value of the commodities carried it was up to this time the more important of the two. The discovery of America and of the passage to India around the Cape made maritime transportation the chief agent of international communication. From this time down to the present century trade by sea remained very much in the ascendant and land movement was quite subordinate. Readers of Macaulay[2] or of Smiles[3] will remember how pitiful was the condition of inland ways in England even in the eighteenth century. The most striking feature of the present development of transportation, as regards a comparison between land and water, is the surprising relative increase of the land movement.

Canals, which have not been specially mentioned, may be regarded as a branch either of land or water transport as is found most convenient. Their greatest historical importance was during the period just previous to the rise of railways. As a step in the overcoming of natural obstacles they serve to extend

[1] Heeren's "Researches," Introduction. Professor Robertson Smith is perhaps the latest and best authority on all that relates to the pastoral nations of the east.

[2] "History of England," i, chap. iii.

[3] "Lives of the Engineers," part iii.

inland the cheapness of water movement, or they shorten old water routes and create new ones by cutting through isthmuses or making a passage for vessels around rapids and through shallows.

CHAPTER V.

TRANSPORTATION AND ORGANIZED SOCIETY, —GENERAL.

The character of transportation as a whole and in detail, at any particular time and throughout its history, is altogether determined by its inter-relations with physical and social forces and conditions. To understand transportation means simply to analyze these inter-relations. So far, attention has been fixed as much as possible on the simpler and more obvious conditions, the physical. We now approach the more complex question of the social relations of transportation.

The need for the movement of things and persons underlies every sort of social organization, every institution whatever. It is equally necessary to that economic organization which supplies society with food and other material goods, and to those psychical organizations, the church, education, research and the like, which, though ideal in their aims, require material instruments. The transfer of books, of scientific instruments and, above all, of men charged with multifarious social functions, is as necessary to society in its way as the transfer of grosser material

substances. There can be no adequate theory of transportation which has regard only to some one aspect of its social function, as the economic aspect. That is not the only aspect, nor can one truly say that it is more important than the others. All are co-ordinate, equally indispensable to social progress.

Precisely because transportation underlies social development it is in turn determined by that development. It is a tool of the economic, the political, the military organizations, and the character of the tool varies with their needs. The most permanent conditions of its progress are the natural obstacles it has to overcome and the natural forces it employs; but even these in their practical bearings are relative to social development. The art of scientific sailing converts a contrary wind from an obstacle into an assisting force. When men discover how to utilize coal through steam and the steam-engine, it is as if there were a new and ample creation of natural power. The natural forces were always there, but they exist for man only as they are discovered and used by art. The mechanical arts, again, do not advance in an accidental manner, but are intimately associated with economic and political conditions as well as with the progress of physical science. We have the railroad not only because of the ingenuity of men like Stephenson, but because the great economic need of the time was back of that ingenuity urging it on. The chief characteristic of the economic revolution begun in the latter part of the previous century, was industrial concentration and specialization. These could not go far without better means of land movement, and the canals first and then the railroads supplied that means. The railroad is insep-

arably bound up with the other changes of the time, in part their cause, in part their effect.

What, in general, is the social function of transportation?

Sociologically considered it is a means to the physical organization of society. Development or evolution, the organization of social forces, implies unification of aim, specialization of activities in view of a common purpose, a growing interdependence among the parts of society. Such organization, such extension of relations, involves a mechanism through which the relations can exist and make themselves felt. This mechanism is Communication in the widest sense of that word; communication of ideas and of physical commodities, between one time and another and one place and another. These are the threads that hold society together; upon them all unity depends. And transportation, the means of material communication between one place and another, is one of the strongest and most conspicuous of these threads.

Following this conception we may analyze communication or the mechanism of social organization as follows:

The mechanism of material communication:
- Place communication—transportation.
- Time communication—storage and the like.

The mechanism of psychical communication:
- Place communication—gesture, speech, writing, printing, telegraphs, mails, etc.
- Time communication—writing and printing regarded as means for recording and preserving thought for considerable periods of time; custom, imitation and heredity as conservative agents.

However imperfect this analysis may be it shows sufficiently well what is here held to be the part played by transportation in the social mechanism as a whole. It is a universal organizing machinery, variously specialized to suit various sorts of organization. I shall attempt to throw some light on these more special relations in the succeeding chapters.

It follows from the intricacy of these relations, from the fact that transportation is but one pigment of the social picture, that the test of its efficiency is a variable one. The only perfectly general criterion is that it is efficient in proportion as it furthers the actual type of social development. This criterion continually means more and more as progress goes on and conditions become more complex. At bottom are the mechanical tests stated in the first chapter—that transportation is efficient in proportion as it has speed, cheapness or economy of force, and independence of natural obstacles. Taking the social point of view, security becomes a very important and ever present requirement,—security to the persons and things transported from all loss or injury whatever. The means, very highly developed, for meeting this requirement are seen in all those complicated modern arrangements that aim not only at safety but at obviating all the smallest inconveniences of travel and of the movement of goods. To these general tests each variety and stage of social progress adds appropriate details. A system of military conveyance must be carefully adjusted to actual and possible military conditions. In societies chiefly industrial, where the principles of freedom and equality have gained recognition, it becomes a fundamental requirement of

transportation that it do justice among individuals—the requirement underlying the present railroad problem.

In order, therefore, to develop a theory of transportation that shall be at all adequate, one must examine severally its relations to various social institutions. For this purpose I shall for convenience classify those institutions as military, political, economic and ideal, including among the last all forms of organization having primarily religious, ethical, intellectual or artistic purposes. It is a sufficient defence of this classification that it corresponds well with the concrete facts of history. These classes of institutions are those which are in fact most obvious in the study of the past. As soon as institutions begin to differentiate at all they differentiate in this way. Other classifications may very probably be found preferable for other inquiries. The study of society has many aspects, and each aspect may call for a new classification of social facts.

In discussing the relation of the means of conveyance to any particular phase of society the inquiry may be looked upon as two-fold: first as to arrangements of a certain character found in transportation itself, and second as to the relation of transportation to institutions of this character in society at large. The several sorts of activity characterized as military, political, economic and ideal, work themselves out not only through great specialized organizations like the army, the state, economic exchange, science and art, but also in a greater or less degree through subordinate arrangements existing in all social institutions, among others in the institutions of transportation. It is obvious, for example, that a highly de-

veloped agent of transportation, like a railroad system, requires an internal political organization of much complexity and importance. And it is quite the same with other kinds of activity.

CHAPTER VI.

TRANSPORTATION AND MILITARY ORGANIZATION.

From the fact that during the earlier development of society the prevailing state of things is a state of war we have the corresponding fact that the means of transportation have a marked military character. Where the ways of trade lead among hostile tribes, or across seas infested with pirates, the carrying on of commerce by individuals acting independently and protected in their operations by law and public sentiment is of course out of the question. In order to break through the barriers of hostility and distrust separating primitive nations, trade and transportation must concentrate, organize, and avail themselves of every expedient and ally. Accordingly we have the general fact of concentration and military organization. Instead of each merchant setting out whenever he finds it most convenient, movement takes place at infrequent intervals and in correspondingly large numbers. The merchants of ancient Mexico made their longer expeditions in large companies, and their armies of porters often attacked hostile tribes and even took towns.[1] So the caravans

[1] Prescott's "Conquest of Mexico," i, 147, 148.

of the eastern land trade had and still have a military character. Pitched battles with robber tribes are common, and the latter not infrequently carry off the freight and sell the merchants into slavery. So it was with emigration to the west in the early history of the United States. Commerce by sea has had a similar character until quite recent times. Trading vessels commonly went in fleets, often accompanied by a special convoy of war vessels. And even at present express messengers and stage drivers go armed and merchant vessels usually carry a gun or two. In general, however, the military side of commercial transportation, once a very conspicuous one, has decayed until it is relatively insignificant.

Beside the fact that a state of general militancy obliges economic transportation to take on a military character we have the still more important fact that military organization on any great scale itself requires transportation of a type quite distinct from the economic.

It is a question whether military needs have not, the world over, given the first powerful stimulus to the development of communication. The earliest societies to attain wide dominion and comparative permanence of power were military monarchies. So with the ancient monarchies of the east; so with Mexico and Peru on our own continent. Unity was maintained by coercion, and coercion over a wide range of country required rapid movement of armies and supplies by land and sea. And what took place here on a great scale doubtless took place on a smaller scale elsewhere. Institutions in general were based on militancy, and military movement was better organized than any other kind.

As every one knows, the Romans had a system of artificial roads, whose construction was one of the most signal achievements of that people. These roads, which extended over the length and breadth of their empire from Britain to the far east, the more important of them built in the most solid manner and paved with stone, were distinctly military in character. They were intended primarily for the passage of armies and supplies for armies, and were located and constructed accordingly. Whatever trade took place over them was secondary, and they never would have been built for trade. Their fundamental difference from modern works of this kind appears from the fact that they were not constructed for wheeled vehicles, though some use was made of such for the carriage of persons and light commodities. The carriage of military supplies was upon the backs of beasts of burden. This stupendous system of transportation was of a type altogether non-industrial.

It would seem, from the accounts relating to ancient Peru, that the roads of that country were comparable to those of Rome for expense and solidity.[1] These also were of a character exclusively military. They were meant for the quick passage of the armies by the force of which this highly centralized empire was held together; not for trade, which appears to have been insignificant, certainly not for wheeled vehicles, since the Peruvians made use of none. It will be found that the principle, of which these are conspicuous instances, prevailed quite generally.

[1] "Descriptive Sociology," no. 2, p. 61; Humboldt, "Views of Nature," Bohn's ed., 393 *et seq.;* Prescott's "Conquest of Peru," i, 63 *et seq.*

Early road-building on any large and expensive scale was usually for a military purpose.

Nor was it otherwise with regard to vehicles. War chariots have been in use from the earliest times. We find them in Homer and pictured among the records of the Egyptians and Assyrians. In Wilkinson's volumes on Egypt[1] may be seen representations of ancient inscriptions illustrating in detail the making of these vehicles and showing that great skill had been attained. This, like all trades relating to war, was clearly a subject of careful study from a very great antiquity. On the other hand, wheeled vehicles were either not in use for carrying commodities at all, or such as were used were of the rudest construction. The Romans employed heavy carts,[2] rarely wagons, the wheels of which were rudely formed of two or three planks fastened together by cross-pieces and cut into a circular form. These clumsy, solid-wheeled vehicles are still in use in many eastern countries, and were until recently common throughout southern Europe.[3] It seems probable that the commodious vehicles of modern land transportation trace their descent rather to the war chariots of Britain and Gaul than to any other source.[4] Thucydides[5] seems to hold that the first use of ships was as a means of plundering towns near the shore. Whether this view can be sustained or not, there can be no doubt that military enterprise

[1] "Manners and Customs of the Ancient Egyptians," i, 227 *et seq.*

[2] Smith's "Dictionary of Antiquities," art. "*Plaustrum.*"

[3] Many books of travel mention them; see especially Smyth's "Sardinia," 92 *et seq.*

[4] See Smith's "Dictionary of Antiquities," arts. "*Reda,*" "*Cisium,*" "*Essedum.*"

[5] "History," i, 4 *et seq.*

was a powerful spur to early navigation, and has always had important reactions upon its direction, the construction of vessels and other particulars of maritime and river transportation. So military harbors and military canals were not improbably the earliest constructions of that character.

The swift transfer of armies and supplies to possible seats of war and the rapid communication of information and commands are the chief requirements of military transportation. Swiftness and security from interruption by the seasons are much more important than economy or capacity to carry any great bulk of commodities. Military roads in early history are commonly distinguished by a solid and expensive style of construction and by a directness that takes very little account of minor natural obstacles. That this last was the case with the Roman roads has often been remarked. They proceeded for the most part in a right line over hills and other obstructions that might have been avoided by a little deviation. This peculiarity is probably to be explained partly by the greater importance given to speed than to economy of labor in the minds of the projectors of the road, and partly by the fact that military roads are usually constructed by a despotic central power situated far from the spot where the work is done. Enterprises carried on at arm's length in this way by a power having no detailed knowledge of or interest in local circumstances must always tend to take on a certain arbitrary uniformity. Plans are drawn at the center of administration based on a general knowledge of localities, and carried out to the letter by subordinates who have no authority to deviate from them.

Another reason not altogether fanciful may be found in a certain conscious magnificence and pride of power characteristic of military ascendancy in its prime. The acqueducts, the most imposing monuments of Roman grandeur, afford another example of the great style of that people.

Military transportation of all sorts shows the tendency to carry the development of speed beyond that of economy or burden-bearing capacity. War ships have been generally distinguished from merchant vessels by a lighter and swifter build; the horse, the swiftest of the beasts of burden, has been in great part reserved for war, while the slower and more patient animals served the purposes of trade. It appears also that the earliest arrangements for the quick transmission of intelligence were everywhere designed to serve military purposes. That of Peru,[1] a country which offers a perfect example of absolute despotism absorbing all social activities, appears to have been most efficient. The relays on the principal roads were only about a mile apart, so that the whole distance was traversed by the runners at full speed. Another familiar example is that of the military post of the Persian empire described by Herodotus.[2] It traversed the great military road extending from the original home of the nation in Persia proper to the bounds of the empire on the western coast of Asia Minor. Swift horses carried the post and the stations were at such distances that full speed could be maintained. The Roman post[3] was similar in its

[1] "Descriptive Sociology," no. 2, p. 54; Prescott's "Conquest of Peru," i, 66, 68, 70, etc.

[2] Book v, chap. 52.

[3] "Descriptive Sociology," no. 8, p. 133.

general plan, being simply a system of military despatches. It could be employed for private despatches only by special permission. So in France,[1] the earliest post was maintained by the monarchy for its own exclusive use, and its chief purpose was doubtless the forwarding of military despatches.

Another sort of communication which has some interest as in a sense the precursor of the modern system of instantaneous communication by electricity was also, apparently, of military origin. This is the transmission of intelligence by beacons of fire or smoke, or other visible signals, and by shouting. The former has been in use in all parts of the world from the earliest times and has ever had for its chief purpose the spreading of a sudden alarm of military danger. The plan of shouting news from one point to another was employed in ancient Gaul for a similar purpose.[2]

Military transportation, then, is remarkable for its early development; and more particularly for the fact that it led to the construction of the first permanent and substantial roads and of the earliest means of swift transport and communication.

As society progresses and economic organization comes to the front the means of military transportation previously in existence have an important influence in determining the course of commerce. The most conspicuous example of this is the influence of Roman roads upon the subsequent development of Europe. These substantial highways, or many of them at least, survived the centuries of disorganization that followed the breaking up of the empire;

[1] "Descriptive Sociology," no. 8, p. 134.

[2] *Ibid.*, table 1.

and when a new group of states began to appear and trade to awaken with the restoration of some measure of order, they still furnished the best available routes of land communication. In England and doubtless elsewhere, they had precisely the same influence upon transportation and the settlement of the country as a river or other natural highway. "Settlements were made and towns sprang up along these old 'streets' and the numerous Stretfords and Stratfords and the towns ending in 'le-street' ***mostly mark the direction of these ancient lines of road."[1] Thus the geography of Europe to-day retains important traces left by the military transportation of Rome.

On the other hand, in case of the introduction of an entirely new sort of transportation at a late period, the question whether it shall take on a military or an economic character must depend upon which sort of organization, economic or military, is ascendant in the existing social order. Thus we may say that the railroad system of the United States is exclusively economic in character, although the construction of the first line to the Pacific coast was hastened by military considerations. But in France and Germany military requirements have certainly played a very important part in determining the location of lines, while the railway system of Russia is perhaps more military than economic. The choice of routes upon military grounds may result in quite a different arrangement of lines from that which would best answer economic needs. Both must, to be sure, overcome the same obstacles in the same way, so that on the technical side they are likely to be nearly or quite the same. But it is clear without discussing

[1]Smiles, "Lives of the Engineers," i, 157.

the matter in detail, that the location of those lines which will best serve trade is likely to be different from the location of those whose chief aim is rapid movement with a view to strategical operations at possible seats of war.

