

U.S. Census Office. 9th Census, 1870.



# STATISTICAL ATLAS

OF THE

# UNITED STATES

BASED ON THE RESULTS OF THE

## NINTH CENSUS 1870

WITH CONTRIBUTIONS FROM MANY EMINENT MEN OF SCIENCE  
AND SEVERAL DEPARTMENTS OF THE GOVERNMENT

COMPILED UNDER AUTHORITY OF CONGRESS

BY

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JULIUS BIEN, LITH.

1874.

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STATISTICAL ATLAS

UNITED STATES

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# PREFACE AND INTRODUCTION TO THE STATISTICAL ATLAS.

BY THE COMPILER.

THE present work is a growth from the series of maps introduced into the quarto volumes of the Ninth Census. During the year 1871, the writer, as Superintendent of Census, had caused to be laid down in color upon outline-maps of the United States, the proportions disclosed by the enumeration as existing in the several sections of the country, between the aggregate population and its principal constituent elements. No originality of design was claimed in this mode of representation. These maps having been borrowed from the Census Office by Prof. D. C. Gilman, now President of the University of California, were by him exhibited at a Session of the American Geographical Society, eliciting expressions favorable to the application of this method to these and other subjects in connection with the Statistical Tables then about to be published.

In January, 1872, a Memorial was addressed to the Census Office by several Professors in the Sheffield Scientific School, recommending the graphic illustration of the census volumes. The subject having been brought to the attention of the Department, a communication was addressed, June 5, 1872, by the Secretary of the Interior, to the Speaker of the House of Representatives [Ex. Doc. No. 9, 42d Cong., 3d Sess.], inviting the attention of Congress "to the importance of graphically illustrating the three quarto volumes "of the ninth census of the United States, by a series of maps exhibiting to the eye the "varying intensity of settlement over the area of the country, the distribution among the "several States and sections of the foreign population, and of the principal elements "thereof, the location of the great manufacturing and mining industries, the range of cultivation for each of the staple productions of agriculture, the prevalence of particular "forms of disease, and other facts of material and social importance which have been "obtained through said census," and recommending an appropriation therefor.

At the same session Congress made an appropriation for the purpose here expressed. Under that appropriation 24 plates of graphic illustrations were incorporated in the volumes which appeared during that and the following year. The several subjects taken for illustration were as follows:

A Hypsometric Sketch of the United States, prepared by Prof. A. Guyot of Princeton College; with addition of intermediate level curves, by Prof. Chas. A. Schott, of Washington. (Pl. X, A, of the present publication.)

A Temperature Chart and a Rain Chart of the United States, being a reproduction of charts published by the Smithsonian Institution. (Plates V and VII.)

A Geological Map of the United States, compiled by Profs. C. H. Hitchcock and W. P. Blake. (Plates XIII and XIV.)

The remaining maps were prepared in the Census Office.

The following were the subjects taken for treatment. [The Arabic letters denote the page of the quarto volume of the Census, where the map first appeared. The Roman figures denote the Plates of the present publication, which correspond more or less fully to the maps as they first appeared.]

*Volume on Population and Social Statistics.* (25,000 copies.)  
The density of the Total Population, 1, (XVIII-XIX.)  
The Colored Population, 75, (XXI.)  
The Foreign Population, 297, (XXV.)  
The Germans, the Irish, 327, (XXVII, maps 1 and 3.)  
The Swedes and Norwegians, the English and Welsh, the Chinese, the British Americans, 343, (XXVIII, in part.)

Illiteracy, 393, (XXIX.)  
Wealth, 393, (XXXIII.)  
Area and Political Divisions of the U. S., 571, (XV.)

*Volume on Vital Statistics.* (10,000 copies.)  
Deaths from Consumption, 1, (XLI.)  
Deaths from Malarial Diseases, 145, (XLII.)  
Deaths from Typhoid, Typhus, and Enteric Fevers, 305, (XLVI.)  
Deaths from Dysentery, Diarrhoea, and Enteritis, 425, (XLV.)  
Hypsometric Sketch, 513, (X, A.)  
Temperature Chart, 579, (VII.)  
Rain Chart, 649, (V.)

*Volume on Industry and Wealth.* (15,000 copies.)  
Wheat, 81, (XXXVI, in part.)  
Corn, 121, (XXXVI, A, in part.)  
Cotton, 161, (XXXVI, in part.)  
Hay, 217, (XXXVI, in part.)  
Tobacco, 289, (XXXVI, in part.)  
Dairy Products, 369, (XXXVI, A, in part.)  
Geological Map (in pocket at end of Vol.), (XIII-XIV.)

The rudeness of the maps prepared in the Census Office, as thus first published, hardly requires apology. The writer had only begun to appreciate the capabilities of this method, which now opens before him, whatever way he turns, so that the hardest task is that of selection and rejection, while the art of construction and arrangement is one in which indefinite improvement appears to be possible. The public acceptance of this early effort at the graphic illustration of the statistics of the United States, was cordial in the extreme. In his Annual Report for 1872, the Secretary of the Interior recommended—

"That a Statistical Atlas of the United States, based upon the results of the Ninth Census, to contain a large number of maps, with appropriate text and tables, be "authorized, in an edition not exceeding five thousand, to be prepared under the direction "of the Superintendent of the Census, for distribution to public libraries, learned societies, "colleges and academies, with a view to promote that higher kind of political education "which has hitherto been so greatly neglected in this country, but toward which the "attention of the general public, as well as of instructors and students, is now being turned, "with the most lively interest. The exact knowledge of our country should be the basis "of this education, and it is in the power of Congress, by authorizing such a publication

"as is here recommended, to practically inaugurate the study of political and social statistics "in the colleges and higher schools of the land." (Report, pp. 15-6.)

In accordance with this recommendation, Congress, by Act of March 3, 1873, made the appropriation under which the present work is issued. The compilation was undertaken by the writer with a corps of able assistants, immediately upon the passage of the act cited, and the full results are now presented to Congress and the country. Freedom from errors in matter, and faults in style, is not claimed for the work; indeed, now that it lies finished, the Compiler can detect many blemishes, and could lightly promise to make it much better, were it to be done over again; but he trusts that, such as it is, it may be accepted as justifying the recommendation of the Secretary of the Interior and the action of Congress.

## ACKNOWLEDGMENTS.

In performing the duty with which he was thus charged by Congress, the Compiler has had the good fortune to secure the co-operation of two of the Scientific Services of the Government, and of several eminent gentlemen, to whose contributions especially, has he looked, to give character to this publication. The names of the official and private contributors to the Atlas will be found recorded in connection with their several Maps and Memoirs, and also in the Index immediately preceding this page. In addition to such mention, the Compiler begs to acknowledge his obligations for suggestions bearing on the general scope of the work, or for specific information and advice on mooted points, or for valuable Maps and Documents supplied upon request, to the following gentlemen:

Prof. Joseph Henry, Secretary, and Prof. S. F. Baird, Assistant Secretary, Smithsonian Institution, Washington.

Maj. Gen. A. A. Humphreys, Chief of Engineers, U. S. A.

Brig. Gen. A. J. Myer, Chief Signal Officer, U. S. A., and Prof. Cleveland Abbe and Lieut. Henry Jackson, U. S. A., of the Signal Office.

Prof. J. E. Hilgard, U. S. Coast Survey.

Brevet Col. J. J. Woodward, Surg. Genl's Office, U. S. A.

E. B. Elliott, Esq., Chief Clerk, Bureau of Statistics.

Prof. W. L. Nicholson, Topographer, Post Office Dept.

Prof. W. H. Brewer, New Haven.

Col. G. D. Harrington, Chief Clerk of the Census Office, has rendered much assistance by consulting the records of that office for information not contained in the published Census volumes.

The Assistants employed upon the work, besides those engaged solely in computations required for the paper on "The Progress of the Nation" and therein mentioned, have been Messrs. S. A. Galpin, formerly of the U. S. Census and Indian Offices, J. J. Skinner, C. E., and H. R. Elliot. Mr. Galpin has had charge of the correspondence arising in the progress of the work, has prosecuted special researches in connection with subjects, historical and statistical, under treatment, and has assisted in the delineation of groups upon the maps, especially those relating to population. Mr. Skinner has drawn, under the direction of the Compiler, all the geometrical figures, except those (Pl. XLVII-LIV) which were contributed by Mr. Wines, and has performed a considerable part of the computations required for these as well as for other graphic illustrations in Parts II and III. Mr. Elliot has been largely engaged in arithmetical computations, but has also assisted in plotting groups for the geographical illustrations. To these gentlemen is the Compiler indebted, not only for zeal and fidelity in the performance of their several parts, but for many intelligent suggestions respecting the details of the work, as its scope was gradually developed and its successive difficulties were encountered.

Mr. Julius Bien, of New York, has done all the lithographic work upon the Atlas. How he has done it, form and color in the result will tell without any words of the Compiler, who cannot refrain, however, from adding his acknowledgment of the patience with which Mr. Bien has submitted to frequent modifications and corrections of "copy," and of his zealous interest in the work which has made the Compiler's task sometimes less difficult.

The Compiler desires, on behalf of the Government and of himself, to acknowledge much courtesy and material assistance from the Governing Board of the Sheffield Scientific School, who granted the use of a room for the construction of maps, and afforded, from time to time, many facilities for this work.

## AN ACCOUNT AND TECHNICAL DESCRIPTION OF THE MAPS AND CHARTS.

The three Parts of the present publication contain together sixty plates, of the full single-page size. The highest plate-number is, however, the fifty-fourth, six plates bearing duplicate numbers. The division of this total between the several Parts is shown by the Index, preceding.

Of the sixty plates, sixteen are devoted to Geometrical Illustrations. In these, the special configuration of States and Sections is disregarded, and the statistical facts which form the subjects of the several charts are exhibited by lines and plane figures. Twelve of the sixteen are to be found in Part III, "Vital Statistics," the remainder in Part II, "Population—Social and Industrial Statistics." Some of these charts contain many distinct figures, the aggregate number being in excess of 1200.

The remaining forty-four plates are occupied by Geographical illustrations, the special configuration of States and Sections being here observed, and the statistical facts treated being exhibited by colors and shades of color imposed upon the surface thus presented.

In six cases, maps occupy each two pages. Five of these are found in Part I, "Physical Features," the sixth being the map which shows the Density of Population at 1870, in connection with Indian Reservations, Plates XVIII and XIX, Part II. In the case of seven plates, viz., XVI, XVI, A, XXVII, XXVIII, XXXVI, XXXVI, A, XXXVI, B, more than one distinct map is offered on a single page. In the case of the remaining twenty-five plates, the entire page is devoted to a single map. The whole number of maps, whether covering the United States or some smaller field, is, if we count that a distinct map which completes the representation of a separate subject (see the first page of Crop-Maps, Pl. XXXVI), sixty-nine. Of these, ten, occupying fifteen pages, are contained in Part I; fifty-three, occupying twenty-three pages, in Part II; and six, occupying six pages, in Part III.

The Map which has been used as the base for all the illustrations (excepting the River and Coal Maps) which occupy two pages, or one page for the Territory east of the 100th meridian (for example, those on Pl. XVII-XXIX), is that prepared in the Office of the Chief of Engineers of the U. S. Army.

We will first speak of those illustrations embraced in the present publication which we have termed Geometrical, to distinguish them from the Geographical illustrations, of which less will require to be said in explanation, whether of method or of result.

Mr. Wines has, in the first four of his charts of the afflicted classes (Pl. XLVII-L), made use of a method which the Compiler believes to be a novelty in the graphic illustration of Statistics. With Mr. Wines' sanction, the method has been applied in the construction of the Charts, Pl. XXXVIII, XXXIX, XLIII, XLIV (Parts 1 and 2). The limitations of Mr. Wines' method are obvious, yet, in spite of those limitations, its advantages are unquestionable.

The more familiar method of illustration is that made use of in Part 3, Pl. XLIV, where a series of perpendicular lines are cut at distances above the horizontal base line, corresponding to the proportions existing between the various statistical subjects to be represented. Thus, charts are constructed showing to the eye fluctuations in the volume of currency, in connection with movements occurring simultaneously in the prices of commodities; or, the changes of temperature and of humidity throughout the year are brought into contrast with the varying death-rate of the corresponding seasons.

The chief advantage of this method is that it enables the eye to make very minute measurements, at single points, of the dimensions of the different subjects under treatment. Thus, with a perpendicular of the length taken for the figure in Part 3, Pl. XLIV, a preponderance of one-half of one per cent. is easily shown. The limitation of this method is found in the fact that but a few subjects can thus be shown together, without the eye becoming confused and losing its clue, its *thread*, as it passes across the figure from side to side. The use of alternately light and heavy lines, of continuous, of broken, and of dotted lines, and the printing of lines in different colors, will do much to postpone this result; yet, after all is done that can be done to extend the capabilities of this method, it fails in representing any large number of statistical subjects together.

According to Mr. Wines' method, whenever a statistical subject consists of two parts approximately equal, as male and female, a perpendicular is erected, and from this bilateral ordinates are drawn, at equal distances from each other, the ordinates on one side being devoted to, say, the male, and the other to the female element, and the several ordinates, on the one side and on the other, being determined as to length by the statistical proportions to be represented. The end of each ordinate (away from the perpendicular), instead of being left "out in air," is connected with the ends of the ordinates next above and below, and thus a completed and closed figure is formed. A separate figure is devoted to each statistical subject, and comparison is made between the several figures *as to the general effect only*, since nice comparison by the eye, of part with part, is, of course, impossible. There are few persons who can distinguish differences of 2, 3, or perhaps even 5 per cent., in the lengths of lines which cannot be laid against each other. But where preponderances are decided, and it is sufficient for the purposes of the statistician to convey a general impression, this form of illustration has, the Compiler ventures to say, an advantage over any other yet proposed. The figures are neat and compact, each strikes the eye, as a whole, at once, instead of requiring the eye to pass now up and now down from side to side of a page, much of the impression of what has gone before being lost as each new portion of the figure is brought into view. And the number of subjects which can thus be drawn into ready comparison as to their general dimensions or proportions, is very large. Thus, on Pl. XLVII, Mr. Wines has presented 73 figures, each of which can be studied separately, or in turn compared by the eye, as to its main proportions, with any other.