CHAPTER VII.

TRANSPORTATION AND POLITICAL ORGANIZATION.

Although military and political organization are nearly identical in early stages of development and are closely associated in modern nations—the power of war and peace and the control of armies being commonly lodged in the same monarchs, presidents, ministers and legislative bodies that control the internal affairs of the state—yet they may conveniently be separated for our purposes. While the military aspect continually lessens in importance, the political increases as time goes on, and has given rise to numerous questions of practical difficulty.

We have seen that not only does transportation play a very important part in the general military organization, but under the perilous conditions of early trade takes on a military character of its own for protection against the dangers that beset it. This two-sidedness holds also in respect to other phases of organization. The choice by the members of a caravan of a leader with authority to preserve order and quell disputes on the march,[1] the lodging

[1] Fraser, "Narrative of a Journey into Khorasan," 346.

of similar powers in the captain of a ship and even in the conductor of a train, are examples of political organization taking place within the means of transportation. The complicated administration of a railway from the president down to a foreman of track hands shows organization of this sort in its highest development. Nor are political arrangements on a larger scale lacking or inconspicuous. The merchants' and carriers' associations that have always existed where there was any considerable trade, have ever had for one of their objects the removal of tolls and other restrictions on transportation, the opening of rivers and the improvement of roads, the furtherance of the negotiation of treaties favorable to trade, and the like. So at the present time the promoters of railways, shipping, street railways, etc. form associations to advance the interests of these various kinds of transportation.

On the other hand, transportation bears very important relations to the political state. I have already noted that in a primitive condition of society it usually has a character chiefly military. In so far as it is not military it is likely to be political. Tribute and visits of ceremony are the occasion of a large share of the movement of persons and things that takes place in despotic societies, such as most of those were that held wide and long-continued sway in early times. The former is the means by which the central organization is nourished and aggrandized, its function being the same as that of taxation. In a state where the central organization overshadows and depresses individual initiative, trade, carried on through the medium of exchange, is often a very subordinate matter and may even be

crowded out of existence altogether. In this case the society becomes communistic, and money, wages, contract, even barter, may be unknown. Whatever movement of commodities takes place is of a political character, either the movement of tribute toward the center or state distribution of food, materials, tools, etc. to places where it requires them for its own purposes. This absolute communism appears to have been nearly or quite realized in some despotic states, as in ancient Peru,[1] while many others, as Egypt, Assyria, Persia, Japan, had much of a communistic character in this sense. In such a state of things transportation is both economic and political; the two forms of organization are not differentiated. That individual initiative, involving money, contract, etc., which comes at a later stage of social development to be peculiarly characteristic of economic life, has little or no scope.

One who has not looked into the matter must be surprised at the extent to which the movement of persons upon visits of ceremony and submission may attain under a despotic form of government. The principal use of the public roads may be for this purpose.[2]

[1] "Descriptive Sociology," no. 2, p. 3.

[2] To illustrate this I quote from Kaempfer, an intelligent Dutch traveller who visited Japan in 1691. [Kaempfer's "History of Japan," English translation, London (1727), bk. v, chap. 5.] "It is scarce credible" he says "what numbers of people daily travel on the roads in this country, and I can assure the reader from my own experience, having passed it four times, that *Tokaido*, which is one of the chief and indeed the most frequented of the seven great roads in *Japan;* is upon some days more crowded than the public streets in any the most populous town in Europe. This is owing partly to the country's being extremely populous, partly to the frequent journies, which the natives undertake oftener than per-

Transportation may, then, under conditions that, though extreme, are not uncommon in semi-civilized states, have a character almost exclusively political, consisting chiefly of the movement of tribute and of the journeys of subjects to make ceremonial visits. A broader field of inquiry, however, opens when we consider the political relations of transportation in states where the political and economic organizations have in some measure at least a distinct development.

We may notice in the first place the strong tendency of transportation to be limited or in some way determined or modified by political boundaries. Among the nomadic peoples of the plains and deserts of Asia, where the earliest considerable land commerce arose, these boundaries were simply the limits of the power of a tribe or tribal nation.

haps any other nation, either willingly and out of their own free choice, or because they are necessitated to it. . . .

"The Princes and Lords of the Empire, with their numerous retinues, as also the Governors of the Imperial Cities and Crown Lands, deserve to be mentioned in the first place. It is their duty to go to court once a year, and to pay their homage and respect to the Secular Monarch at certain times determined by the supreme power. Hence they must frequent these roads twice every year, going up to court and returning from thence. They are attended in this journey by their whole court, and commonly make it with that pomp and magnificence, which is thought becoming their own quality and riches, as well as the Majesty of the powerful Monarch, whom they are going to see. The train of some of the most eminent among the Princes of the Empire fills up the road for some days. Accordingly, tho' we travell'd pretty fast ourselves, yet we often met the baggage and fore-troops, consisting of the servants and inferior officers, for two days together, dispersed in several troops, and the Prince himself followed but the third day attended with his numerous court, all marching in admirable order. The retinue of one of the chief *Daimios*, as they are called, is computed to amount to about 20,000 men, more or less, that of a *Sjomio* to about

Across these limits transportation could not well pass without interruption, except the tribe in possession of the territory chanced to be so weak that a strong caravan could force a passage through it. Accordingly there was commonly a break at tribal borders and the movement of commodities was continued through the medium of fairs or religious festivals at which they changed hands.[1] These were probably the medium of the earliest land trade, though as it increased it naturally tended to win a more definite and convenient organization. The first caravans appear to have been nomad hordes moving from place to place with the seasons, and incidentally, for the most part through the medium of religious festivals, trading with the peoples with whom they came in contact. The pastoral peoples always took and still take a prominent part in caravan trade even though they may neither produce nor consume the commodities carried. The fact that

10,000, that of a Governor of the Imperial Cities and Crownlands, to one or several hundreds, according to his quality or revenues.

"If two or more of these Princes and Lords, with their numerous retinues, should chance to travel the same road at the same time, they would prove a great hindrance to one another, particularly if they should happen at once to come to the same *Siuku* or village, for as much as often whole great villages are scarce large enough to lodge the retinue of one single *Daimio*. To prevent these inconveniences, it is usual for great Princes and Lords, to bespeak the several *Siukus*, they are to pass through, with all the Inns sometime before; as for instance, some of the first quality a month, others a week or two before their arrival."

And so on. Next in number to these political pilgrims are the multitudes of religious pilgrims, then countless beggars, then a swarm of small hawkers and peddlers of a mean sort. What a picture of a state of society now forever lapsed and all but forgotten!

[1] "Descriptive Sociology," no. 7, pp. 95, 96, 97; no. 5, p. 45; Yeats, "Growth and Vicissitudes of Commerce," pp. 68, 178, 378; Heeren's "Researches," Introduction.

they command the means of transportation through their domains—the roads, the springs, the necessary beasts of burden—puts them in a position to take such a part. When not themselves the merchants, as they often are when intelligent and enterprising, they act as carriers, furnishing to foreign merchants camels, guides and armed escort for a price which may be looked upon as partly payment for transportation, partly tribute. Sometimes tribute alone is paid and the merchants find their own means of conveyance. In any case the political sovereignty of the pastoral tribe has to be reckoned with in some manner.

A somewhat similar instance of the influence of political disunity upon the character of transportation may be seen in the condition of Europe previous to the rise of strong monarchies. The use of roads and bridges depended upon the will of feudal lords or other local authorities. Tolls and arbitrary extortion were everywhere met with; there was no power able to construct good roads or interested in doing so. The movement of commodities, as in the case of desert tribes, was effected in an occasional and precarious manner through the medium of fairs and religious meetings.

The progress of transportation is, then, necessarily dependent upon the consolidation of political power. The rise of strong monarchies, though these no doubt granted monopolies and imposed many restrictions for their own benefit upon the movement of commodities, brought in a condition of things infinitely better than that which had prevailed before. The kings did away with the previous economic disintegration, and improved the roads,[1] while the re-

[1] "Descriptive Sociology," no. 8, pp. 133, 134; no. 1, p. 48.

strictions they imposed upon trade were more uniform and less severe than the old ones.

At the present time, and among the most advanced countries, political boundaries remain a very important element in transportation. Customs-duties, laws discriminating in any way against foreign traders, restrictions on immigration and travel, and the like, still have a notable action in limiting movement and determining its character.

Among the effects ascribable to the action of the principle now in question is a retardation of the development of land movements relatively to water movements. The water is not only in many respects a better road from a physical point of view, but offers no social obstacles. The discouragement of commerce by piracy is by no means equal to its discouragement by such conditions of political disunity as those just mentioned.

As to the relation of states to transportation within their borders, we have first and last the familiar fact that this relation is very close. I know of no time or country, when economic transportation existed at all, in which it was not in an important degree a concern of the coercive, governing, organization of society—the political state, large or small, general or local. From the time when the earliest movements of the land trade were set on foot by desert chiefs to the present day, roads, bridges, harbors, and often the vehicles and other instruments of carriage, have been a public concern. At one time it was the local authority—lord, city, monastery, etc.—that controlled and exploited it; later the monarch; now a small state, now a large one made by consolidating the smaller; sometimes a commercial federation like the

Hanseatic League. But the policy of *laissez-faire*, of turning over transportation to individual initiative and control, has never entirely prevailed. It is sometimes imagined that the public regulation of railways in the United States and Great Britain, which has made so rapid progress during recent years, is in some way the introduction of a new principle into the relation of transportation to government. But this impression cannot survive historical study. Highways and shipping were regulated by law in both countries previously to the building of railways. In the United States a national system of roads and canals was projected by the federal government at a very early period and partly carried out.[1] Aside from this the canals and chief roads were generally state enterprises. Many states[2] undertook the construction of railways when the railroad period came, and abandoned the undertaking only after discouraging experience. The present tendency to more regulation can at most be regarded as a reaction from a policy of relative *laissez-faire* that was itself a reaction and had prevailed for only two or three decades. Harbors, shipping and navigable rivers have remained always subject to peculiar and somewhat minute regulation by public authority; while highways, city streets and other means of local movement have been regulated either by the several states or, more commonly, by the minor political bodies—counties, towns, cities, etc.

[1]See the famous report of Gallatin, "American State Papers," Misc., i, 724; Schouler's "History of the United States," vols. ii and iii; Benton's "Thirty Years' View," i, chap. x; Adams' "Public Debts," part iii, chap. ii.

[2]Notably Michigan, Illinois, Indiana, Pennsylvania. See Adams' "Public Debts," part iii, chap. ii.

Indeed, it is easy to perceive that although regulation has always and everywhere existed it has, on the whole, tended to diminish rather than increase. Such complete absorption of the means of transportation by the political state as existed in some of the cases mentioned above is now unknown within the bounds of civilization. Many states own all or part of the railroads within their borders, but the movement of commodities and persons is everywhere a matter, for the most part, of private initiative. The ownership, control or regulation of the means of conveyance by modern states has for its chief aim not, as anciently in Peru, Persia or Rome, the direct aggrandizement of the governing power by military operations, tribute and visits of submission, but rather the furtherance of the economic organization. So much is this the case that transportation is quite generally looked upon as an exclusively economic function, and the study of it has become, with good reason, an important branch of economic science. This is not the place to discuss the question whether there is not some narrowness in treating transportation as a peculiarly economic matter. The point is that historically it has become less a political matter than it once was. And precisely the most marked instance of this is found in the internal transportation of the United States. The fact that numerous laws are enacted relating to railways, street railways, earth roads and the like, should not be allowed to obscure the broad fact that private initiative has a greater scope in connection with transportation than ever before. In what other time or country, save recently in Great Britain, has the projection, the location, the construction, the operation of the chief

means of transportation within a great nation been left entirely to private enterprise, subject in its working only to a control which is rather negative than positive in character; is confined almost wholly to prescribing in certain matters what private enterprise shall not do?

We touch here upon that aspect of the matter which is of most importance at the present day, the question, that is, of what part the political state should take in relation to economic transportation. The problem here is that of the apportionment of functions between the state, or the coercive form of association, on the one hand, and individuals or private and voluntary associations, on the other. It is purely a problem of expediency and the proper basis for a solution must be found in a careful analysis of the various social functions of transportation. Accordingly such general discussion of it as belongs to the Theory of Transportation will be reserved for a final chapter.

CHAPTER VIII.

THE RELATION OF TRANSPORTATION TO ORGANIZATION HAVING AN IDEAL PURPOSE.

Beside the coercive state, or political organization of society in the narrower sense, and the industrial or economic organization, there is a third well-marked type of organization that is distinguished by its more ideal purpose. In an early stage of

progress the religious organization commonly embraces all the ideal aims of society among its purposes. Whatever of philanthropy, of general education, of research and the like exists, does so as a part of religion. Later, ideal organization differentiates in a complex manner, and philanthropy, education, art, science, attain a social machinery more or less distinct. Schools, colleges and universities, philanthropical establishments of all sorts, societies for the furtherance of social reforms, learned societies and the like, are instances of the later development of ideal organization.

The most general fact to be noted as to the earlier period is that in the midst of the state of war that commonly prevails in early times, the religious organization is the only force strong enough to secure even temporary peace among hostile tribes or states. Industry, trade and other peaceful occupations have been sheltered, the world over, under the wing of religion. They have begun in an unobtrusive manner under its protection and have remained there until strong enough to shift for themselves. Religion has ever insisted, for its own purposes, on the observance of sacred times and sacred places when and where hostilities should be intermitted. These times and places have been the opportunities of trade. Religious festivals and the holy ground in the neighborhood of churches and temples are inseparably connected with fairs and market places.

Thus among those pastoral peoples where the first land commerce sprang up there were from the earliest times, as indeed there still are among such peoples, periodical festivals having their origin in a kinship of blood, speech and religious tradition among neigh-

boring tribes.[1] These gatherings, accompanied by a cessation of hostilities and, in the case of places held to be sacred, by the concourse of pilgrims from a distance, were the occasion in this case, as they have been the world over, for the exchange of commodities, ripening under favorable circumstances to a regular fair. Such festivals and pilgrimages with incidental transportation, communication and diffusion of arts and knowledge, were without doubt the earliest centers of incipient commercial activity. So in the early history of Christian Europe, "Fairs arose at saints' tombs or other sacred spots on occasions of anniversaries, for which at first provisions were wanted and where, afterwards, merchandise was sold."[2] These fairs remain the chief seat of commercial exchange and the principal destination of commercial transportation until such time as a more stable political organization takes trade and transportation under its own protection and gives them a securer and more convenient mechanism. Where, as in the case of desert nations, a centralized political organization is not attained, this close relation between religion and trade may continue indefinitely. Mecca has ever been both the religious and the industrial center of Arabia, and the connection is so ancient and so close that it is doubtful which is cause and which effect. The religious festival was and is a great fair, and the movement of pilgrims and the movement of commodities are inseparable.[3]

[1] See references p. 57, note.

[2] "Descriptive Sociology," no. 8, table 4. Pages 133 and 134 of this number and the extracts collected under the head of "Distribution" in all the numbers are full of matter illustrating the early connection of religion with trade. See also Ashley, "English Economic History," i, 69.

[3] Robertson Smith in "Encyclopedia Britannica," art. "Mecca,"

For a similar reason cathedral squares and the ground about monasteries and other religious buildings were the earliest location of shops and market places in the various countries of Europe.[1] These places were commonly under clerical jurisdiction and the clergy used this jurisdiction in such a way as to encourage trade. So also the monks and clergy encouraged and practised manufactures of a non-military sort. Indeed what is here said with particular reference to transportation applies to economic progress in general.

The construction and improvement of highways, bridges and the like appears often to have been an immediate object of philanthropic activity on the part of monks and clergy in the middle ages. Bishops and other rulers of the church frequently undertook public works of this sort, and there was even a congregation of monks, *fratres pontifices*,[2] formed for the especial purpose of building bridges and providing ferries for the service of commerce and travel.

In what has just been said attention has been directed chiefly to the importance of the religious organization in encouraging the economic movement of commodities. But it is true in this case as in the case of the military and political organizations, that there is associated with religion a distinct, non-economic sort of transportation that may and sometimes does attain a great development while the economic movement remains insignificant. The most peculiar and distinctive feature of it is the pilgrimage. Thus in the quotation already made to illustrate the condition of things in Japan two hundred years ago, we

[1] "Descriptive Sociology," no. 8, p. 134.
[2] "Descriptive Sociology," no. 8, p. 141.

should have seen, had we turned over another leaf,[1] that the chief use of the roads, beside the making of political visits, was for pilgrimages. Every citizen of the country was obliged to make certain pilgrimages every year. So in the middle ages, the chief movement of persons other than military, was apparently the movement of pilgrims, or of persons pretending to be pilgrims for greater security. The crusades may be regarded as an instance of transportation of this sort, attaining enormous extent and formidable organization.

From the fact that the religious organization is in early times the chief nurse and protector of higher thought of all kinds, it naturally follows that thought-transportation is an important part of its machinery. For example, in so far as early communication in Europe was not military or political, it was religious; that is, it took place in connection with the religious organization of society. Books and ecclesiastical documents of various sorts were circulated by traveling clergy, letters on secular business were entrusted to pilgrims, and the universities, monasteries, etc. maintained special messengers when no regular post existed.[2]

If we pass on to consider a more modern state of society than that of the preceding paragraphs we are confronted with the problem of the relation of transportation to ideal organization in its complicated recent development. The word "religious" no longer covers the ground. The churches, which embrace all that is commonly understood under this

[1] Kaempfer's "History of Japan," bk. v, chap. 5.
[2] "Descriptive Sociology," no. viii, p. 134.

head, form but a small part of the modern organization of thought.

We may remark in the first place that we have here, as in the case of political relations, an organization of the kind in question within transportation itself as well as in society at large. Of the complicated structure of modern railway service, for example, a considerable part may be regarded as devoted to psychical rather than physical processes; to observation, discussion, decision and communication. Statistical, accounting and auditing bureaus, boards and committees of various sorts, and many of the higher administrative officers have this character. On the side of the physical instruments of the communication of thought we have signals and alarms of all sorts, a special mail, telegraph and despatch service, etc.

Leaving this question of internal structure as too technical to be very important to our present purpose, we have no difficulty in perceiving that transportation is connected in an important manner with the psychical organization of society in general. A theory of transportation must give some notion as to the character of this connection.

For greater clearness let us recall in what this psychical or ideal organization chiefly consists.

In its simplest aspect, that of the instruments of which it makes use, it embraces all the physical means for the communication and preservation of thought—signs and gestures, spoken language, letters and manuscript records of all sorts, newspapers and books, telegraphs and telephones. To regard only these physical instruments, however, would be like limiting the study of psychology to that of the anat-

omy of the nervous system. If we look somewhat deeper into the matter we see everywhere social as well as physical arrangements for this purpose. We have just seen that the higher organization of the *personnel* of transportation is largely psychical. It is so with every institution, and especially with that most conspicuous of all institutions, the coercive state. The state tends continually to develop on the psychical rather than on the physical side. Legislatures, statistical bureaus, courts and the higher administrative officers have functions of observation, communication, decision and discussion as contrasted with the physical and directly coercive functions of armies, navies and police.

We have moreover certain great institutions that have a distinctly and peculiarly psychical purpose. Such are science, education, literature and art. These are not merely names for a certain side of human activity, but they are institutions having a more or less definite social organization for carrying out their peculiar purposes. Thus the organization of science is without doubt the most universal social mechanism, and perhaps the most perfect for its especial purpose, that exists. Through its learned societies, universities, scientific books and periodicals, bibliographies, etc., it maintains something like perfect communication and unity of effort among scientific men the world over.

If one rightly considers the enormous intricacy and importance of these psychical processes of society, this social thinking, perceiving, feeling and deciding in all its unspeakable multiplicity, he may well conclude that its adequate analysis and interpretation is

the most complex and difficult problem ever offered to science.

What, then, is the relation of transportation to this ideal or psychical organization? It is obvious, on the one hand, that the association is somewhat close as far as physical instruments are concerned, and on the other that these matters as a whole are far too large to be included in an inquiry directed primarily at transportation.

The fact is that material transportation and the communication of thought make use in part of the same instruments, especially in their early development, and are analogous in their functions even when highly organized. On the other hand their functions, though analogous, are widely different, while the course of mechanical and technical progress tends more and more to separate them even in respect to their physical means.

Thus a century ago the "post" carried light commodities and was also a vehicle of the transfer of thought. Persons, goods, letters and books went by the post. Yet there was never a time when communication and conveyance did not employ different means to a considerable extent. Signalling to a distance by shouting, by fires, smokes, etc., was practiced by savage nations and at a remote period of time. The military post of the Persians, Romans and other warlike nations was chiefly for communication, while their trains of pack animals were only for the carriage of commodities. So, more recently, but before railroads, there was always, in addition to the post, a wagon service for the carriage of heavy commodities. At the present time the carriage of books,

newspapers, letters and other vehicles of thought is effected by the same means, for the most part, as the conveyance of light merchandise. But we have also a special mechanism of communication in telegraphs and telephones, a mechanism that dispenses entirely with the transfer of material masses and renders communication instantaneous.

Nor should we overlook that the carriage of letters, despatches and the like is but a small part of the physical mechanism for the communication of thought. That mechanism embraces spoken and written language, the printing press and the technique of the arts and sciences. It is with these rather than with transportation that the theory of communication is most intimately and inevitably connected.

Moreover there is good reason for the separation of the two in the unlikeness of their processes. That movement of physical masses which is the essential thing in transportation either does not take place at all in the communication of thought, or if it does it is merely incidental and not of the essence of the thing. Transportation is physical, communication psychical. The latter belongs to a distinct branch of study of immeasurable importance and complexity, namely, social psychology. It cannot profitably be dissociated from that field of inquiry which embraces language as an instrument of social organization and all the material agencies that language employs.

I think, then, that a separation can advantageously be made between the theory of transportation and the theory of communication, notwithstanding that they use, in part, the same vehicles, have a common aim in the overcoming of space, and exert in many ways an analogous influence upon social develop-

ment. A study of communication from the point of view of place relations may be undertaken in connection with the study of transportation; but such a study cannot penetrate more than skin-deep into the social meaning of communication. In transportation place relations and the overcoming of obstacles in space are everything. In communication place relations, as such, are of diminishing importance, and since the introduction of the telegraph it may almost be said that there are no place relations. Space—distance—as an obstacle to communication has so nearly been overcome that it is hardly worth considering. In the transportation of material goods and of persons such a result is inconceivable, and in this field the "annihilation of space" must remain a figure of speech. Although the conquest of physical obstacles to movement is a principal feature of the development of transportation, yet it is clear that this conquest is only relative. It cannot be said, on the whole, that territorial relations were ever more important in the exchange of goods than now. Efficient transportation greatly modifies and extends them, making them world-wide instead of local, but has no tendency to diminish their general significance.

The obvious analogies between transportation and communication are somewhat superficial and supply no adequate basis for the common theoretical treatment of the two subjects. The nervous and circulatory systems of the animal body also offer close analogies from an anatomical point of view; they are not more widely separated in their functions than are the conveyance of material goods and the conveyance of thought.

The view here taken of course does not involve any conclusion as to whether such means of communication as telegraphs do not have political relations so similar to those of transportation that they may advantageously be regulated in a similar manner or even by the same agencies. This is a political and administrative question that must be decided on quite different grounds.

CHAPTER IX.

TRANSPORTATION AND ECONOMIC ORGANIZATION.[1]

In this essay the economic idea is held to be, at bottom, the nourishment idea, using the word nourishment in a wide sense to include the getting and using of all material commodities whatever. As all forms of social organization require nourishment in this sense, so all have some kind of economic structure. Organizations devoted primarily to other ends, as the family, the state, schools, need material commodities and so must have, secondarily, an economic organization of one sort or another. There is also a great and general organization that is primarily economic and only secondarily anything else. This rests upon the division of labor, territorial and personal, and embraces the whole mechanism of production and economic exchange.

Theoretically, therefore, the study of the economics of transportation covers two fields, that of the

[1] Strictly speaking this title covers also chapters x–xiii.

economic structure existing within transportation itself and that of the relation of transportation to the economic organization of society at large. The former subject, as well as the latter, is one of very great importance, including as it does the private or internal aspect of all the problems of transportation—such questions, for example, as that of the theory of railroad rates regarded as a means of getting the greatest possible private revenue. In practice, however, it will be convenient to treat the two together, taking chiefly the public standpoint but referring to the private where it seems important to do so. We come, then, to the relation of transportation to economic society.

We strike the key-note of this matter when we say that the study of economic transportation is equivalent to the study of economy in its place relations. Transportation is a mechanism for moving things and persons from one place to another, and so far as economic phenomena are related to this movement they are related to transportation. Whatever is connected with territorial conditions, with the surface of the earth considered as an area, is connected with transportation, which is a mechanism conformed to these conditions.

The whole matter, then, of the distribution of population, wealth and industries over the face of the earth is in one of its aspects a matter of transportation. We have before us such great questions as that of the territorial division of labor, general and local, the concentration of population in cities, the location of cities, and the relation of territorial conditions to prices, markets, competition and other phases of economic exchange. These are, to be

sure, questions of transportation in only one of their many aspects; but that one is important, perhaps as important as any.

The best plan of procedure in discussing these questions will be to begin with their simpler, more physical or mechanical, aspects, and then go on to those that are more complex or symbolic. Commencing, then, with the segregation of population as a merely physical matter, we shall pass first to some discussion of the territorial division of labor and of the theory of cities, and then to the relation of transportation to a complex system of commercial exchange.

Without transport mankind would necessarily be pretty uniformly distributed over the surface of the arable earth, the main irregularities being those due to differences in the fertility of the soil. The earth is the only primary source of food, and man must stay where the food is produced unless he can have it brought to him. The existence of the smallest village involves the movement of commodities to and from it, the beginnings of social transportation. Side by side with this general fact we have the fact, equally general, that development is dependent upon differentiation, upon the breaking up of uniformity and the redistribution into a complex and interdependent system of centers of mass and force. Or, to be more specific, any efficient organization of industry is quite inconceivable without the concentration of men and other industrial forces in cities and and other foci of industrial activity. Economy of force and concentration are inseparable. All kinds of industry except agriculture are distinctly and directly centralizing in their tendency. Nor is agriculture a real exception, since efficient agriculture

means specialized agriculture, and specialization implies centers of collection and distribution.

Apparently this tendency to industrial concentration must continue to be an accompaniment of industrial progress. It is sometimes said in a speculative way that the present industrial concentration is the concentration incident to the generation of power from coal through steam, and that if electricity, for example, should accomplish the economical distribution of power from a central plant over wide areas, industrial concentration would diminish. As to this it may be said that, even though power could be distributed indefinitely without loss, this distribution could by no means produce the effect suggested. The division of power is the simplest of many questions of division that must first be solved. How divide expensive machinery, such as steam-hammers, rolling mills and the like? Production is daily becoming more dependent upon complicated and costly pieces of machinery to multiply which would be quite out of the question. If this problem could conceivably be solved there would still arise the more difficult one of the division of the social machinery of collection, distribution and economic exchange that must ever accompany complex industry.

The point here is, of course, that transportation is the instrument of all social specialization in place. Just in the degree that transportation is mechanically efficient can this segregation of men and things in accordance with various laws of economic progress, take place.

It is also true, however, that since the aim of transportation is to set men free in respect to place relations, to make these relations more plastic to social

needs, it can mitigate or do away with those aspects of concentration that are socially undesirable. The extreme concentration of population at centers has, for example, deplorable effects upon the health, intelligence and morals of persons who have to live in such places. Transportation having rendered ex-extreme concentration possible now turns around and by means of street railways and other forms of urban travel endeavors to mitigate its evils. Humanity demands that men have sunlight, fresh air, grass and trees. It demands these things for the man himself and still more earnestly for his wife and children. On the other hand, industrial conditions require concentration. It is the office of urban transportation to reconcile these conflicting requirements; in so far as it is efficient it enables men to work in aggregates and yet to live in decent isolation. The greater its efficiency in speed, cheapness and convenience, the greater the area over which a given industrial population may be spread.

The development of transportation and of the territorial division of labor must ever proceed side by side. Neither can be said to go before the other, since they are mutually dependent. The only source of local or international trade in ancient or modern times is international or local specialization in production—something is produced in one place which is lacking in another. In the presence of an active demand for these distant commodities they tend to move from the place where they are produced to the place requiring them; transportation is set up. On the other hand the transportation resulting from these forces is by no means a mere passive effect but becomes in turn a very active cause of counter-

changes. It enormously stimulates and greatly modifies that specialization to which it owes its origin. Under the spur of transportation existing differences in production are increased and new ones are introduced that could not well have been maintained previously. Amid the complication of causes and effects, of reiterated interaction, from which economic life as a whole results, transportation, determined in great measure by permanent natural conditions, has its firm position as one of the fundamental and comparatively independent causes. There is no first cause: this one is as early as any.

On account of its peculiar relation to place-specialization in industry transportation increases more rapidly than production. As the efficiency of productive processes is multiplied by the division of labor, the bulk of goods carried is increased not only proportionately but far more than proportionately. A greater share of the whole product must be conveyed from one place to another. Thus in a somewhat simple state of society, where half of what is consumed is produced at home, the other half only will require transportation. If owing to greater territorial division of labor nine-tenths of what is consumed comes from abroad, transportation must increase in the same ratio, independently of that general increase of production which goes on, of course, at the same time. Conveyance, then, is an industry that must ever grow much more rapidly than industries in general. One puts the matter forcibly if not accurately when he says that transportation increases as the square of production.

For the closer study of the relation of conveyance to the territorial division of labor we must turn to the

latter and observe that there are two underlying reasons for it. Place-specialization in industry is necessary, first, because of the economy inherent in the principle of the division of labor; second, because of the existence of local facilities for production. These causes, though everywhere in operation—sometimes in harmony, sometimes at variance—are in theory quite distinct. If the surface of the earth could be conceived as perfectly uniform, offering nowhere peculiar natural encouragement to the development of particular kinds of production, men would yet find their advantage in local specialization because specialization saves force. On the other hand, even though there were no economy in the territorial division of labor as such, yet the face of the earth being diversified as it is, territorial division would result from that diversity. Even in the first case men would aggregate in towns, cities and factories; even in the second they would produce wheat in one place, cattle in another and metals in a third. It will be worth while to divide these two principles in thought and to glance at their separate operation.

First, then, is place-specialization in industry regarded simply as an economic distribution of force and without reference to differing natural facilities.

I have already remarked,[1] in a general way, that transportation, in the absence of marked diversity in the earth's surface, tends to take on a complex radial form, the primary roads converging to central points which are themselves connected by secondary roads with other and more important centers. In its operation this tendency is closely associated with the principle of local division of labor, and the two

[1]Page 14.

acting together bring about that primary separation into town and country everywhere observed. The tendency of society to divide into town and country comes from the economy of division of labor; the size and location of towns is determined largely by transportation. The blacksmith, the miller, the carpenter, etc. are required in every agricultural community; convenience of access to them and other craftsmen calls for the formation of a village at a point easily reached by converging roads. The question whether this division and concentration of labor shall be carried so far as the building of large towns depends upon the facilities of movement to and from the center.