Although the notes to the charts explain the construction of these figures, the explanations are yet necessarily so condensed that a few additional remarks may be of assistance. Let us speak particularly of the one just referred to, Pl. XLVII. The subject is, the Distribution of the Blind of the United States at 1870 and 1860, between the two sexes and among the several periods of life. It is known that many persons who are blind are not so set down in the census returns: while not a few of such persons may be omitted entirely from enumeration, yet it is believed that when so large a number as twenty thousand is taken, the proportions obtained therefrom will conform substantially to the law of the whole body.

The upper left-hand figure of all represents the distribution of this total of 20,313, the Blind of the United States. Ordinates are drawn on each side the perpendicular, for ten ten-year periods of life. The ordinates on the left represent the males, those on the right, the females. Each ordinate is drawn of a length corresponding to the number of persons of that sex and age, who are blind, the total having first been reduced to thousandths for convenience of expression, and the figures for the appropriate number of thousandths being set down, for convenience of verification or comparison, opposite the end of each ordinate. Now let us briefly discuss the figure. We find the lines which stand for the males and the females, severally, under 10 years of age, to be not far from equal, the liability of the sexes to blindness from birth being substantially equal, and the perils of the nursery and the playground being nearly the same for both, though still somewhat greater in the case of the boy than of the girl. Up to 20 years the same proportion holds, but after this period, the liability to acquired blindness becomes greater on the part of the male. Perhaps the man goes into the machine-shop, the furnace, the mine, where his eyes are incessantly exposed to destructive accidents; perhaps he works all day in the direct glare of the sun; perhaps he rides much on the cars, as passenger or as railway employee; perhaps he engages in riots on the street or fights in the saloon, and, through one or another of these means, loses his sight.

All the while, the woman is, in a degree, protected by her place, her occupation and her disposition, from accidents involving loss of sight. But after middle life, say at 45 or 50 years of age, the liability of the man begins to diminish relatively, that of the woman to increase. He is less actively employed, less adventurous, less reckless, less quarrelsome. The woman is perhaps no more quarrelsome, reckless, adventurous or actively engaged, but her patient sewing and darning through long years, trying at the best, and often with insufficient or unfavorable light, now begin to tell. Moreover, her greater tenacity of life after 50 operates to increase relatively the number of her sex living at the higher ages, and, by implication, the number of blind women at such ages. So that, we find the female side of the figure swelling out again after 50 years of age until at 70 the number of the two sexes becomes about equal, while after this, the females remain distinctly in excess. Thus we have, as a consequence, a figure which we may call "hollow-backed," as the type of *the blind population*, the males in excess on the whole, and their side being shaded to represent that preponderance.

The other figures on the upper half of this plate represent the blind of each State, by turns, at the same census, 1870. And here we note, together with many irregularities, an

almost unailing intimation of *the type*. The hollow-back appears in almost every case, though generally without the easy curve of the typical figure. Why these irregularities? Two reasons exist. The first is that the law of Average operates more effectively, the wider scope is given it.\* The second is that migration within the Union is constantly tending to destroy the proportions naturally existing between the several classes of the population. For example, Maine and New Hampshire are States from which there is constant emigration. The blind, however, as a rule, do not emigrate. The birth-rate of Maine and New Hampshire is also low (see Pl. XXXIX and XL). As the result of these two causes these States have not only a greater number of blind proportionally to population than new States, like Wisconsin and Minnesota, but also an unusual proportion of their blind in the higher ages of life.

In Pl. XXXVIII this method has been applied to the distribution of the whole living population by age and sex. Here we see how each 1000 of the inhabitants of the United States, and afterward of each State by turns, is distributed between the two sexes and among the eight periods of life taken. In a later series, on the Plate next in order (XXXIX), the Native and the Foreign populations are separately treated in the same manner.

The striking difference between the type-figures (the figures for the United States, in the upper left-hand corner of their respective groups) for the Native and the Foreign population is referred to and important use made of it a little further along in the text; but this difference is scarcely more striking than that which exists between figures of the same series: compare the lines which represent the number of children under 10 years of age in the Native population of New Hampshire and Maine with the corresponding lines for Minnesota and Wisconsin; note, too, how the preponderance shifts from the female to the male side as you go westward (cf. Pl. XXXVII). In the figures for the Foreign population, again, compare California with Massachusetts, Arkansas with Rhode Island. Observe that here the only figures in which the right side is shaded to denote an excess of Foreign females are those for the cotton-spinning and paper-making States of Massachusetts, Rhode Island, and New York, for the District of Columbia, where the population is highly exceptional, and for the polygamous Territory of Utah; and this last remark leads us to refer back to the figure for the Native population of Utah, in the preceding series. Observe that more than half the population is under 10 years of age. The study of these two pages will bring out to the careful observer a hundred points of interest. Observe, for instance, the "nick" on the male side at 30-40, in so many of the Southern States, telling of the unrepaired losses by the war. Especially compare the figures for Alabama, Georgia, Mississippi, and Virginia, with that for the United States.

On Pl. XLIII, the same method of illustration is applied to the distribution *by age and sex* (1) of the body of deaths for all diseases occurring in the United States, and in each State, during the Census year, and (2) of the deaths occurring within the United States from each of certain specified diseases and groups of diseases. Here, again, the upper left-hand figure of each group affords the type, while the conformity to, or divergence from, the type, in the figures which succeed, becomes significant of causes or conditions characteristic of the individual State, or of the special disease or group of diseases.

On Plate XLIV, parts 1 and 2, we have the same method applied to the distribution of the Deaths occurring during the Census year, by sex and *Month of Death*, (1) for the United States and for the several States, in the aggregate of deaths from all diseases, and (2) for the United States, in the aggregate of deaths for each specified disease or group of diseases.

One caution needs to be offered here. As explained in the paper of Mr. Elliott, presenting a Life-Table for the United States (Part III, Vital Statistics), considerable omissions take place in the returns of deaths in a Census of the United States taken under existing laws. This tendency to omission is clearly greatest in respect to those deaths which occur furthest away from the date of enumeration (June 1), which are, of course, the deaths of the June of the preceding year. Hence there would be anticipated, what the Census actually discloses, a deficiency in the returns for this month, a deficiency which it is not practicable to supply, or even to measure with certainty, yet which must be seen to exist. In the study of the figures on Pl. XLIV, therefore, the accidental deficiency in the deaths for June must always be held in mind. On this account, as well as for the better guidance of the eye in tracing the monthly ordinates across the page, the line for June has been made heavier than the others.

Part 3 of Pl. XLIV, forms the subject of a separate paper by the Compiler (Part III, Vital Statistics).

On Plates LI-LIV, Mr. Wines has shown the distribution of the afflicted classes according to sex, race, and nationality. Let us take the Chart of the Blind (LI), for description. Here the numbers of the Blind in the United States and in the several States are shown by proportional circles. The upper left-hand circle represents the total number in the United States, and the sectors of that circle show the parts into which that aggregate is divided by distinctions of sex and nationality.

If we may compare the radii of the circle to the hands of a clock (supposing these to be, instead of two, four, all of equal length), one hand, in these figures, always stands at six o'clock, and the others are moved around at various angles to it and to each other, to represent the distribution indicated above. Thus, to carry out our image: one hand standing at 6, another stands at just 11:30, the sector formed by the two hands containing 165 degrees of the circle, being the share of the Blind of the United States who are Native Males. A third hand stands at 12:20 o'clock, the sector formed by this radius and the one just mentioned containing 36 degrees of the circle, which represents the share ( $\frac{1}{5}$ ) of the total Blind who are Foreign Males. The fourth hand stands at 1:20 o'clock, the sector formed by this radius and the one last mentioned, containing 22 degrees of the circle, showing the share of the total Blind who are Foreign Females. Of course there remains a sector, to complete the circle, comprised between this last radius and the one that stands fast at 6, which sector contains 137 degrees of the circle, representing the share of the total Blind who are Native Females.

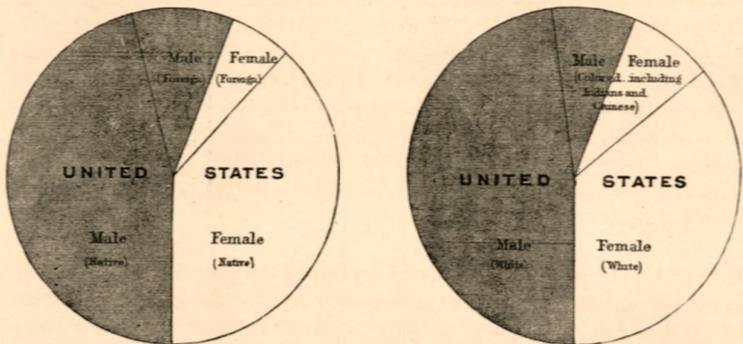
These sectors manifestly can be put together to form larger classes, either without the distinction of sex, or without that of nationality. Thus, to take the sectors in the order named, Nos. 1 and 2 represent the Male Blind, Nos. 3 and 4, the Female Blind. Nos. 2 and 3 represent the Foreign Blind; Nos. 1 and 4, the Native Blind.

The first horizontal series of smaller circles are constructed upon precisely the same principle, with the difference only, that the circles here stand for the blind in each State, by turns.

The large figure on the upper right-hand corner is constructed upon a similar principle with that in the left-hand corner, except that the sectors here represent the White Males and White Females, the Colored Males and Colored Females, while the second horizontal series of smaller circles show these classes of facts by States.

\* The same principle applies as between the figures for large States and for small States, where the second cause, *migration*, does not come in to disturb natural proportions. Note the extreme irregularity of the figure for Delaware. A population of 125,000 does not afford scope for the law of average to produce symmetry. When the mode of representation is applied to Territories, like Dacotah, Wyoming, and Idaho, with populations of 9,000-15,000, the figures resulting are of course shockingly distorted, a single mining or railway accident serving, in so small a field, to exaggerate or even to reverse the relations existing in the typical figure.

For convenience of reference, the two principal figures described are reproduced here.



The third horizontal series of circles on Pl. LI are intended to show, for each State, the increase of Blindness during the decade 1860-70, the inner circles being proportional to the number of blind at 1860, the outer circles being proportional to the number at 1870, and the rim between (showing the increase) being shaded for better effect.

The technical description here given of the Chart of Blindness, will apply to the three following. The Males are shown to be in excess among the Blind, the Deaf Mutes, and the Idiots; the Females among the Insane. The Foreigners are shown to be in excess of their proportion among the Blind and the Insane; the Natives among the Deaf Mutes and Idiots. The Colored are shown to be in excess of their proportion among the Blind and the Idiots; the Whites among the Insane and the Deaf Mutes.

Of the four remaining plates which are occupied by geometrical illustrations, the first in order, Pl. XX, is intended to exhibit the Constituent Elements of Population of the several States, at 1870. The scheme on which the diagrams are constructed, is there succinctly stated. It may, perhaps, facilitate their use, to show in detail how the figure for a single State is made up. Let us take that for the State of Missouri.

Here we have a square, proportioned to the population of the State, on the scale of 350,000 inhabitants to the square inch. This is divided by perpendicular lines into three rectangles of the full height of the square. That on the left-hand represents the number of persons living in Missouri who were born outside the United States. The central rectangle of the three represents the number of Colored persons living in Missouri; but this is divided by a horizontal line into two parts, the lower of which represents the Colored persons now living in Missouri, who were born in that State; the upper, the Colored inhabitants of Missouri, who were born in other States of the Union. There remains to complete the square, a rectangle very much larger than the other two combined, which represents the White inhabitants of Missouri who were born in the United States. This rectangle, also, is divided by a horizontal line into two parts of not very unequal size, of which the lower represents the White Missourians who were Missouri-born; the upper, those who were natives of other States.

While, therefore, the square is first divided by perpendicular lines into three rectangles of the full height of the square, two of these are divided by horizontal lines, so that the figure is finally constituted of five rectangles, representing the following elements of population:

Foreign	}	Born in the State.
Native Colored . . .		Born in other States.
Native White . . .	}	Born in the State.
		Born in other States.

Close by the square thus composed, and on its right, stands a rectangle of equal height, which, on the same scale (350,000 inhabitants to the square inch), represents the number of persons Missouri-born, who are found, by the Census, in other States of the Union. This rectangle, again, is divided by a horizontal line into two, the upper representing the Colored Emigrants, the lower, the White.

Such being the principle upon which these figures are constructed, some of the most important facts relating to the population of each State may be seen at a glance. Observe the width of the Foreign rectangle in some States and of the Colored rectangle in others. Observe how largely the Native White population of Kansas and Arkansas, of Iowa and Texas, and other States Northwest and Southwest, is made up of persons born outside the States in which they now live. On the other hand, note how small has been the Native White emigration from other States into the Carolinas, Maine and Virginia, and even in comparison with the States first named, into New York and Pennsylvania. Observe how differently the Colored populations of the States are made up in this respect; compare Louisiana, Texas, Arkansas, and Mississippi, with Virginia, the Carolinas, and Kentucky.

And turning to the rectangles which stand for the emigration from the several States, observe how strongly they are contrasted. Compare the figures for New York, Ohio, Vermont, New Hampshire, and South Carolina, with those for Kansas, California and Michigan. And still keeping our attention on these isolated rectangles, note how largely the emigration from Virginia has been composed of Colored persons; how largely that of Tennessee, of Whites.

In the Charts (Pl. XXXI and XXXII), devoted to Church Accommodation and the Occupations of the People, a different principle of representation was adopted. The States are here taken as equal bodies; that is, equal squares are taken to represent their population of 10 years of age and over. Inside each square, and symmetrically placed with respect to it, is another square which represents the proportion of the Chart-subject to such population. Thus, in the figure for any State, on Pl. XXXI, the sides of the inner square are to the sides of the square exterior to it, as the square root of the aggregate number of sittings in all the Churches of the State is to the square root of the population of 10 years of age and upwards. The interval between the two squares, which is shaded in black, is, therefore, in exact proportion to represent the share of the population over 10 for which sittings are not provided. It will be noted that in the figures for the States of Ohio and Vermont, the shaded margin disappears entirely, the aggregate Church Accommodation equalling the population over 10 years of age.