If those facilities permit we have, situated near the center of a group of country villages, a large town connected with them by converging highways. The country villages themselves, instead of being simply centers where the farmers and craftsmen meet and exchange products, now become the starting point and end of longer movements between the villages and the town. They become centers of collection for such commodities as are produced in the neighborhood and of distribution for such as are brought in from abroad. The division of labor in them is increased by the addition of a class that occupies itself with buying, selling and storing the goods that go abroad or come thence. The formation of the large town is due to precisely the same forces as the formation of the village; the higher division of labor requires factories and other forms of concentrated production which call together a large population and must be located with reference to the conditions of transportation. And these large towns

are again connected with great cities whose existence is due to the same general causes.

In the larger town we see another sort of local division of labor introduced in the specialization of the various parts of the city. The separation between city and suburbs, between the portions assigned to residence and to business, is an example. It is this that chiefly determines the character of local passenger movement by street and elevated railways and other forms of rapid transit. Here also we see at work the general principle that the degree of specialization is determined by the efficiency of transportation. Only as the machinery of this local movement is developed can we have that separation between the place of living and the place of working that permits certain parts of cities to be devoted wholly to industry. The speed of street-cars determines the distance from his work at which a man can conveniently live.[1] Another form of place-specialization in cities is the setting apart of different quarters for different industries. This existed in mediæval cities, and is quite marked in modern ones.[2] The wholesale and retail quarters are commonly quite distinct, while the chief establishments in each line of industry may be found grouped together. Only restaurants, retail provision and drug shops, and other places where small and frequent purchases must be made, are without this segregation.

The larger the city the greater the part played in it by those industries that are concerned with move-

[1] Compare pp. 76, 124 *et seq.*

[2] In the middle ages this segregation appears often if not usually to have been compulsory. See Ashley, "English Economic History," ii, 19.

ment. At an important center we have radial movements in and out—centrifugal and centripetal—of a very complex character. There is, to begin with, the local or primary movement of commodities to and from the country in the immediate vicinity. This is of the same sort as that about a country village and is effected chiefly by the teams and wagons of the farmers, gardeners, etc. Next is the other local movement peculiar to the large centers of population and exchange. To accomplish this we have for commodities a countless multitude of trucks, wagons, etc., for persons hacks, omnibuses, street, elevated and underground railways of all sorts, bicycles and the like. Even the movement up and down becomes here so important that we cannot well omit freight and passenger elevators from the list of means of transportation. All of these devices, of course, have their numerous *personnel* and their important and costly mechanism—tracks, overhead and underground structures, wires, cables, power-plants and barns. Together they make, as any one may see, an industry that takes up a great part of the labor and wealth of the city.

Not only the local movement but the longer movement connecting the city with other towns and cities, requires its own complex machinery. The terminal structures of railroads for the accommodation of passengers and freight, offices, storage-warehouses, hotels, grain elevators, docks and the like, are an important and conspicuous part of city structure on the material side and the people connected with them are equally important on the personal side. All industries concerned with the collection of commodities and persons in the city for shipment away from it, in

the distribution of commodities and persons coming in from without, or in the transfer and storage of what is passing through the city, are a part of the machinery of this secondary or distant movement. Nor should it be forgotten that the whole mechanism of commercial exchange,—wholesale and retail shops and stores, banks and other instruments of trade,—is in one sense a part of the means for the movement of commodities and persons. The relation of transportation to exchange will presently be examined more closely.

All those forms of place-specialization that have been described can be conceived to exist in a country without natural diversity of surface. They would grow up out of the economy resulting from the division of labor even were they not, as in fact, stimulated and modified by a difference in the natural capabilities of places. As a matter of fact they do take place in regions where there is almost no perceptible diversity in natural conditions. This is the case over wide areas in certain of the western states of this country, where the land is flat and of uniform fertility, the rivers too small to be navigable, and irrigation unnecessary. The railroad alone enters to disturb the prevailing homogeneity. A considerable town grows up at a central point whose position is often determined by the accidental circumstance that it is near the center of a county and therefore chosen for the county seat. This slight advantage gives it a start, and population and industry accumulate around it simply because economic progress requires industrial centers. About such centers the roads exhibit much of that

radial arrangement[1] which transportation naturally takes on in the absence of diverse physical conditions.

More commonly, however, transportation and place-specialization in industry are closely associated with and determined by differences in the character of the earth's surface. For the purposes of the present inquiry we may think of all these natural differences as of two sorts: first, fixed local facilities for production, such as coal, iron and other mines, water power, fisheries, peculiar qualities of soil, etc.; second, natural facilities for transportation. Differences of the first sort are precedent to and independent of transportation, but affect it indirectly by influencing production. Those of the second sort are not only the chief factors in determining transportation but in doing so they create facilities for production. These propositions will be more fully elaborated as we proceed. The point here made is that the economic distribution of persons and goods over the surface of any country is ultimately determined by natural conditions falling under these two classes.

In hilly regions a point convenient for getting water power from a stream very commonly fixes a mill site about which a village grows up. Here is a simple example of a natural facility for production making the nucleus about which population clusters under the operation of the principle of local division of labor. This simple example may be looked upon

[1] But not so much as would be advantageous. Compare Professor Jenks's monograph on "Road Legislation for the American State," p. 49 *et seq.* [In Publications of the American Economic Association, vol. iv.] The allotment of land by sections interferes with the natural arrangement.

as the prototype of a large class of mining and manufacturing towns and cities. The existence of mines builds up towns and cities in regions otherwise wholly uninhabitable, and manufactures of a coarser sort, such as lumber mills, blast furnaces, etc., must commonly be placed near the source of raw material, as in the case of saw-mills, or of fuel, as in the case of the iron industries.

These local facilities cannot be utilized without transportation, and they supply one of the chief spurs to its progress. From this point of view the efficiency of transportation is measured by the degree in which it enables natural resources to be exploited. The more perfect is transportation the more exclusively can people everywhere devote themselves to those pursuits for which their dwelling-place is suited. The territorial division of labor takes place and industry becomes interdependent and organic. How but for this could a large population in the southwest devote themselves exclusively to the raising of cattle, another large population in the northwest to growing wheat, another in Pennsylvania to the iron manufacture, and so on? To make only one thing means that nearly all the product must be sent abroad and most needs supplied from thence. We see in the condition of agriculture in many parts of the United States what a hindrance imperfect transportation is to economic development. The secondary or long distance transportation, the railroad, has outstripped the means of the local or primary movement, the country road. The last remains for the most part in a miserable condition, offering an insuperable obstacle to the bringing of agricultural products from any great distance and confining pro-

fitable farming to the strip of land nearest the railroad.

So in turn the existence of local facilities for production stimulates transportation. It was the movement of coal that caused the construction of tramways in England, that suggested and stimulated the inventions of Stephenson,[1] that furnished an early motive for the building of railways in the United States.[2] In general, mines, which are commonly situated among mountains, have been of the first importance in the development of land transportation. They have forced it out of its easier channels and compelled it to surmount the most formidable obstacles.

In attempting comparison between different countries and different times with reference to the development of industrial specialization, we find the question greatly modified and complicated by differences in the state of the industrial arts and in the industrial character of the people. We may, however, abstract some general principles concerning the relation between the development of transportation and that of the territorial division of labor. Thus, from the point of view of the utilization of natural forces, the local division of labor may be said to develop, under the influence of transportation, in three chief ways.

1. From a natural or primary specialization, that is, one so necessitated by natural conditions that it exists before the interchange of products, to a social or secondary specialization, that is, one that could not exist without interchange.

[1] Smiles' "Life of Stephenson."

[2] Ringwalt's "Transportation Systems in the United States," p. 68 *et seq.*

2. From a specialization upon light and costly commodities, that is, those comprising great value in small bulk, to one upon those that are heavier and cheaper.

3. From a specialization confined to durable commodities to one that includes also perishable commodities.

It is clear that these changes in production are the reflection of changes in transportation and are inseparable from the latter. The interchange of bulky and perishable commodities means quicker and cheaper movement.

That there is a natural specialization of products before trade arises is easily seen. Nature supplies gold, spices, furs and other things of great value which are unattainable in some places, and in others to be had almost without labor. Savage tribes produce what they can produce easiest. In the tropics they live upon cocoa-nuts, elsewhere upon game or milk. The earliest trade is simply an interchange of these familiar products, and production is at first stimulated without being changed in character. Thus Heeren[1] classifies the commodities of the primitive land commerce of the east as follows:

I. Precious metals and gems: gold, silver, precious stones, pearls, etc.

II. Articles of clothing: fine wool and cotton and their manufactures, silks, furs.

III. Spices, aromatic woods and gums.

Most of these things are obviously primary natural products. They are also such as comprise great value in small bulk and are not perishable through simple lapse of time. Modern commerce is widely

[1] "Researches," "Asiatic Nations," i, 40 *et seq.*

different in all these respects. Only a minute portion of its commodities are at once natural, costly and durable. The great bulk of it consists of relatively cheap things: grain, iron and its manufactures, coal, cattle and meat, cheap cloths. Again, though it is still largely concerned with raw materials, the products of mines and of agriculture, these are seldom the obvious and indigenous products of a primitive industry. And, lastly, a large and increasing proportion of what is exchanged is perishable, as dressed meat, fruit and the like.

It seems only necessary to state these principles in order to secure their acceptance. How little, for example, of that specialization now existing among the pursuits of the people of the United States could have been maintained under a system of transportation like that caravan movement which sufficed for the splendid commerce of the primitive east. Ours could have none of that splendor. We have gold, to be sure, on one border of our land, but silks, gems, spices, unguents and the like are almost entirely lacking. Our heavy though useful products could not be moved at all; each neighborhood would have to produce what it consumed; agricultural tools could not be had, the men of the plains would have to live in *adobe* huts, food would everywhere be limited to a few indigenous products, great cities would be out of the question; in a word, the American continent could support nothing but a squalid, ignorant and hopeless peasantry.

Of the two sorts of diversity in natural conditions alleged a few pages back as chiefly determining the territorial distribution of population and wealth, namely, natural facilities for production and natural

facilities for transportation, I have so far confined myself as closely as possible to the former. I have considered mines, water power, fertility of soil and the like, as fundamental causes in determining the growth and location of industries and of population, stimulating movement and in great part determining its character. Passing now to natural facilities for transportation we note, in the first place, that it is in many if not most cases these, and not facilities of the former class, that determine the location of manufacturing industries and of the population associated with them. Convenience of transportation becomes itself, in all advanced conditions of industry, the most important of local facilities for production. While it is true that the cruder manufacturing processes, such as the sawing of lumber, the smelting of ore and the coarser iron industries, must take place near the source of raw material; those of a finer sort, in which the cost of moving the raw materials is relatively less important, tend to seek the large centers of the collection, distribution and exchange of products. The vicinity of cities, wherever these may be located, will always be the chief seat of the finer manufactures on account of the conveniences that cities offer for selling and shipping goods.

Before going farther it will be well, for the sake of clearness, to indicate in a general way the character of the relation between the conveyance of goods and commercial exchange. I have just pointed out the connection of transportation with one part of the economic process, namely, agricultural and manufacturing industry; if I can now show its connection with the exchange of goods I shall have isolated it, as far as possible, from those inquiries

with which it is most closely associated, and shall be in a position to formulate a theory of its own peculiar action in determining the local distribution of population and goods.

What, speaking generally, is the relation that transportation bears to the rest of those activities known as trade or commerce? Commerce is commonly understood to embrace transportation and exchange (purchase and sale), with incidental regard to the underlying conditions of production and consumption. Of these, transportation grows out of territorial conditions, purchase and sale out of the institution of property. As the need for the division of labor, conditioned by territorial relations, finds its solution in transportation, so the same need, conditioned by the institution of property, works itself out in exchange. The movement of goods cannot be organized without changes in their ownership any more than without means of transportation. The one is physical, the other symbolic.

Since, then, the two are so intimately bound together, how, it may be asked, is it possible to dissociate them, and what is gained by such dissociation? The reply is that all social processes are intimately bound up with others, and isolation of one can only be partial and provisional. This provisional isolation, however, is indispensable to analysis. In this case, by separating transportation from commerce and fixing attention upon territorial relations, we eliminate most of those numerous and complicated phenomena that make up exchange, and get a comparatively limited field that offers interesting questions peculiarly its own. These questions are chiefly those arising from a study of the economic

process from the point of view of location. In the theory of the location of towns and cities, a question at which we are now arrived, exchange plays a subordinate part and may be regarded simply as the symbolic aspect of transportation. As far as place relations are concerned, transportation determines exchange and not *vice versa*.

CHAPTER X.

THE LOCATION OF TOWNS AND CITIES.

The theory of urban location is an extremely complicated matter, and not wholly a matter of transportation nor of economic relations. In early and warlike times military considerations are of great if not paramount importance in the original placing of cities. The first towns in militant communities are forts, and their inhabitants find in them a defence, a basis for hostile incursions, and a means of holding conquered territory. There have also been and still are cities that owe their importance to religious prestige, the supposed sacredness of a particular place.[1] Political forces may also determine the matter,—a modern instance is the fact already noted, that in the western United States, in regions where there is almost no diversity of surface, a considerable town often grows up at the county seat simply because of the slight advantage due to the location there of

[1]See Robertson Smith in "Encyclopedia Britannica," art. "Mecca." The importance of Rome, since the fall of the empire, has rested to a great degree upon religious prestige.

the public buildings and offices. Nor can it be denied that the site of cities is sometimes fixed by no better reason than the chance and possibly unwise selection of the first colonists.

These are examples of causes quite apart from the economic considerations that become predominant as society advances. They may work with or against the latter. In many cases it would seem that the military requirement acts merely as a modifying force. The position of a city is determined by economic causes within certain limits, wider or narrower as the case may be, and within these limits the exact site is fixed by military availability.

Aside from these causes cities owe their origin entirely to economic forces. I have attempted to show that among these forces transportation is the most important if we look at the question from the point of view of location; though it was not denied that local facilities for production exercise an important and independent influence. Our next inquiry must be as to the manner in which transportation acts in determining the location of industrial centers. The following is offered as the most general statement of the law.

Population and wealth tend to collect wherever there is a break in transportation.

By a break is meant an interruption of the movement at least sufficient to cause a transfer of goods and their temporary storage. If this physical interruption of the movement is all that takes place we have what I may call a mechanical break; but if on account of the close relation between transportation and exchange already pointed out the physical

interruption causes a change in the ownership of the transported goods, we have a commercial break.

It will at once be obvious that a break of the first sort is of much less importance than one of the second. Even a mechanical break may, however, bring together a good many persons and necessitate considerable structures. There must be loading, unloading and intermediate carriage of some sort. There must be buildings for storage, with persons to care for them and for the goods they contain. There must also be some sort of provision for the instruments of transportation—ships, camels, railroad cars, or whatever they may be—during the process of loading and unloading; provision also for the persons that accompany them. Around this group of specialized labor and appliances there must, of course, collect a corresponding agricultural, artisan and shopkeeping population of the sort characteristic of the time and country in question.

The commercial break is almost always present at or near the physical interruption and greatly increases its importance. Where a break of this sort exists on an important line of transportation—though it be in the midst of a desert—there must be a commercial city.

The reason is not obscure. At a commercial break there necessarily arise, beside the machinery of transfer and storage already spoken of, the highly organized *personnel* and appliance of economic exchange. There must be a class of merchants and money-changers, who require buildings more or less elaborate for the carrying on of their business, and whose wealth tends to a splendid style of living and draws together a relatively large and various sub-

sidiary population. The nucleus thus formed, of a commercial city, tends strongly, though the tendency may be counteracted by adverse conditions, to become the seat of manufactures, of political power, and of the central institutions of all varieties of social organization. Even in the most primitive states the commercial capital usually becomes the political capital and is commonly the seat of the chief temples and of the culture of letters and art.

The next question is, whence do breaks arise? If they have these important consequences, if social substance tends to leak out and fix itself wherever these interruptions occur, it is important to inquire into their causes.

The most important of these causes are necessary physical interruptions; for example, the junction of land transportation with water transportation, of one kind of water transportation with another, or of one kind of land transportation with another.

The location of the greater number of commercial towns the world over, and from the earliest times to the present day, has been fixed at the point of juncture between land and water movements. It is hardly necessary to illustrate this statement in detail. The chief seat of inland towns is, or at any rate was before railroads came in, along navigable rivers at the points where these are most easily accessible from the land. The point where road and river meet may be determined by the conformation of the land, especially if the surface is rugged or mountainous. We may then look for a town not far from the most commodious passes or at the confluence with the river of some small tributary whose valley makes a convenient roadway. Or the charac-

ter of the river may decide the matter and the road may be drawn to a point suitable for a ford or a bridge. The names of innumerable towns ending in these syllables and their equivalents in other languages show how general has been the action of this cause. An artificial watercourse has the same effect as a river; witness the rise of numerous towns upon the Erie Canal immediately after its completion.

Roscher[1] points out the importance of isthmuses in this connection, that is, of the narrowest point in a strip of land separating two seas, two important rivers, or a river and the sea. The two sides of the isthmus become, of course, points of transfer between land and water, and for this reason, according to the theory here maintained, are likely to be the sites of cities.

Upon the coast of a sea or of large lakes the situation of a harbor, especially if harbors are few, is usually the determining element in the matter and fixes the point of juncture between land and water movement.

The physical necessity for a break is not confined to the point where land and water conveyance meet. It exists wherever the technical apparatus of vehicles and forces has to be changed. In water transportation it is found at that point in the course of rivers where sea-going vessels must be exchanged for lighter and shallower craft. This seems to be the chief factor in determining the location of most commercial towns of the first class. They are situated upon the estuaries of navigable rivers, or upon the rivers themselves

[1] "Nationaloekonomik des Handels," chap. i. The first section of this chapter, consisting of two pages of text and several of notes, is devoted to the location of cities.

at a place not too far up to be accessible to large ships. The break is between two varieties of water transportation rather than between land and water, an exchange between boats built to slide over shallows and those built to cut the waves. The fact that many great rivers have produced cities of this sort can escape no one; as the Nile Alexandria and Cairo, the Euphrates Babylon, the Elbe Hamburg, the Weser Bremen, the Thames London, the Seine Havre, the Rhone Marseilles,[1] the Mississippi New Orleans, the St. Lawrence Quebec, the Hudson New York,[2] the Delaware Philadelphia, etc. Indeed of cities famous for their commerce those not situated on the estuary or lower course of a navigable river are comparatively few. Of course the routes of land transportation are also drawn to these points, and it is quite possible that with the surprising development of railroads during recent years the importance to a commercial city of having a navigable river to feed its trade is relatively diminishing.

There is also a large class of towns whose situation is fixed by the meeting of two kinds of land transportation. Thus in these days railways have much the same part in determining social development as formerly belonged to rivers. In their original location they are in great part influenced by the situation of existing cities; but once built they become themselves a cause of new cities, especially in those young countries where railroad building precedes popula-

[1] Not directly on the river, but "on the nearest place on the coast where nature had furnished the conditions which the delta of the Rhone denied." Chisholm's "Commercial Geography," 238.

[2] The Erie Canal, which may be regarded as an extension of the Hudson, first established New York as the commercial metropolis of America.

tion. The active towns are invariably placed on the line of the railway, and the precise location, if the surface is at all irregular or mountainous, is likely to be fixed by the point of intersection with an important earth road. The point where the railroad crosses a navigable river is of course favorable as being a place where the exchange between land and water movement takes place. The intersection of two railways has of itself no tendency to form a town, because there is no change in the kind of transportation, no necessary break.

Before the appearance of railways the formation of towns at the break between two kinds of land movement was not uncommon, though perhaps less conspicuous than now. Thus, the border of a mountainous district, the line where the foot-hills lapse into the plain, is commonly the seat of cities which are likely to be placed at the ends of the principal roads that traverse the mountains. The break here is between the vehicles and seasons peculiarly suited to mountain transportation and those suited to the level and open country.[1] Again, it would seem that in the east, particularly in former times when caravan transportation flourished, the border line between the desert or arid plains and the fertile agricultural regions was often the site of cities.[2] Some place not very far from this line must be the place where caravans are organized and merchandise collected

[1]Compare Roscher, "Nationaloekonomik des Handels," pp. 4 and 5.

[2]The history of Palmyra is an interesting illustration of this. This city seems to me to have been one whose location and importance can be explained only on the break theory. See Robertson Smith in "Encyclopedia Britannica;" art. "Palmyra;" Heeren's "Researches," "Asiatic Nations," ii, Appendix ix.

and distributed. Thus Professor Robertson Smith[1] explains the situation of Mecca as the place where the most important routes from the arid interior of the country come down through the mountains and meet the arable plain.

Looking at this matter from a slightly different standpoint, it appears that the interruption is not necessarily due to a change in the natural features of the earth's surface, but may be simply the change from the vehicles of a small and scattered movement to those of a large and unified movement. Breaks of this sort are exceedingly important in land transportation, and exist wherever a number of small local movements come together and form by their junction a single large movement, or go to swell a large movement formed elsewhere. They correspond to the fact that the raw material of all commerce comes originally from the soil and must be collected at central points by the vehicles and at the convenient seasons of local transportation. So also whatever of local produce is consumed by the scattered population must be distributed by similar means. This sort of movement naturally takes on a radial form,[2] the small local movements drawing together to a common point and contributing to the larger movement that takes place between that point and others at a distance. At the point of junction of the larger and better equipped and organized long-distance transportation with the crude vehicles of local conveyance, there is necessarily an interruption of the movement. If the conditions are in every respect uniform, considerations of convenience tend to place

[1] "Encyclopedia Britannica," art. "Mecca."

[2] See pp. 14 *et seq.* 78, 79.

these points of collection and distribution at the center of the tributary plain. The location of many towns and cities seems to be fixed by this requirement alone.[1]

Leaving the study of purely physical conditions and taking with us our hypothesis that a break in transportation is the indispensable condition to the formation of a commercial city, we see that the interruption may be due to political forces. The obstacles to trade arising out of the non-industrial organization of many societies and particularly of international relations, often render it impracticable for merchants to extend their operations far into other countries than their own. Trade is carried on through the medium of fairs, marts, staples, emporia, to which the merchants of both countries resort to exchange their wares. The national line, especially if it also divides different races, acts very much like the line between sea and land, or other natural separation. Both the means of transportation and the ownership of goods must be changed, and we have the essential conditions of a commercial break. Among barbarous nations at all times and among civilized nations in their early development, this is a cause of the first importance. At the present time its operation is not very obvious, partly because the practice of shipping goods to the interior under bond tends to prevent the action of existing restrictions from being localized at national boundaries.

Before concluding this subject it is worth while to emphasize the fact that, contrary to a somewhat general impression, the mere intersection of lines of

[1]Compare Roscher, "Nationaloekonomik des Handels," chap. i, sec. i.

transportation has no necessary tendency to cause the growth of a commercial city. What is required is a break—transfer, storage and change of ownership—and if the break exists, no intersection is necessary. There are many points in this country where two railroads, each doing an immense business, intersect without the slightest tendency to cause the growth of a city. Even if a large amount of freight and many passengers are interchanged, an insignificant "junction" and a restaurant are all that is necessary. In that case we have a mechanical break of a very simple sort. More perfect arrangements for interchange of cars, for through-billing and the like, tend constantly to make intersections, as such, of less importance.

Indeed we have here one reason for the continual aggrandizement of the large towns at the expense of the smaller, by the removal to them of the mechanism of transfer and commercial exchange. From one point of view the number of breaks represents the expense of transportation, and the tendency to dispense with the smaller ones by means of interchange of vehicles, consolidation of lines, etc. is a part of the progress of the division of labor. The question whether the result is not, for other reasons, undesirable hardly enters here.

What has been offered regarding the theory of urban location may be summed up as follows:

Non-economic causes, as military and political, have a notable influence, especially in the earlier history of societies.

Of economic causes of cities the most general is pressure toward greater division of labor: the efficient

use of natural forces is inseparable from the concentration of population and wealth. This cause acts independently of particular places and has of itself alone no action in fixing location.

Two influences chiefly determine the location of cities: local facilities for production and local relations to transportation. The former of these acts mostly through the coarser and primary manufacturing industries. The finer manufactures seek the most convenient centers of distribution, that is, of transportation.

Transportation, itself guided in its course chiefly by the physical diversity of the earth's surface, is the main cause of the location of cities in an industrial society. The mode of its action is that *population and wealth tend to collect at a break in transportation;* the reason being in the first place the necessity for the material and symbolic machinery of transfer at breaks, and in the second the tendency of other economic activities to collect where that machinery exists.

CHAPTER XI.

THE RELATION OF TRANSPORTATION TO MARKETS, PRICES, COMPETITION, ETC.

Transportation, in the measure of its efficiency, strikes from economic forces the chains of time and place. We should cover most of what needs to be said in this connection in saying that transportation promotes competition, if we gave a sufficiently wide

construction to the word. Free movement extends the scope and application of agriculture, mechanical labor, directive talent, inventions, capital,—of all economic factors whatsoever. One can best understand this matter by approaching it from several points of view, as those of supply and demand, of markets, of prices and of competition.

In just the measure that the difficulty of movement is overcome, that transportation becomes quick and cheap, is the reach of effective demand extended. Where crude means of conveyance prevent the movement of goods the demand of the people of a single place is limited in its working to the close vicinity of that place, while the needs of other places are not felt as a demand. Facility of movement, by extending the scope of demand, tends also, other things equal, to make it uniform and to give it a more varied character. It becomes more uniform, because not so much affected by accidental local changes. If demand in modern markets is more fickle and fluctuating than in those of an earlier time, it is not because of better transportation, which of itself always tends to uniformity, but because of the contrary action of forces that transportation has been unable to overcome. The character of demand is diversified because things that become accessible become desired; witness the degree in which oranges and other southern fruit have recently become necessary to the people of the north.

Supply tends to become more uniform in different times and places. This is very obvious in the necessaries of life. The great famines of former times are now almost unknown because of the ease with which a local scarcity can be remedied by importation.

Though the interdependence of nations as to these necessaries is increased, it has also become generalized; thus, while the dependence of England upon the rest of the world for grain is greater than ever before, it is less than ever a dependence upon any particular grain-growing country. The supply may come from America, Australia, India, the Black Sea. The general result, therefore, is greater security and regularity of supply the world over.

Quick transportation diminishes the need for holding large stocks of goods. With railroads dealers are far less compelled than formerly to anticipate the demands of their customers a long time ahead. In many lines of trade the stock held is hardly more than samples, the railroad and the telegraph being trusted to for the filling of large orders. This is particularly the case in the wholesale trade, where goods are commonly shipped from the factories after the order is taken. The factories, in turn, adopt the same plan with raw materials; they hold as little as they can and prefer to buy only for immediate needs.

The outcome of this is that the whole economic process is greatly hastened. The holding of a stock involves the lengthening of the time between production and consumption. Under present methods that time is so much reduced that the materials, in the iron trade for example, are frequently in their crude state when the order for the finished product is taken.[1]

[1] In other words we have, so far as this is true, a state of things commonly supposed to be peculiar to a very primitive condition of industry.

It is of course obvious that many forces work directly against transportation in this matter; the growing complexity of production and exchange tends to lengthen the time between the extraction of the raw materials and consumption. But transportation has primarily and of itself the action stated, and is so far effectual that the contrast between present and past trade in the need for anticipating demand is probably less than commonly imagined.

Were all other conditions stationary efficient transportation would tend, for the reasons given, to diminish the need for capital in production and exchange. One use of capital, as every one knows, is to tide over the period between production and consumption. In so far as facility of movement shortens this period it does away with the need for capital. Something of this is seen in the ease with which many sorts of business, as the sale of agricultural implements, are carried on through agents, who are either in the employ of the manufacturer or else local dealers with little or no capital. Only the promptness with which each order can be filled from the factory, does away here with the necessity for large stocks, and hence for a correspondingly large investment.

We see the same facts from a somewhat different point of view when we look at markets. A market is the area over which competition extends, and though it has no sharp boundaries it is clearly determined by facility of transportation and communication. The means of quick movement enable things distributed over a wide area to be offered simultaneously in one place; or they enable things collected in one place to be offered simultaneously in many

places. This is competition on its material side. Communication is the symbolic or psychical mechanism and permits the competitive bidding that must accompany the transactions of the market. If the retail dealers over a circle of a hundred miles' radius are connected by telephone with the wholesale dealers of a single large city, and can have their purchases sent thence in two or three hours, the competition is almost as perfect as among the dealers of a single place. As the distance becomes greater, the time of movement longer, and communication more difficult, competition becomes imperfect; but in the case of durable and staple commodities it has some action over whole countries, continents, or even the world. The market for the precious metals embraces the whole earth in pretty effective competition. The reasons which make a difference in the extent of the markets for different commodities are aside from the question; it is enough to note that this extent varies in the case of any one with the facilities for transportation and communication.

The normal effect of more efficient transportation upon prices is to make them lower and to lessen the variations of the prices of any particular commodity in different times or places. After what has already been said these effects need little further discussion. The cost of movement enters into the price of all that has to be moved; and for this reason alone, without regarding more indirect results, prices fall with cheaper conveyance. A tendency to equality of price at different times and places follows from the action upon supply and demand already spoken of. It may be added that the substitution of one commodity for another that serves a similar purpose, such as the using of corn or rye meal when wheat

flour is dear, is much facilitated by cheap and rapid conveyance.

In general, then, transportation makes for that free interaction of industrial forces which is the ideal of a competitive society. Of course in all that has been said it has been taken for granted that the opportunities of transport are equal to every one. The fact that the means of transportation have been and are used for creating inequalities among persons is a deformity upon their normal beneficence. About these discriminations there can be no question but that of the speediest and most effectual means of doing away with them. They strike at the very root of freedom. That a policy of non-interference with them could find advocates is a strange perversion of the principle of *laissez-faire*, the original intent and only justification of which is that it favors economic liberty. Free competition is altogether dependent upon the just performance of the function of transportation.

Though no one will deny justice as a principle, many difficulties arise in its application. To show what justice requires is a part of the theory of rates.

CHAPTER XII.

THE GENERAL THEORY OF RATES.

In discussing this question it is natural to regard chiefly that form of transportation in which it is most conspicuous and important — railways. The standpoint taken is that of the interests of a society chiefly competitive which depends for its progress principally, though by no means exclusively, upon

the enterprise of individuals and of private associations.

A primary inquiry is that of the relation of the public interest to that of the institutions of transportation, of society to the railroad corporation; the social and the private economies of the matter.

The chief interest in rates from the private point of view is in the revenue resulting from an excess of receipts over expenditures. That system of rates is best which results in the greatest net revenue. Any particular rate is to be judged in the light of a careful study of the increase or decrease of movement that would be caused by lowering or raising it. A lower charge is preferable if it will stimulate movement sufficiently to make the receipts greater, a higher if it does not too much hinder movement to have the same desired result.[1] What is wanted is a rate of maximum return. As regards the adjustment of rates among persons, commodities and places, the private theory works out in the principle of "charging what the traffic will bear"; that is, the charges must be so distributed as to render the movement of goods as large as possible.

The private interest also fixes, theoretically, a minimum rate that represents the immediate cost of handling a particular part of traffic, the cost that could be avoided by not handling it. If this is not covered there is a direct loss. But, as all familiar with railway questions are aware, this immediate cost is small compared to that cost that is not immediate, not the result of any particular movement, but the general expense of the mechanism as a

[1]See Professor Hadley's mathematical statement of the private theory of rates in the appendix to "Railroad Transportation."

whole—the cost that must be borne somewhere but not anywhere in particular. The private theory of rates often permits, and indeed requires, their adjustment without much regard to the cost of any particular service.