Next, the interior square is divided by perpendicular lines into rectangles representing the share of the total church accommodation which is provided by the churches of the several denominations. Four denominations, the largest, are separately shown in the figure for each State, and the remaining denominations are thrown together into a group, "all others," to form the right-hand rectangle (in every case but that of Nevada, where the four denominations separately shown exhaust the list). Ten denominations thus appear in the State figures. Three figures are added, one for the District of Columbia, one for the Northwest Territories, and one for the Southwest Territories. On the last appears a denomination not shown elsewhere, the Mormon, making the number of denominations appearing separately on the Chart, eleven. Of these, one appears 39 times; one, 34 times; one, 30 times; one, 22 times; one, 13 times; two, 7 times; one, 4 times; three, once.

A square for the United States is added, which is made, for convenience only, four times the size of the State figures. Here is shown the ratio between the aggregate sittings of the Churches of the country and the population over 10 years of age; while the interior square is divided to exhibit the eight largest denominations, three which are of importance enough to be represented in some one or more of the States not coming out in the United States figure.

Upon the same plan and on the same scale, the figures on Pl. XXXII are constructed to show the ratio between the population over 10 in each State and the number of persons who are accounted for, either as pursuing gainful occupations (criminal and shameful occupations being excluded from the census tables), or as attending School. The Interior Squares are here divided into ten rectangles, as follows:

Engaged in Agriculture, . . . . .	Male	Female
Engaged in Manufactures and Mining, . . . . .	Male	Female
Engaged in Trade and Transportation, . . . . .	Male	Female
Engaged in Personal and Professional Services, . . . . .	Male	Female
Attending School, . . . . .	Male	Female

Upon the principle of these Charts, the rectangles vary in size to represent the varying proportions in which the populations of the several States appear as engaged in the various occupations. In many cases, however, the females engaged in gainful occupations are so few as scarcely to be shown upon squares of this size. This is especially true of females engaged in agriculture in the Northern and Northwestern States; while at the South, where the negroes are in force, females appear largely in the department of agriculture.

The last remaining illustration of the geometrical series, the Fiscal Chart, Pl. XXXV, A, scarcely needs description. The Compiler will only explain why it was that the revenue and the expenditures of the several years were taken as equal, and only varied to show the varying proportions in which the total revenue was made up of receipts from the several recognized sources, and in which the total expenditure was directed to the several recognized objects: in other words, why the Chart does not combine both the *absolute* and the *relative* methods (see the title following, "Suggestions for the Study of Statistical Maps and Charts"). The reason was found in the enormous differences in the receipts of different years within our fiscal history, and still more, the differences in the disbursements of those years.

Thus, the receipts for 1866 were nearly 170 times those for 1792. If, therefore, the receipts for 1866 had been represented by the full width of the page, those for 1792 could have been allowed but one-ninth of an inch. On the other hand, the expenditures of 1865 were more than 400 times those of the period May, 1789, to December, 1791, so that, had the full width of the double page been given to the expenditures for 1865, those of the earlier periods would have been crowded into less than the fourteenth of an inch. Hence the Compiler felt constrained to adopt the relative method solely, showing in the figures themselves, only the proportions in which the Revenue and Expenditures were made up, each year, of the several parts recognized in the Treasury Reports, but adding the actual figures of receipt and disbursement, opposite the line for each year.

The Geographical illustrations, in general, require no verbal description and explanation, beyond what is given on their face. It is not the Compiler's intention to preach from them, as a text; nor does he assume that attention needs to be directed to their more obvious or their more recondite suggestions. Certain of these maps will be specially mentioned in this present paper. Others\* form the subjects of separate discussion by their Compilers. For the rest, the account given on the first page of the paper on the Progress of the Nation (Part II), of the method adopted in the formation of map-groups, according to a scale taken, will answer in substance.

There are, however, a few of these maps which, as we have said, require that their principles of construction be more fully stated and illustrated than it was found possible to do upon the plates themselves. These are, the Signal Office Maps (Pl. VI, VIII, IX, X), the Crop Maps (Pl. XXXVI, XXXVI, A), and the Pacific Coast Maps (Pl. XXXVI, B).

*The Signal Office Maps.*—The following is the descriptive text furnished by the Chief Signal Officer of the Army.

I.—CHART SHOWING THE FREQUENCY OF STORM CENTRES. (Pl. VI.)

This Chart is designed to show the frequency with which the centres of areas of low barometer (assumed to average fifty miles in diameter) have passed over any given district. It does not include local thunder or hail storms.

The Chart is constructed upon the following principles: supposing it to be divided into squares of one degree each, the determination of the frequency is arrived at by counting the number of areas of low barometer, as shown by the Signal Service Reports, to have passed over any designated square, or to have approached within twenty-five miles of it. The Chart shows the *annual* average as obtained from the records of the two years ending February, 1873. This chart is of interest in connection with all statistics bearing on the security of navigation, and on the habitability of a country, and the diseases that originate in the sudden changes of weather that attend storms.

2.—CHART SHOWING MEAN TEMPERATURES AT 4:35 P. M. OF THE HOTTEST WEEK OF 1872, AND AT 7:35 A. M. OF THE COLDEST WEEK OF THE WINTER OF 1872 AND 1873. (Pl. VIII.)

The distribution of heat is the controlling influence of all climates, and the data of temperatures are already well given in the chart of annual isotherms, published in the second volume of the publication of the Census Office,† but the knowledge of extremes of heat and cold at any point, in any one year, is of the greatest importance.

An extremely hot week, or even a hot day, has a very marked effect on human life; an extremely cold day or week is equally destructive.

This Chart is designed to show these extremes at any point, and is compiled from data furnished in the Signal Service Reports of the average of the maximum daily temperature for the hottest week of the year 1872, and the average minimum daily temperature for the coldest week of the winter of 1872-73. Thus, at Breckenridge, Minn., the average maximum daily temperature for the week ending July 13th, was 83° 7', while the average minimum temperature of the week ending December 21st, was -22° 4'.

The hot temperatures are shown by red lines, and the cold, by blue ones.

\* The Woodland Map, Pl. III and IV, is particularly discussed in Prof. Brewer's paper. The Coal Map, Pl. XI and XII, is described in Prof. Hitchcock's paper, and the Geological Map, Pl. XIII and XIV, in the joint contribution of Profs. Hitchcock and Blake. The Area Map, Pl. XV, is explained in Mr. Stocking's Memoir and the tables accompanying. The Eight Maps, Pl. XVI-XIX, are described and discussed in the paper on "The Progress of the Nation."

† Pl. VII, of the present publication.

## 3.—CHART SHOWING ANNUAL MEAN OF BAROMETER AND TOTAL MOVEMENT OF THE ATMOSPHERE, WITH RESULTANT. (Pl. IX, X.)

The Isobarometric lines, shown on the Chart, are for the year ending May 30, 1873, and are compiled by an approximate formula, but are yet sufficiently exact, when the uncertainty of the altitudes and reduction to sea-level is taken into consideration. The total movement of the atmosphere is for the year ending May 31, 1873, and is designed to show the total movement in each recorded direction, as shown by the Signal Service Reports, and the yearly resultant of the same. It is charted as follows: Take the total movement of northerly winds, as measured by the Robinson Aneuroimeter, and lay it off by the scale to the south of the initial point, do the same with the movement from the northwest and lay it off from the initial point to the southeast, and the same with the movements from the west, southwest, south, southeast, east, and northeast; connect the points and it gives the figures as shown on the Chart. The resultant is obtained by starting from the initial point and laying off to the south the total movement of north wind; from the end of this line to the southeast the same for the northwest wind; from the end of this to the east, the movement of the west wind; and finally, having plotted the eight courses, connect the initial point with the point at the end of the last course, and this line gives the resultant of the total movement for the year. This chart might be compared with the statistics relating to disease and the rainfall on the coasts.

*The Crop Maps.*—Pl. XXXVI contains maps which exhibit the range, and, within the range, the degree, of cultivation of eight crops. The process of forming the scale for these maps is briefly stated at the foot of the page. Pl. XXXVI, A, contains a map of the Corn Crop constructed upon the same principle. The other maps upon this page fully explain themselves.

These nine crop-maps, then, are constructed by the following rule. The number of bushels, bales, tons, or pounds (according to the unit of quantity appropriate to the special crop) produced in each county, is divided, first, by the number of inhabitants, and second, by the number of acres of improved land in the county; the two quotients thus obtained are multiplied together, and the square root of the product is taken as the measure of the productive power, in respect to that crop, of the county. This method of constructing a scale for crop-maps must be admitted to be somewhat arbitrary. The Compiler submits it to the judgment of statisticians; and in doing so, has only to say for it that he knows of no other scheme against which more objections have not occurred to him than against the one here adopted. His reflections and tentative computations have satisfied him that no simple ratio can be taken which will not in many cases grossly exaggerate, and, in other cases, as unjustly disparage, the importance of the crop to the county, and of the county to the crop of the country.

The *per-capita* test is notoriously unjust, as the *per-capita* product may, on the one hand, be brought down by the prevalence of manufacturing industry or the presence of commercial towns, and, on the other, may be enhanced by the mere fact of a partial settlement of a region, population being so scant as to be saved from the necessity of resorting to inferior soils. Nor does a section sparsely settled and producing an inconsiderable aggregate, though showing a high average yield, deserve to be ranked quite on terms of equality with a section all settled up, and, though with no higher yield for each inhabitant, pouring out each year a vast volume for export.

And yet, on the exact contrary of this, a sparsely settled county of Minnesota which produces 120 bushels of wheat for each man, woman, and child within its limits, with an undoubted capability of maintaining a rate approaching this with twice and three times as many inhabitants, ought not to be set down as of precisely the same grade of productive capability, in respect of this crop, as an Eastern county producing, in fact, exactly as many bushels to the square mile, but with a far greater laboring population. Hence, the test of *absolute production* seems not wholly satisfactory.

Even less satisfactory still, is the more usual test applied, that of *acreage*. Without reference to the breadth of land sown, the report of average yield per acre often affords a most fallacious representation of the productive power, in respect to a given crop, or of the actual contribution to that crop, of any region. The cultivation of any crop as a fancy-crop, or upon the more favorable soils only, may give results very much out of proportion to what would be, were that crop to be generally cultivated as an essential part of the industry of the people and extended over a considerable area.

The considerations thus briefly sketched, determined the mind of the Compiler to the adoption of the mode of constructing a scale for the crop-maps, which has been stated. It is believed that the two elements taken are those which have most importance in the connection, and that the plan of compounding them tends to reduce any extravagant excess of one element over the other, due to exceptional conditions.

*The Pacific Coast Maps.*—The *raison d'être* of Pl. XXXVI, B, will doubtless appear upon the most casual examination of the Atlas. To have extended the maps treating the various subjects exhibited on Pl. XXI to XXXVI, over the vast uninhabited tracts west of the 100th meridian, in order to take in the narrow areas of settlement on the Pacific Coast, would have required, either that the maps should be reduced one-half in size, or that one-half of them should be omitted. It was deemed far more expedient to bring together on a single Plate, both for economy of space and for readiness of comparison, such map-subjects as most concerned the Pacific Coast. This has been carefully done by Mr. Galpin, on Pl. XXXVI, B.

Ten small maps are here given. The first, counting from the upper left-hand corner, shows the areas of Pacific Settlement, as by the Census of 1850; the representation corresponding, therefore, to that given of the Atlantic and Mississippi Settlements, on Pl. XVII. The map on the right of the first mentioned, shows the Settlements of 1860; corresponding, therefore, to that on Pl. XVII, A. The areas of Pacific Settlement at 1870 having been shown on Pl. XVIII, it was not deemed necessary to repeat the representation here. The areas correspond substantially, however, to the colored portions of the maps of Foreign Parentage, German Birth and Preponderating Sex. It will be observed, that on each of those maps just named, the colored areas coincide exactly in extent, and that, in each, the outside limits of color are shaded off in faint black lines which indicate that the population outside is less than two to the square mile, which means, generally, no population at all.

Besides the two maps for 1850 and 1860, the eight maps of this Plate represent the constituents or the conditions of the population of the Pacific Coast at 1870. The map-subjects are in order, counting from left to right, as follows:—1. Foreign Parentage, corresponding to Pl. XXIV, for the country east of the 100th meridian. 2. Proportion of Foreign to aggregate population (Pl. XXVI). 3 and 4. Proportion of the Irish and the German elements, severally, to the aggregate population (Pl. XXVII). 5. Proportion of Chinese to aggregate population. 6. Preponderating Sex (Pl. XXXVII). 7. Illiteracy of the total population (Pl. XXIX). 8. The Wheat Crop (Pl. XXXVI, Map 1).

## SUGGESTIONS FOR THE STUDY OF STATISTICAL MAPS AND CHARTS.

The Compiler trusts that it will not seem presumptuous in him to say, that much study will be required, even on the part of those most accustomed to observe and discriminate, before the full significance of these Maps and Charts, even the simplest of them, will be exhausted.

The first faculty to be acquired, for the use of maps like the most of those presented, is that of distinguishing readily BETWEEN THE SHADES OF COLOR which mark the comparative intensity of the prevalence of the map-subject. With the eye uneducated in this special direction, there is a liability to accept the distinction between the colored and the uncolored portions of the map, as the great distinction to be observed, the student failing to realize that the positive difference between the regions where the element under representation is found in a degree so slight as not to call for coloring on the map, and regions in the lowest shade of color, is often, and indeed generally, much less than the difference between two groups next each other in the scale.

The Compiler has noted, in exhibiting those maps to many cultivated persons, that the tendency was almost universal, on the first glance, to dwell on the outline of all the groups as a body, without much reference to the distinction between the successive groups. And after this disposition has been mastered, one has still to acquire the power, not by a single effort, but by a process of education, of discriminating easily and accurately the several groups with a due appreciation of their comparative significance, in order to give the just effect to the stronger tones of the picture. The preservation of the lower grades will prove a hindrance and not a help to the comprehension of the subject, unless this caution is observed; but, with due consideration of this, the lower grades of color become not less interesting and significant in their relation to the uncolored parts, than the higher grades, in their place.

Let us turn for illustration of these remarks to Plate XXV. We have here first to realize the dense foreign settlements in the lower New England States, along the Hudson and around the shores of New York Bay, in the anthracite regions of Pennsylvania and at the junction of the Alleghany and Monongahela Rivers, across the central region of New Jersey, at the head of the Chesapeake Bay, along the shores of the Great Lakes from Rochester to Milwaukee, at the junction of the Missouri with the Kansas, of the Mississippi with the Rock River, and of the Missouri and the Mississippi with each other, and finally, at various points up the Ohio River. Anything that defeats this impression impairs the usefulness of the map, and if the lower grades of color are to be allowed to do this, it were better they should not appear. But it is possible, as has been said, to give these regions as distinct *relief* from the surrounding regions in color, as the latter receive without any effort of the mind, by reason of their strong contrast with the unstained page. When once this distinction between the higher and lower grades is effected, the extensive regions covered by a comparatively sparse foreign population, pursuing agricultural occupations, become suggestive of many economical and social considerations when viewed in contrast with tracts which are substantially destitute of foreign settlements.