It is not proposed to work out in detail the theory of rates from the private standpoint, nor to inquire how far an adjustment according to that theory would consist with public policy. It is simpler to discuss the matter from the public point of view, qualifying our conclusions by such deference to the private aspect as justice seems to require.

There are only two considerations suggested by the private theory of rates which, it seems to me, need to be borne in mind during the further discussion of the question. These are, first, that rates as a whole should be such as to afford a reasonable return to investment, and, second, that particular rates, though they may be adjusted within a wide range, may not be reduced below a certain minimum representing the immediate cost of movement spoken of above. The first cannot be neglected without something resembling confiscation; the second seems required by a common-sense regard for the mechanical conditions of movement. Having admitted these qualifications we may, I think, take altogether the public point of view.

Four principles are here advanced as fundamental to the theory of railway rates.

I. They should do justice among persons.

II. They should permit the utilization of special facilities for production arising from soil, climate, mines, or other immovable natural agents.

III. As to the distribution of manufacturing and commercial industries, they should favor decentralization rather than concentration.

IV. In other respects they should give the greatest possible freedom to the action of economic forces.

As these four propositions are unfolded it will appear, I hope, that they form the groundwork of a comprehensive theory of rates. It may be worth repeating that in this part of our inquiry the question is not of the practicability of adjusting rates to a theory, but solely of what they ought to be, supposing we had the power to make them what we would.

The first principle, that requiring that there be no discrimination among individuals in the rates of transportation, is so self-evident as to be of little interest from the theoretical standpoint. The equality of industrial opportunity, a fair chance for every man, is the very breath of a competitive society. Without equal rates among persons there is not a fair chance. The application of this principle is as difficult as its justice is plain. Personal discriminations continue to exist and to threaten industrial freedom in spite of all measures hitherto employed to prevent them. The redress of this evil is perhaps the most important of the practical questions connected with railway rates.

The principle plainly requires that rates be equal among persons in the same place and dealing in the same or equivalent commodities. Precisely in what this equality consists is often a difficult question, as appears by the numerous cases in which it is not clear whether a discrimination has or has not been made. One question of this sort may be mentioned as involving a principle of so general application as

to require consideration in any inquiry into the theory of transportation.

Should large quantities be carried proportionately cheaper than small quantities? Or, to state the question in the practical form it often takes, should carload rates be less than those for smaller shipments? From the point of view of public industrial policy it is not clear that this distinction is admissible. It has plainly a tendency, by giving advantages to the shipper of large quantities of goods, to make large dealings more profitable than small, and so hasten the concentration of industrial power. This concentration has already forces enough behind it and tends to become so great as to threaten the existence of competition. If competition is to continue to be the ruling principle, concentration requires rather to be checked than encouraged. Wherever a question of this sort arises it would seem that the small shipper should have the benefit of the doubt. The most plausible ground on which to rest the defence of carload rates appears to be the claim that in their absence small shipments would be so greatly and unnecessarily multiplied as to increase the general cost of transportation to a degree that would more than counterbalance the advantage of encouraging the small dealer. That any such result would follow the abolition of carload rates appears doubtful. The question is one to be considered in a more detailed discussion than the present.

The second principle means that, wherever a region is found peculiarly adapted by its soil and climate to the raising of a certain product, it should be enabled to raise that product. Thus, to permit the development of the fruit-growing of Florida and California,

the wheat-raising of the northwest, the rearing of cattle on the southwestern plains, low rates should be made if necessary. The principle applies not only to these conspicuous examples of natural aptitudes, but also to less obvious instances. Every agricultural district may be supposed to have in some degree peculiar natural capacities. With a given amount of labor each can produce a greater value in certain commodities than in any others. The use of these special powers is indispensable to the efficiency of industry as a whole, and rates should not be such as to prohibit it.

It will readily be seen that this second proposition is closely related to the theory of the territorial distribution of persons and wealth already put forth. Two fundamental causes of this distribution were recognized,—local facilities for production and the conditions of transportation. What is here asserted is that the latter should, so far as practicable, favor the operation of the former.

This, however, is very far from being identical with the theory of "charging what the traffic will bear," as that is generally understood. What is here advanced concerns only industries that rest upon immovable natural agents, notably agriculture. The question what relation transportation rates should bear to manufacturing and commercial businesses, which are not, for the most part, determined in locality by immovable natural conditions, but by transportation itself, is quite a different matter. The second proposition may be held by one who does not admit the validity of "charging what the traffic will bear" as a principle of general beneficence.

This second principle is already recognized, in a general way, by the making of very low rates upon coal, lumber, wheat and the like heavy commodities, for the production of which particular regions are peculiarly suited. It is, however, no part of the just application of this principle that great areas of specialized productive facilities should be encouraged while the smaller ones are neglected. Rates from the northwest should be low enough to enable the development of the great wheat regions in that quarter, but the wheat regions further east should also receive such rates as to enable them to ship to the same market. In so far as rates can determine the matter they should permit each district in the country to raise that to which its soil is best adapted.[1] That there are great difficulties in the way of obtaining the statistical data requisite for the detailed application of this principle may readily be admitted. But these difficulties are met on every hand and impede the application of any principle whatever that takes account of the complex conditions of economic life. They are no more conspicuous here than elsewhere.

This principle makes one legitimate basis for the classification of freight, for differences in rates among commodities. To utilize local facilities for the production of things having little value in proportion to their weight and bulk, the rates upon these must sometimes be reduced to the minimum of immediate

[1]The limit to the adjustment of rates for this purpose is pointed out on page 107, where it is said that particular rates "may not be reduced below a certain minimum representing the immediate cost of movement."

It is not meant that any mining or agricultural region should be encouraged to the extent of carrying its products at a loss.

cost of movement,[1] by which, of course, a portion of the general cost is shifted upon something better able to bear it. It is clear, however, that since the principle relates only to the immediate products of the land and of other immovable natural agents, it can afford no complete theory of the classification of freight.

It cannot be too clearly pointed out that the logical basis of the second proposition is the immovability of the natural facilities for production to which it relates—the fact that if these facilities cannot be improved where they are, through the aid of transportation, they cannot be improved at all. On the other hand manufacturing and mercantile industries are as a rule not fixed to the soil, and may be developed almost anywhere if the conditions of transportation are sufficiently favorable. We come then to the third proposition.

The third principle put forward is that with respect to manufacturing and commercial industries rates should favor distribution, decentralization, rather than concentration. The importance of the questions here involved will readily be grasped by any one who has followed that detailed inquiry into the place relations of society in which it was held that the conditions of transportation are a chief cause of the manner in which population and wealth are distributed over the face of a country. The size, location and character of cities, and all kinds of territorial development, are dependent both in general and in detail upon transportation. In discussing railway rates we treat of one of the most important elements of transportation, in whose adjustment all

[1]Compare p. 106.

of these momentous consequences are in a great measure involved; an element, moreover, that is not determined by any automatic process whatever; but one that must be consciously determined, and should be determined upon considerations of public expediency. There is no avoiding this question of rates; it has no tendency whatever to settle itself.

We have before us the question of the relation that rates should bear to places; whether and in what manner and degree they should vary with the distance that things are carried, whether a distinction between places may be made on other grounds than that of distance. And indirectly the question of the classification of commodities is involved, since different places deal in different commodities. Distinctions among places in the matter of rates may, in fact, be divided into two classes: those effected directly by different rates on the same things, and those effected indirectly by the way in which rates are adjusted among different things.

There are several causes operating in practice to give lower rates to some places than to others, which are here held to be distinctly of evil tendency. Among these are competition among railroads, and a favoring of the larger towns for no other reason than that, because they are larger and more opulent, their merchants are able in various ways to influence the policy of the railroads. That large towns should be able to secure lower rates than small ones otherwise similarly circumstanced, plainly operates as a discrimination against the merchants of the latter, and tends artificially to hasten that concentration of population and wealth which of itself proceeds quite fast enough. Differences due to competition are

commonly of the same character; they are differences in favor of the larger towns due to the fact that these are competing points,—places, that is, where there is a choice among rival routes of shipment. That very great differences in rates due solely to this cause exist in all quarters is a well known and a pernicious fact. From the point of view of public policy these differences are altogether inexpedient. They tend artificially and with enormous force to aggrandize the great centers of population at the expense of the smaller. It is impossible to know how much they have to do with the fact that large cities are growing so fast compared with the country as a whole, but it may well be believed that they have a great deal to do with it.[1]

We may say of discriminations among places made upon these grounds, as we said of discriminations among persons, that there can be no question save of the speediest and most effectual way of doing away with them. A great difficulty, however, arises in trying to discover when differences come from this cause and when from better. As to this I hold that competition in railroad rates is opposed to the general interest and ought to be replaced by union under public control.[2] Active at comparatively few points, it tends to enrich these at the expense of all the rest. Because it is confined to a small field its operation in that field is altogether abnormal and unhealthy. The public feeling in favor of railroad competition is loyalty to an idea

[1]Such is the opinion of the Interstate Commerce Commission; see their Second Annual Report, 30 *et seq.* A recognition of this fact, in my judgment, involves a condemnation of the whole system of railway competition as it now exists.

[2]Compare pp. 141–148.

that has here no practical application. The disappearance of competition would be one step toward the adjustment of rates on other and better grounds.

Supposing it granted that differences made for these reasons are inexpedient, we come to the question, what is a proper basis for the adjustment of rates among places? It will be convenient at this point to take up the fourth principle, that requiring that rates should give the greatest possible freedom to the action of economic forces, and ask what adjustment of rates would be required by the unconditional application of this principle. Then we shall be in a position to see what ground there is for limiting its application and how this limitation bears on the theory of rates.

The leading idea of the fourth or greatest-freedom principle is that transportation, in so far as it can, should set economic forces absolutely free, and that rates should be adjusted with this aim. Facility of movement has had this operation in the past; let it continue it to the maximum point attainable. In so far as freedom from physical restrictions is attained society is enabled, by the maximum of specialization, to get the greatest possible result from the division of labor. Under the normal operation of economic laws, freed from the trammels of distance and from the unjust discriminations now prevailing, cities will locate themselves at such points as offer special facilities for manufacturing production, and grow to such size as is advantageous, and no larger. If they become very large it will be because that is necessary and expedient.

To conform to the greatest-freedom theory rates should, it appears to me, be adjusted as follows:

The classification of freight should be based as nearly as practicable, upon value; that is, the more valuable commodities should pay rates in proportion to their value in order that it may be possible to give the cheaper ones rates low enough to move them. Or, looking at the matter somewhat differently, it may be said that by charging for value rather than bulk or weight, these mechanical and, so to speak, accidental elements, are in so far eliminated from among economic forces.[1] Economic forces are freed in the degree that those that are social in character are enabled to supersede those that are merely physical. And value is the social measure of commodities as opposed to the purely material measures, bulk and weight.

The theoretical effect of basing rates upon value is that the movement of useful things is promoted in the highest possible degree, and that the cost of transportation enters as a uniform percentage into the cost of all commodities. Movement is promoted because its cost is distributed equally and not made to fall harder upon heavy things than upon light. It may be assumed, in general, that the value of a thing and not its weight is the measure of its ability to pay for transportation; and that in distributing cost of movement according to value we are distributing it according to the ability to bear it. The statement that such a distribution would also make

[1]There is doubtless an impression abroad that basing rates upon anything but weight is in some way a "discrimination." But surely, except from a purely mechanical point of view, weight is not a rational basis.

the cost of transportation enter everywhere as a uniform percentage of the cost of the commodities is sufficiently accurate for our present purpose, though perhaps inexact. It is clear that if it cost everywhere five cents to move a dollar's worth of goods to market, that five cents will, in general, raise the total cost at the point of delivery to one dollar and five cents.

I accept the greatest-freedom principle in so far as it relates to a classification of commodities based upon value. Its unconditional application requires, however, an adjustment of rates to places that appears to me inexpedient.

Rates upon the same commodity should, under the greatest-freedom theory, be everywhere uniform, without regard to distance. Classification would remain on the basis of value, but as regards a particular kind of freight the postal system of a uniform rate would prevail. Distance, by being rendered a uniform cost to all competitors, would be as nearly abolished as it can be by the adjustment of rates. This element no longer entering, all other forces would have full scope. No dealers would be shut out of any market because it cost too much to reach it. A difference in time in traversing different distances would of course remain, but that is something over which rates are powerless. Markets, the areas of competition, would be indefinitely enlarged, and no set of dealers or manufacturers could be secure of the exclusive possession of any particular field.

If we accept unconditionally the greatest-freedom principle there is no reason why distance should be recognized in the making of rates; no reason, that is, from the public standpoint. It would require a

certain recognition in so far as a longer haul is actually and necessarily more costly to the railroad than the shorter.[1] This difference would demand attention in the case of very heavy and cheap commodities, as coal, where the rate itself has to be so low that the differences in cost due to distance become important in comparison with it. In such cases if rates were uniform for all distances they must either be so high as to prevent shipment or, if low, the longer movements must take place at an actual loss to the railroad. But to a great degree differences in actual cost might be altogether neglected, as they are in the postal service.

In so far as it aims to eliminate the effect of distance this would be a concentrating and specializing principle. It is so in theory and it would be even more so in practice. In eliminating distance as an economic element it would remove that which has acted and still acts as a chief obstacle to the advance of the territorial division of labor in all its forms. Freer scope would be given to those forces that tend to the building up of great cities and the concentration of manufactures in particular districts. There is ever, as already pointed out at some length,[2] a pressure toward centralization arising from the economy of force associated with it. The friction of movement over the earth's surface is a chief resistance to this pressure, and uniform rates aim at the removal of this friction. It remains, to be sure, as a mechanical factor, but its relation to places and distances is taken away and it becomes simply a uniform charge upon the movement of values.

[1] Compare p. 106.

[2] Page 78 *et seq.*

Such is the theoretical working of this principle in a country, if any such is conceivable, where it operates from the first instead of being applied, as must be the case in practice, after a considerable industrial development has been reached. In this latter case the effect must be, I think, to fix and perpetuate the existing distribution of persons and goods. Cities would become larger and industries more specialized, but would remain in the same places. To be more specific, this principle, applied to the United States at the present time, would stimulate the growth of existing cities and aggrandize the commercial and manufacturing industries of the east, but would prevent the rise of new cities and discourage all attempts to move manufactures and large mercantile enterprises westward. What motive is there for these changes except convenience of situation? And is not the difference in the cost of transportation the chief element in this convenience? Why locate manufactures near the raw material when it costs no more to move the raw material a long distance than a short one?

Here it is pertinent to ask, why indeed? Why should manufactures be near the raw material? Is it not quite as well that they should be somewhere else, especially if thereby we gain the saving of force due to a maximum concentration and specialization of industry? This inquiry raises a number of questions too wide in their scope and too far removed from our immediate purpose to be examined in detail. There is, first, the question what is the maximum economical limit of the concentration of industries? If there is a limit to the law of increasing returns in its application to manufactures,

where is that limit? How far would the building up of great industries and of territorial specialization in manufactures go if allowed free scope? And again, supposing that the economical gain of this process is far from exhausted, how much is it offset or overbalanced by undesirable social conditions that accompany it—overcrowding, narrowness of individual life and the like?

Without answering these questions it is sufficient to say that I share the common opinion that the concentration of population and wealth tends to excess. Accordingly I prefer the decentralizing principle in the making of rates.

This principle as stated on page 108 is negative in form, involving no more than a denial of that just discussed. There are indeed many ways and many degrees in which the adjustment of rates can be made to work against an extreme industrial concentration. What is wanted is a moderate plan, one that shall not prevent society from realizing in large measure the benefits of industrial concentration and the territorial division of labor; and a simple plan, one that can be understood and applied.

So far as I can judge, the best simple and comprehensive principle toward which to work, in adjusting rates upon any particular manufactured commodity, is this; that rates should be proportional to distance, provided only that the rates for short distances do not fall below a certain minimum representing the actual and immediate cost of hauling the freight.