Another distinction which needs to be held clearly in mind, for the study of most of the maps dealing with the statistics of population, is that herein drawn between the ABSOLUTE and the RELATIVE modes of representation. These are terms made use of for the highest convenience of expression, though not without liability to philological criticism, to indicate—the first, the exhibition of an element of the population, by itself, leaving out of account the general population and showing merely the number of that special element to the square mile, within the field depicted; the second, the exhibition of that element, no longer by itself, but in its proportion to the general population. It will be seen to follow, from these definitions, that very different regions may be colored, and the same regions be colored with very different degrees of intensity, in representing an element of the population by the one and the other method.

Let us refer, for illustration, to Plates XXVII and XXVIII. Here are five specific foreign elements, each shown absolutely and also relatively. Let us select the first of these, the Irish (Maps 1 and 2), and confine our attention to the State of Iowa. It will be observed that, on Map No. 2 (*relative*), almost the entire State is colored. This is because the Irish everywhere constitute, at the least, one to four per cent. of the population,—not an inconsiderable contribution to be made by one foreign element. On Map No. 1 (*absolute*), however, less than one-half of the State is colored. This is because, though the Irish form a noticeable element of the population, such as that is, everywhere throughout the State, yet, in the northwestern and south-central sections, the population is so sparse (cf. Pl. XVIII and XIX) that the number of Irish to the square mile falls below the lowest figures taken for representation by the absolute method, 36 of the counties of the State having less than 100 Irish each; and some, less than twenty. In the same way, many counties of Kansas are uncolored on Map 1, because the absolute number of Irish found in them is small; while these counties are colored in Map 2, because, sparse as their population is, it includes this element in a very appreciable degree.\*

This distinction between the absolute and relative methods of representing the constituent elements of population, must be borne constantly in mind in studying the series, Pl. XXI–XXVIII.

On the other hand, in the maps representing illiteracy, Pl. XXIX and XXX, the relative method alone is followed, illiteracy being nowhere shown as, what you might call, an accumulation or deposit, but exhibited simply as a feature, more or less prominent, of the actual population, be the same greater or smaller.

Again, in the maps devoted to wealth, public indebtedness, and taxation, Pl. XXXIII–XXXV, these facts are only shown as *per capita* of the population, without reference to the density thereof.

Thus, on the Wealth Chart, a Western county 30 miles square, having 9000 inhabitants, with a total valuation of \$4,500,000, would bear the same shading and make four times the show upon the map, as an Eastern county 15 miles square with a population of 18,000 and a total valuation of \$9,000,000. That is, the map, as it purports to do, only gives the amount of wealth to each man, woman, and child, in each section by turns, without reference to the number of inhabitants; consequently, it does not assume to show directly where the wealth of the country is. In the cases taken, the equal *per-capita* wealth of the two counties would need to be wrought with the numbers which represent the respective densities of settlement in the two counties, before we should have the positive amount of wealth for a given space upon the map.

It is to facilitate the reference so constantly required, to the density of population, that the series of "population-lines" have been introduced upon Pl. XXI–XXVI, XXIX–XXX, XXXIII–XXXV, XXXVII, XL–XLII, and XLV–VI. The lines thus imposed upon the maps which show the distribution of the Foreign and Colored elements, the prevalence of Illiteracy, the predominating Sex, the Birth-Rate, the prevailing Diseases, etc., are a reduction from the outlines of groups on the eastern half (Pl. XIX) of the map showing the density of population at 1870. The five groups there shown are consolidated into three for use in maps whose principal purpose is to show other elements than population. The consolidation effected is as follows:

GROUPS.	ON DENSITY MAP, PL. XIX.	FOR OTHER MAPS.	GROUPS.
I	2 to 6 inhabitants to the square mile.	} 2 to 18 inhabitants.	I
II	6 " 18 " " "		
III	18 " 45 " " "	} 18 to 45 inhabitants.	II
IV	45 " 90 " " "		
V	90 " and more " " "		

\* Opinions might easily differ respecting the comparative interest and usefulness of the two methods. In the quarto volumes of the Census of 1870, the elements of population were treated according to the absolute method only. The London Saturday Review, of January 26, 1873, intimates its opinion that "the proportion to population generally" should be shown, and not "the number on a square mile." The Compiler holds, however, that where a choice must be made between the two methods (as was imperative in the census volumes, on account of the limited number of maps), the absolute method is to be preferred. The first question to be answered by the graphic illustration of any statistical subject is, *where is that element found?* This question is answered directly by the absolute method, and only indirectly, and by comparison, through the relative method. Thus, in 1870 there were five millions and a half of foreigners in the U. S. Where were they? The third map of the "Population" volume showed where they were. And in like manner, the Geographical distribution of the specific Foreign elements and of the Colored element, was shown by the absolute method. Those who wished to ascertain the proportions which the several elements bore to each other and to the total population, could do so, only generally, it is true, and somewhat laboriously, by comparing the several maps with each other.

These population-lines are printed in blue over the maps showing the special elements, while the figures showing the number of inhabitants to the square mile, 2-18, 18-45, 45 + are stamped at convenient places within the groups so defined.

The advantage of ready comparison with the general facts of population will be obvious without illustration. Suppose we are examining the map of State, county, and municipal taxation, and our attention is for the moment attracted to the State of Iowa. We see there a number of counties in the western part of the State, in dense color, indicating the highest degree of taxation. The first impression is perhaps unfavorable. But the blue lines superimposed show that this section is as yet sparsely settled. Those people have come in from the older States, with sentiments and traditions requiring schools, bridges, and good roads. They believe these to be the best investment they can make of a considerable portion of their present earnings. They know the soil is capable of supporting ten or twenty times the population now upon it; they know that immigration is setting by tens of thousands a year into their State, and that those sections will be preferred which have to show, ready made, these attractive institutions. Consequently, with what we must call a wise prevision, they tax themselves heavily, through their town-meetings, or their County Boards, knowing well that they will receive back tenfold the money they now put into roads, schools, and bridges, through the enhanced value of their lands, in a near future.

Again, in the examination of the map showing the proportion of deaths from Malarial Diseases, the question cannot fail to arise, whether the diseases prevail most in regions very sparsely settled, where but little land has been broken up, where swamps remain undrained, and vast vegetable deposits lie decaying all around, or whether this prevalence is determined by causes independent of this single condition. For such a comparison, while reference will sometimes be required to the more minutely delineated groups of Pl. XIX, the population-lines traced on the special disease-map, will often answer the purpose equally well.

But the highest use of these Maps and Charts is when they are COMPARED WITH EACH OTHER, so far as their subjects are cognate in any degree, for the discovery of relations and proportions which can not be made to appear on any one map. The greater the number of maps which can thus be brought into comparison, the larger the result. Let us take an illustration of this use of the maps. In figure 3 of Pl. XLIV, is shown the distribution of the body of deaths resulting from certain important diseases and groups of diseases, among the several constituent elements of the population.