The theory of rates advanced in the preceding pages may be summed up in the following propositions:

a. Personal discrimination must not exist.

b. Differences in the rates given to different places, arising from railroad competition or the favoring of large cities, must not exist.

c. Rates must be such as to permit the utilization to the public benefit of local facilities for mining and agricultural production.

d. Rates on any particular commodity, not among the raw products of immovable natural agents, are to be proportional to distance, except that for short distances a minimum may be fixed sufficient to cover the immediate expense of handling the freight.

e. The classification of commodities, other than raw products, is to be such as to make rates as nearly as possible proportional to value.

Whatever may be thought of these propositions it is claimed that they constitute, when taken together, a comprehensive general theory of rates. General principles of this sort are to be used as a basis upon which to build up a complex structure of detailed practical reasoning. Beside the question of their truth there is the farther question whether, if true, they form an adequate basis for the practical structure.

Rates may vary with persons, with places, with commodities. A sufficient theory of rates, however general, should indicate their relation to these three possible causes of variation. It seems to me that the propositions above answer this requirement. Thus *a* declares that so far as persons are concerned there should be no differences on this account. The relation of rates to places is determined by *d* modified by *c*. It is not denied that *c* is indefinite, but only with that indefiniteness inseparable from a

general proposition relating to so complex a subject. As a principle it is clear enough. And in like manner the relation that rates should bear to commodities is determined by *e*, modified by *c*.

Any practical effort to conform railway rates to the requirements of public policy must of course encounter formidable difficulties whose detailed discussion is beyond the scope of the present inquiry. The question whether and in what manner they should be regulated by government will presently come up in connection with the theory of the relation of transportation to the state. The chief difficulties in the way of rational change, from any quarter, may be classed as statistical difficulties and those arising from the existence of competitive conditions which it is troublesome to disturb. The lack of information, of a sufficient body of trustworthy, comprehensive and well-arranged facts, is alone an insuperable obstacle to the efficient public or private regulation of railway rates.[1]

The application of any theory of rates would disturb existing conditions of competition, and the question just how much this disturbance ought to be admitted as a reason against changes otherwise desirable, is a practical inquiry of considerable importance. The merchants of a given city may have been enabled by actual rates to compete in markets from which they would be shut out were rates what they should be; or industries may have been established in places where they could no longer maintain themselves. In answer to such objections, however, it is pertinent to inquire whether an unsettled and planless state of things is not continually working

[1]Compare p. 141 *et seq.*

wrongs of this character, and whether anything looking toward a rational and permanent adjustment is not preferable to chaos.

CHAPTER XIII.

TRANSPORTATION AND RENT.

The relations of transportation to the distribution of product among industrial classes—to wages, interest and the questions of labor and capital associated with these, are for the most part too remote and indirect to enter into our inquiry. This, however, is not the case with rent.

Rent is closely connected with transportation because it is a matter of areas and distances, of place relations. I said at the beginning of the present division of the subject that the study of the economic relations of transportation was nearly equivalent to the study of society in its place relations; and this notion holds good at the present point.

Rent would exist as a result of transportation alone, were there no differences in the fertility of soils. That is to say, varying productivity, a fundamental conception of the Ricardian theory, is not indispensable to the existence of rent. Nor is it necessary that the supply of land be limited. In the case of an unlimited area of uniform soil rent would exist, and its law would be as follows:

Rent arises from differences in the cost of getting commodities to market, and is measured by the differ-

ence between this cost in any given case and that in the case of the most remote land which it pays to cultivate.

There is of course nothing new in this proposition, but it emphasizes the fact, perhaps imperfectly realized, that the conditions of movement are an independent cause of rent, coördinate with fertility and the margin of cultivation.

Transportation is, accordingly, an element entering into all rent, and changes in transportation change rents. It is the tendency of progressing facility of movement, other things remaining equal, to lower rents by diminishing the differences in the cost of reaching markets. A familiar example is the fall of agricultural rents in England, due to that development of steamships and railroads which gave American wheat fields access to English markets. Something of the same sort has also taken place between the eastern and western states of this country. Agricultural rents in many parts of the east have gone down and farms ceased to be cultivated because the cheapening of railway movement has decreased the advantage of their situation.

This principle has an application to ground rents in cities that is important in view of the economic problems connected with such rents, and of the surprising progress of urban transportation. Street, elevated and underground railways, in proportion to their efficiency, tend to diminish ground rents by distributing city population and business over a wider area. This is particularly true in the matter of dwelling sites, which commonly seek as great a distance from the center as the means of getting back and forth will permit. As already pointed out,[1] it is

[1] Pages 76, 80.

the function of urban transportation to spread out the people, and in so spreading them out it reduces the rent, per unit of area, that they have to pay. It does this by enlarging the area of ground available for residence, increasing the supply of land in proportion to the demand.

The area of available land increases not simply with the efficiency of transportation, but in a much greater ratio. Suppose, for example, we consider simply the matter of speed in street railways. It is approximately true that the area available for residence increases as the square of the speed. Thus if by the construction of a system of underground railways with four tracks, permitting the running of express trains, the speed of travel in a given city becomes three times as great as before, the space over which population may be distributed becomes nearly nine times as great; or the city may have nine times as many people as before without becoming more crowded. On this far greater area the total ground rent would be no greater than on the original area of the city; and rents per rod or per foot would be only one-ninth of what they were before.[1]

The reason for such a relation between speed and area is found in the fact that quicker transportation, by increasing the distance at which people can live, increases the radius of the habitable circle, while the area of the circle, according to a familiar geometrical rule, increases as the square of the radius. Thus if a man can afford to spend half

[1]That is if we assume, as it seems to me we may to simplify the discussion, that ground rents vary inversely as the supply of land, other conditions remaining the same.

an hour in riding to his business at the center of the city, and the speed of cars is six miles an hour, he can live three miles from the center. The area of a circle whose radius is three miles is about twenty-eight square miles. If the speed is doubled, becomes twelve miles an hour, he can live six miles from the center. But the area of a six mile circle is about 112 square miles, just four times as great as before.

To analyze more closely the theoretical effect of improvements in transportation upon advantages of position, a simple diagram will be used. It will of course be understood that the problem is reduced to its lowest possible terms by the elimination of everything except the element of situation, and that a simplicity is given to it far removed from actual conditions. The theory is applicable not only to cities but to agricultural rents, in so far as they are determined by transportation.

Let O be the center of a city, AC its original diameter, and ac its diameter after the speed of transportation has been doubled. If other conditions remain unchanged, the total of rent (conceived as due solely to relative position) cannot be affected, only its local distribution.[1] If in the first instance, it was greatest at the center and diminished uniformly toward the circumference,—the simplest supposition,—its total may be represented by the volume of a cone, whose section would be the area of a triangle, as ABC; that is BO would represent the rent of a unit area of ground at the center, while at A and C rent would become nothing. When, by doubling the speed of movement, the city is extended to a and c the total of rent is the

[1]See note on previous page.

same, but its different distribution is indicated by the shape of a triangle *abc*, the section of a cone whose volume is the same as that of the cone *ABC*. (Since the circle that forms the base of this second cone has four times the area of that of the first cone, equality between the volumes of the cones requires that the height of the second be only one fourth that of the first.) At the center, then, rent per unit area (represented by the height of the cone) is reduced to one-fourth of what it was before. Thence the change diminishes until at the intersections *X* and *Y* we have points where rents remain unchanged. Beyond *X* and *Y* they are higher than they were, while from *A* to *a* and from *C* to *c* rents are now paid where none were paid before.

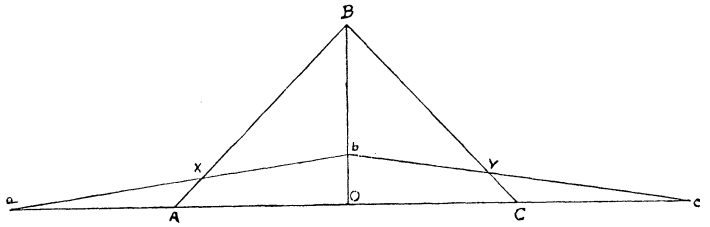

DIAGRAM ILLUSTRATING THE THEORETICAL RELATION OF TRANSPORTATION TO RENT.

This illustration may be more concretely grasped if one will imagine a conical lump of lead that is first of the shape *ABC*, and is then beaten out with a hammer into the shape *abc;* the lead is rent, the hammer improved transportation.

So far speed has been the only element of efficiency spoken of, but the same analysis is applicable to cheapness. Thus if we are considering the relation of an agricultural area to an industrial center, and

desire to examine the effect upon rents of a cheapening of movement, substitute in the foregoing "halving the cost" for "doubling the speed" and "area available for profitable cultivation" for "habitable area." The margin of cultivation corresponds to the outskirts of the city. Precisely the same geometrical relations hold.

This may be stated as follows: In so far as rents depend directly upon facility of access to a given center (whether facility be measured in time or in cost), they vary near the center inversely as the square of the efficiency of transportation (that is inversely as the square of speed, directly as the square of cost). The area of the rent-yielding circle, on the other hand, varies directly as the square of the efficiency of transportation.

CHAPTER XIV.

THE POLITICAL RELATIONS OF TRANSPORTATION FURTHER CONSIDERED.

I shall not consider in much detail those problems of the public regulation or control of transportation that are of so much present importance. What I propose is only such a discussion as will show in outline their relation to the general theory of transportation. The wise practical solution of these problems depends principally, perhaps, on a minute and yet comprehensive statistical study of actual conditions; but it also depends on the formulation and

acceptance of right general principles concerning the degree and manner in which political authority can and should change those conditions.

My standpoint as to the general theory of the relation of governments to industry will be that which appears, in fact, to prevail at the present time; namely, that competition is the best available regulating force in most kinds of industrial activity, but that it is not necessarily nor always good, and may require either to be altogether suppressed in certain cases or more or less stringently regulated for the public good. Individual enterprise is chiefly relied upon for progress, and those who propose to substitute government control for it must show a probability of benefit from the change; but when the probability is tolerably clear it ought to be acted upon. As economic organization becomes more complicated and the various parts more interdependent, it constantly happens that the securing of general freedom demands particular regulation.

The subject will naturally divide itself into two parts. In the first I shall try to show that transportation is a highly organic activity, requiring to be conducted according to a comprehensive plan and by unified instruments and methods. For this reason it is and must be effected through associations, public or private, whose size and degree of organization correspond, in a general way, to the magnitude and degree of organization in the means of transportation. In the second I shall briefly consider the expedient division of transportation functions between the state and private associations at the present time.

Much confused thought about transportation arises from the failure adequately to grasp the fact that it is a distinct social function. It is not agriculture, nor manufacture, nor trade; it is something having a distinct character of its own, quite apart from these. The unconscious assumption that it is an industry essentially like other industries should be got rid of. Such an assumption implies a failure to get to the social point of view, from which it appears that this is one of several fundamental social processes.[1] It is an agency by which every part of society is brought into relation with every other, and interdependence, specialization, in a word, organization, made possible. It is not merely an industry larger than others, but it is quite a different sort of thing.

Not only does transportation hold this peculiar position as the physical basis and instrument of social organization, but it is itself, from one point of view, the highest example of that organization. As the political state is the most conspicuous instance of social unification in its higher or moral form, so transportation is the most conspicuous instance of it in the lower or physical form.

Take for example the simple and primitive case of one of those military roads of the Romans or the ancient Peruvians. Such a road is, in its simplest aspect, a long strip of ground devoted to a public end, namely, social consolidation through military power. It is a unified instrument; that is, it is continuous and laid out upon a definite plan. Any one part of it is nothing without all the rest. If a single mile is impassable there might as well be no

[1] For its sociological character, in general, see p. 42.

road at all. And to get the most good out of it, it must be used by uniform methods, that is, by vehicles peculiarly suited to it, perhaps by a regular military post. Uniformity in vehicles and methods, however, comes more to the fore in the later development of transportation. A uniform way is the earliest, always the most obvious, example of the general or organic character of transportation.

Pass now to the present and consider a railroad, or better a system of railroads. The continuous strip of ground remains, but upon it has been developed an elaborate strip of uniform structure. The gauge of the tracks must be everywhere the same, and the curves, grades, strength of bridges, height of tunnels and the like, must be adjusted to the same general requirements of traffic. Uniformity of structure extends to the vehicles. These must all couple with one another, and so must have couplers in the same position. The air brakes and the continuous heating arrangements must also be uniform in their appliances. So with the signalling arrangements of all sorts. They should be uniform in order that they may be generally and readily understood.

A still more elaborate adjustment is necessary in methods—arrangements for the interchange of cars and freight, for the connection of passenger trains and the issue of through tickets. And the widest unity, the most advantageous and economical organization, requires that rates over a whole country be determined in accordance with some wise and comprehensive plan, to the common end of the efficient performance of the social function of transportation.

As to this matter of organization there is a notable difference between movement by sea and by land.

In the latter the earliest and most conspicuous instance of physical unity is the way—a uniform and continuous strip of land devoted to this purpose. This unified way is the basis of much of the need of unity in a farther development; because the way must be uniform, the vehicles and arrangements must be so likewise. By sea, as already pointed out, there is, as a rule, no way in the sense of a specialized or artificial path. It is chiefly for this reason that maritime transportation never required that minute and detailed organization, on the physical side, that is characteristic of railroads. It is for this reason, also, that competition in maritime conveyance is more practicable than on railroads.

These remarks apply in a much less degree to inland than to maritime waters, to canals hardly at all, (from the present point of view these are rather to be regarded as a form of land conveyance), to rivers and lakes only in so far as they perform a different function from that of land transportation. In so far as they serve the same purpose, are capable of competing with it, they are part of the same system and should be treated on like principles.

From this organic character of transportation as a physical agency necessarily follows an organic character in the means of carrying it on. It must be accomplished by associated power and wealth, public or private, of the state or of voluntary associations. Throughout history it has been one of the principal concerns of government,—extremely important, indeed, both as cause and effect of the existence of governments. It has been equally important as a motive for private organization,

particularly in the present century, when the largest and most complex development of private corporations takes place in connection with transportation.

This statement will hardly be disputed by one who has followed the discussion to this point, but some illustrations may make its meaning clearer.

The question of constructing a local earth road is typical. A road is to be built which is necessary to the agriculture or trade of 1,000 persons. It passes through ten farms. Strict application of the individual principle would require that each farmer make, or refuse to make, the road upon his own premises. Two facts are evident: that though he will have to build one-tenth of the road he may get only one-thousandth the good of it; and that even were he so public-spirited as to do this, his work would be useless unless the other nine farmers were of the same mind. As an individual he lacks both the motive and the ability to do anything about the matter. It must be and is done through associated action. This example sets forth a principle that operates not only between the individual and a small community, but between small communities and large, between the general and local governments of a federated nation, between private corporations and the state, between small private corporations and large ones.

We note its operation in the case of the more important country roads. It is a fact of familiar experience in our American communities that a main road, one which is of importance to a whole county or even to a whole state, will not be maintained in a manner corresponding to its importance if its maintenance is left to the townships or other small politi-

cal divisions. These last, like the farmers in the previous case, have neither interest nor power adequately to meet the general need for a costly highway. No one of them will or should bear more than its share of the general expense; and even if disposed to do this, it cannot unless all the others through which the road passes consent to do likewise, and do it in accordance with some plan agreed upon. These conditions of unity and uniformity require, as a matter of fact, that the construction of roads whose importance is general should be undertaken by the general authority, the county or the state.

Just so between the states and the federal government of our union. No question in connection with the public control of railways is more fundamental than that of the proper boundaries between federal and state control. The general answer to it is that in all those matters in which railroads are or should be a unified and interdependent whole, an organization, their control must be unified and general. In those matters that are local in the sense that uniformity in them is of no great importance, the control may properly be left to the local authority. The tendency of the control of railroads to pass from state to federal authorities is the natural and necessary consequence of increasing organization in the railroads themselves.

Turning to private corporations we notice here also the general operation of the principle that increasing organization in transportation requires a corresponding extension of the agencies that undertake and direct it. The rapid progress of consolidation, of the superseding of small corporations by great ones, is the necessary accompaniment of greater

unity in the conduct of railways, and rests primarily upon the fact that transportation is something that requires a general organization. A small corporation owning and operating a short piece of some great highway of railway traffic, is situated very much like a farmer through whose farm the high-road passes. Its local interests and powers are quite inadequate to the carrying out of those large and uniform operations required for the economical conduct of a great through traffic.

A similar relation holds between private corporations, large or small, and the state or nation. Representing only a small part of the citizens (and them, perhaps, very imperfectly, since it is not uncommon for officers to misuse the confidence of stockholders), the largest of them controlling only a small fraction of the total means of transportation, it is always possible that private corporations may be conducted in a manner hostile to public policy. This hostility may arise either from imperfect organization, or from organization to a wrong purpose. It may consist in a lack of unity, uniformity and subordination to right general principles of operation and rate-making which obstructs the efficient performance of the function of transportation, and is injurious not only to the public but to the stockholders; or it may consist in the misuse of efficient means in such a manner as to make the public suffer to benefit the corporations. Contrary, perhaps, to the general impression, the chief evils actually arising are of the former character. They are such as injure both the public and the general interests of transportation as a business. Particular corporations benefit, or try to benefit, at the expense of

others, with the general result that all suffer. The difficulty is in imperfect organization.

The results of the analysis, to this point, may be summed up as follows:

The development of transportation requires general agencies,—associations, political or private, rather than individuals; great associations rather than small ones. This is a reflection of the fact that transportation, being a fundamental and general process, pertaining to society as a whole rather than to any particular part of it, must have a high degree of organization; that is, must be carried on with general aims, by unified instruments and uniform methods.

So much for the organic character of transportation and the requirement of associated control. We now reach the question whether private associations or the state should exercise this control, or how it should be divided between them.

This is eminently a question whose answer must be relative to political character and development. There is no general solution; different times and countries require a different policy. In the form that the problem takes in the nineteenth century it is entirely new, since nothing corresponding to the present development of private industrial associations was ever known before. It is also quite a different problem in the United States and in other countries. Here private enterprise and corporate wealth have been found ample for the construction of railways as fast as they were needed. If anything there are too many. In many countries of Europe, on the contrary, the state was obliged to

build the railways because of the deficient enterprise of private associations.

We may approach the problem as it presents itself in the United States by inquiring what, in general, are the advantages of public and private control.

In the conduct of any enterprise the state enjoys the advantages belonging to an association of the widest extent and the amplest power and prestige. In a function requiring an organic unity, like transportation, this is much. The state is in a position to give that unity and uniformity of aims, methods and equipment that is so important a part of organization.

Its weakness is in the nice adjustment of its operations in detail, and in the lack of those simple and comprehensible motives of personal advantage that control private business. The business motive, the hope of private gain, gives to private industrial associations the strongest inducement to conduct all their operations economically and with a careful adjustment to the industrial needs of the community. In the case of the state this business motive is so generalized and attenuated as almost to disappear. The fact that public business is less economically managed than private follows from the lack of the particular and definite motive of private gain in those who conduct it.[1] It is true that private enterprises are not always conducted in the best manner from the business point of view, and that public enterprises sometimes are; but no one will question

[1] I do not assert that this difference in detailed efficiency must always exist, only that it does exist and is rooted in the principles of association—not a matter merely of official corruption or incapacity. Yet I think that it is abnormally great with us at the present time.

that the fact in general is as stated, or that there is good reason for it. A study of public works, and especially works of transportation, undertaken by states, will unquestionably, I think, show that not only at the present time but throughout history such works have been carried out with a certain disregard of economy and of detailed conditions in general. The Roman roads and aqueducts, in their imposing but often entirely unnecessary solidity, magnificence and straight-forward contempt of natural obstacles, are typical.

The advantages and disadvantages of private associations are, of course, just the reverse. They are organized expressly to secure the most economical and profitable adjustment of capital and labor power to industrial conditions. Though the problem of the organization of great corporations is a difficult one, and the interests of the stockholders are often imperfectly represented by the officers; yet as business associations they enjoy an enormous advantage over the state, which is not only far larger and more complex, but is organized primarily for a different purpose and only undertakes business incidentally. They therefore adjust themselves more readily and carefully to the details of the question how to do the greatest business at the least expense. They lack, however, the reach and coercive authority to bring about unity of aims and methods wherever that would be advantageous.

This may all be expressed as follows: Organization in industry has two sides, the side of unity and that of detail or specialization. On the former the state

has some great advantages; on the latter private associations are much superior.

It follows from this general state of things that those industrial activities are best suited to the state that are universal and uniform in their aims and methods, but simple in detail,—have a great need of unity and little of specialization. This is the real basis of public conduct of such enterprises as streets and highways, the post, water-works and the like. These serve universal needs and require to be designed and conducted in a uniform and comprehensive manner, but require little nice adjustment to particular conditions, involve no complex business problems. Streets and highways are free and almost the only business in connection with them is that of keeping them clean and in repair. The post and water-works sell their products, are in a sense commercial, but the former has only three or four prices, determined by simple and universal rules, and the latter only one.

The business of transportation unites the requirement of the widest unity with that of very great complexity of detail. It is here held unquestionable that the railroad system of a country should be unified throughout in its instruments, its methods, and particularly its rates; that these should be, not indeed all alike, but intelligently adjusted to one general plan. But there is also everywhere required a close study of and adaptation to particular natural and economic conditions. It is the most organic of all industries, and as such is both unified and complex.

The question of what the state should do with regard to railroads may be considered either as to their location and construction, or to their opera-

tion when constructed. The opinion here advanced is that, in view of the preceding analysis, a country having the history and the present economic structure of the United States, would better leave both of these processes to the enterprise of private associations, subject to a control more or less detailed and stringent as experience may indicate. It is certainly the spirit of our institutions to give private initiative the benefit of the doubt in all questions relating to the conduct of industry, and in the case of railways there appears to be very great doubt whether public construction and operation would be expedient.

It seems to me improbable that the railroad system of this country would be so well laid out and constructed at the present time had this been done by either state or federal agency. Doubtless many mistakes have been made, but the matter has been in the main determined wisely by individuals who have carefully studied the natural and economic conditions of railway building with a view to their own profit. It is true, in a general way, that a road that will pay well is well located from the public as well as from the private point of view.

During the thirties, soon after the first railroads were built in England, a number of American states experimented, more or less extensively, with public construction. Among these states was Michigan, where a system of internal transportation was designed and partly carried out, which consisted chiefly of three railroads and one canal extending on nearly parallel lines across the state.[1] Each of these four

[1]See the map in Tanner, "Canals and Railroads of the United States," (1840).

lines of transportation passed about through the center of one of the four lower tiers of counties in the state, the design apparently being to secure public support to these works by distributing them uniformly. It is possible that this is typical of a principle that, in this country at least, would largely influence the construction of new railroads by political agencies.

The question is somewhat different when railways are once constructed, but here also I think that all the details of equipment and operation, even of rate-making, are better organized now than they would have been by exclusively public action. The hope of private profit has everywhere been the strongest force making for economy and improvement of all sorts.

The real railroad problem in the United States appears to me to be that of the aims and methods of public control, rather than the question between public and private ownership and operation. The traditional policy of the nation, the rooted aversion of the people to the unnecessary aggrandizement of government, the splendid results which, in spite of great and unquestionable evils, have been achieved under private ownership and operation; these and similar considerations must long cause the question of the national purchase or operation of railways to remain a speculative one. A policy of control will be preferred as more elastic, permitting the trial of various methods, more in agreement with historical tendencies, and more probable of success.

The first aim of control is publicity. This underlies all else, is the indispensable condition of any successful public intervention whatever. It consists

in collecting, arranging, analyzing and communicating all those facts which throw light upon any matter with respect to which a question of control arises. There is required an adequate body of trustworthy information, collected and arranged in a uniform manner, and so presented as to yield its meaning as readily as possible. Publicity is not attained until facts are not only collected but communicated.

To begin with the facts themselves, publicity requires that the accounts of private associations carrying on transportation be trustworthy, and be kept throughout the country upon a uniform plan. The work of public statistical bureaus rests upon that of private accountants, and as long as the latter is diverse and unreliable the former can accomplish little. Public statistical agencies should have authority not only to prescribe forms of report to railroad companies and the like, but also to see that the facts in these reports are really prepared and inserted in a conscientious and scientific manner. The auditor's office of an important railroad is itself a statistical bureau of great extent, and it should be organized and conducted in the interest of publicity. There can be no sufficient knowledge of transportation, no adequate basis for deciding questions of regulation, so long as the work of these offices can be manipulated to private ends.

Public statistical bureaus connected with transportation have had a rapid growth since 1870, and a far greater growth undoubtedly awaits them. They should have power and means sufficient for their work and an adequate body of scientific statisticians, not only trained in the details of their work, but cap-

able of comprehending the vast forces and interests upon which statistical development rests, and of guiding that development in the best manner. There needs also a severer and more detailed criticism of work of this character on the part of the public, in order that the bad may be detected, the good appreciated, and statistics relieved from the reproach of slovenly and unscientific methods.

Aside from publicity the aims of control are, in general, two: to further a better organization of transportation, and to control the end or purpose of organization. The aim may be to benefit both the public and the private interests in transportation through a better adjustment of forces, or to prevent the public interest suffering to benefit the private. The former aim is the more important and embraces most of the practical problems of control. Rightly understood the case is not so much that of the public *versus* the railroads, as that of the public and the railroads *versus* disorganizing private interests.

The problem of control relates chiefly to those matters requiring a wider and more perfect unity, a better coördination of instruments and forces.

Thus, on the side of physical apparatus, the matters in which the need of government intervention is most felt are those in which uniformity is necessary. The general adoption of automatic couplers on freight cars, for example, is impossible without general agreement upon a uniform type of couplers, each of which will couple with every other. Moreover no individual railroad has an adequate motive to fit its cars with them unless other railroads are to do the same. Railroad companies acting singly are quite unable to effect this reform; and this

fact, admitted on all hands, has been the basis of national legislation on this and similar matters.

The same general principle holds with reference to unity of methods, of arrangements, particularly of rates. Efficient organization requires not indeed a mechanical uniformity, but that unity in diversity that results from adjustment to a common aim. As to the management of passenger and freight trains, the issue of tickets and bills of lading, and the like, the railroads of a country should make but a single system, an organized whole in which all should be done with reference to the general requirement of efficient transportation. At present it is not so; a considerable degree of unity has been attained, but much diversity and working at cross purposes remains.

In the matter of rates there is both the greatest need and the greatest difficulty of organization. Here a chief evil is competition in rates, a distinctly disorganizing force. It is here held that railroad competition, in the sense of competitive rate-making at a comparatively few important points of shipment, has no permanent and legitimate economic function within a railway system; that is it is justifiable, if at all, only on the ground that the time is not ripe for better organization. Those who have followed the chapter on the theory of rates will readily understand the grounds of my opinion that such competition is hostile to any adjustment of rates consistent with public policy. Competition among the parts of what should be an organized whole, in which each part has its own particular work to do different from that of every other part, is something without

a rational basis; it is simply confusion and disintegration.[1]

All over this field public control should be felt as a unifying force, working either through authoritative interference, or through publicity, which by discovering the existence and character of disintegrating forces often insures their suppression. Uniformity in equipments and methods should be urged and, when necessary, enforced. With particular fitness may public authority be called in to prevent a few recalcitrant private associations from hindering reforms that the great majority are ready to adopt. In such cases the principle of interference is analogous to the exercise of the right of eminent domain in constructing a road. The government supplies that coercive element that is necessary to

[1] I hold that there are two independent grounds for the fact, generally recognized, that competition is inadequate to the regulation of the prices of transportation. The first is that hinted at above, namely, the organic character of the industry. In proportion as any activity is organic, in the sense already explained, it is unsuited to competition. Competition means two forces trying to do the same thing; organization means that every force has a special work of its own. This is practically identical with the law of increasing returns, first advanced, I believe, by Professor Henry C. Adams, (Publications of American Economic Association, i, 523, *et seq.*) to explain the failure of competition in certain industries. An industry is subject to the law of increasing returns when it is susceptible of a high degree of organization. The amount of capital that will yield the greatest proportional return corresponds to the degree of specialization and unification of forces that the nature of the industry permits and requires.

The second ground is found in the familiar principle of natural monopoly. Railroad transportation cannot be sent to market but is fixed in place. The cases where two or more railroads offer equivalent transportation at the same place are and must be exceptional. Those who still hold out for the sufficiency of competition are driven back upon such (in my opinion) absurd schemes as that of competition among private trains upon the same tracks.

prevent a small minority of interests frustrating the just and proper aims of the whole.

Public control cannot advance far without holding in view some general theory of rates, such for example as that previously put forth in this essay, and working steadily toward it. The commissions, the legislatures and other public agencies cannot regulate railway charges to much purpose unless they themselves know what those charges ought to be. They may, perhaps, dispense with a minute knowledge of details, but in default of comprehensive principles to work upon, their labors must fail. A theory of rates is not a subject of vague and useless speculation, but is the practical need of the hour. The lack of any definite policy reduces public activity to mere criticism.

Perhaps only one point in the theory of rates is at present generally agreed upon—that there should be no discrimination among persons. This is, to be sure, the most important principle of all, and the work of surmounting the well known practical difficulties that obstruct its application should certainly be pushed to a successful conclusion.

To this should be added the principle that railroad competition for the business of large cities is a disorganizing element, inconsistent with the just or efficient performance of the function of transportation, and should cease to exist. The railroad industry is essentially organic, and in it the principle of unity must and should prevail. Its introduction should be not only permitted but encouraged and enforced. What is wanted is some form of combination that shall be stronger, more permanent and more comprehensive than pools ever were or could have become.

Merely voluntary associations, of limited scope and subject to dissolution whenever any member becomes dissatisfied, cannot meet the problem. Efficient railway organization must be associated with public control, yielding to it the power of ample and minute regulation and deriving from it a coercive authority over disintegrating elements within itself. The public control is needed to ensure that the enormous power of such a combination shall not be turned against the general interest. It is also needed because without some coercion over the members no permanent and effective combination would be possible.

But it would be a mistake to imagine that the railroad problem would be solved by doing away with personal discriminations and by the unification of transportation under public control. There would still remain the most complex question of all, the adjustment of rates among different places and different commodities. It cannot be said that any definite and comprehensive principle concerning this adjustment has yet been announced in legislation. The famous long and short haul provision of the Interstate Commerce Act and of many acts of state legislatures is not so much a principle as a rule of thumb, the setting of an extreme limit to the degree in which rates may disregard distance. It is negative rather than positive and only determines what, in certain cases, rates must not be, not what they must be. It can hardly be called a contribution to the theory of rates, however useful as a practical limitation.

In any case, therefore, the formulation of a comprehensive theory of rates and the cautious but persistent application of it by the exercise of public

authority, is indispensable. The question will no more settle itself under public than under private control, though the application of a principle once adopted will be easier. The aim of public control is the more perfect organization of equipment, methods and rates. Unification is desirable as the necessary condition of this better organization, rather than as an end in itself.

The question whether transportation should be controlled by local or general political authorities depends upon the extent of organization in the particular kind of transportation in question. Thus, street railways are best controlled by the cities whose local needs they serve; small country roads may be left to townships or other minor authorities; those of more general importance to the counties, while the state itself should care for the chief highways. And, as pointed out a few pages back,[1] the regulation of rail and water transport should be divided between the state and federal authorities.

Such questions as those of the precise character and powers of commissions and other political agencies charged with the regulation of railroads hardly belong to the theory of transportation. They belong rather to the theory and practice of administration.

[1] Page 134.