By this it appears that while the Blacks are but  $\frac{12.6}{1000}$  of the population,  $\frac{255}{1000}$  of the deaths from Intermittent and Remittent Fevers occur among this element; but while the Foreigners are not less than  $\frac{14.4}{1000}$  of the population, only  $\frac{28}{1000}$  of the deaths from this class of fevers occur among them. On the other hand, of the deaths from Consumption only  $\frac{11}{1000}$  occur among the Blacks, and not less than  $\frac{22}{1000}$  among the Foreigners. At first this seems to indicate very marked differences between these two elements of the population, as to liability to one and the other of these diseases. So it must be considered, if we look only at this plate (XLIV). But let us take Pl. XLI and XLII, which show the proportion of the total body of deaths, occurring in each section by turns, which result from Consumption and from Malarial Diseases respectively. Here we note that the range of these diseases is, to a certain extent, and even in a high degree, complementary. Where Consumption is most fatal, Malarial Diseases are, as a rule, least fatal, and *vice versa*.

Now, if the two classes of diseases from which, as we have seen, the Blacks and Foreigners suffer so differently, are thus complementary in their range, the question arises whether these two elements may not themselves be found to be complementary, in some degree, in their location. An examination of Pl. XXI and XXV shows this to be true, and in a striking degree. Speaking generally, where the Blacks are, Foreigners are not.

Here, then, after bringing together five plates, we reach the explanation of at least the greater part of the difference discovered in the two elements of the population in respect to mortality from the causes indicated. The Blacks die so largely of Intermittent and Remittent Fevers, because almost the entire Colored population is found within the fields where these are the prevailing forms of disease. The Foreigners do not die of these fevers for the best of reasons, because they keep away from the regions where these prevail. In respect to Consumption, the geographical relations of the two elements are reversed. Whether there still remains a difference in liability to one or the other form of disease, due to differences of stock, breeding, or occupation, is a question too large to be discussed here. We adduce this solely as an instance in illustration of the method to be employed in studying the maps and charts herewith presented.\*

Still keeping our attention fixed on figure 3, Pl. XLIV, we note that the lines representing the several Foreign elements all rise rapidly on the right of the figure, and almost run out at the top before they reach the last perpendicular line. What can be the reason of this? Are there any diseases from which the Foreign population have such marked exemption? Examining the titles on this figure, we find that the diseases on the right are children's diseases. Why do the Foreign nationalities represented among us make such slight contribution to the body of deaths from these diseases?

If we turn back to Pl. XXXIX we shall not fail of an explanation. In the series of figures numbered 3, it will be seen that in every State but Maine and New Hampshire, the line which represents the portion of the Native population under ten years of age, is longer, and generally much longer, than any other line in the figure. Such should be the case in respect to every community, if population is to be kept good. But when we look at the series of figures numbered 4, on the same Plate, devoted to the Foreign population, we find the line representing the first decade of life to be shorter, generally, than any other up to the period 60-70, and sometimes, as in Louisiana, South Carolina, and the District of Columbia, than even the line for the period 70-80; while the lines representing the period 20-30, and that 30-40, exceed that for the first decade sometimes in the ratio of 10 to 1, sometimes in a much larger ratio.

\* This and other of the questions suggested by the proportions disclosed in fig. 3, Pl. XLIV, are discussed in the paper on The Relations of Race and Nationality to Mortality (Part III, Vital Statistics).

Here we have a substantial reason for the vanishing of the "Foreign" lines towards the right of fig. 3, Pl. XLIV. Fewer Foreign children die of the diseases there represented, because there are but few Foreign children, comparatively, to die of them. Whether, over and above the proper effect of this cause, there is found in the proportions herein disclosed, any greater or any less constitutional liability to these diseases on the part of Foreign children, taking equal numbers, is a question not to be dismissed thus in a few words, but calling for a very careful analysis and comparison of the several charts.

Again, turning to Pl. XLIII, we note the surprising length of the lines which, in the figures for the New England States, particularly Maine, New Hampshire, and Vermont, represent the deaths occurring above the age of 80 years. Why is this? Is it a proof of greater longevity in a population of natural growth, or is it due to some disturbance in the relative numbers of persons in the several periods of life?

By turning to Plate XXXVIII, we have our answer in the figures which show, for the same States, the number of living inhabitants of corresponding ages. More people die above 80 years in these States because there are more people above that age to die. But why is the number above 80 greater, relatively, here than elsewhere? Again, other Plates, together with what is of common fame, must furnish the answer. Pl. XL shows the Birth-Rate prevailing at the present time in this section to be, as an average, the lowest known in the United States, while Pl. XX shows (by the width of the rectangles placed by the side of the squares which represent these States) that the emigration to other States out of the Native population has been very great. Thus while the earliest period of life is recruited very inadequately by birth, the attractions of new States are constantly drawing off the young and active, leaving the old in excess of the natural proportion.

Still again, just as a comparison of Pl. XXI and XXV shows the Colored and the Foreign elements to be in a high degree complementary in their location, comparison of the several small maps contained in Pl. XXVII and XXVIII, will show (if due regard be had, as has been explained, to the relative significance of the successive shades of color), that some of the special Foreign elements are also in a degree complementary in their location. Thus, a north and south line drawn through Buffalo will clearly leave about two-thirds of the Germans to the west and an equal proportion of the Irish to the east. A north and south line drawn through Lake Michigan will leave four-fifths of the British Americans to the east, but nine-tenths of the Swedes and Norwegians to the west.

Again, while Pl. XXIII and XXV both refer to the same period, 1870, a comparison of them brings a past generation vividly up to view.

Examine the uncolored space northwest of Harrisburg on Pl. XXV. On no considerable portion of this tract are there Foreigners enough to average 1 to the square mile. Yet Pl. XXIII shows that here are a sufficient number of persons of Foreign parentage to bring the whole tract up into the group "2-5 to the square mile."—Twenty, thirty, forty years ago, there was a considerable Foreign immigration into this region. Since then, the Foreign population has not been kept up and increased by fresh arrivals, while many of the first comers have been lost by death; but there still remain, to witness of the original immigration, a large number of American-born persons who are Foreign by one remove. Take, in the same way, the Group IV, southeast from St. Louis, on Pl. XXIII, and compare it with the Group II over the same tract on Pl. XXV. Forty and fifty years ago this region swarmed with Foreigners, French, Scotch, and English employes of fur and trading companies. Even the floods of recent immigration have not served to bring the number of Foreigners here above 4-8 to the square mile, but there are still found not less than 20-33 persons of Foreign parentage to the square mile, to testify of the old settlers and rovers, of trapping and trading days. But even more instructive will be found the comparison of Pl. XXIV and XXVI which show the proportion borne to the aggregate population, by persons of Foreign parentage and of Foreign birth, respectively. Compare the valleys of the Shenandoah, the Arkansas, and the Mississippi, as represented on the two maps, to bring out the still existing effects of a Foreign immigration in the past. The whole field of the Southern States is, indeed, a most interesting study in this view.

The above are intended merely as suggestions for the use of these maps and charts, and as illustrations of the relations which will often be found to subsist between them. In many cases, the connection of maps is obvious on the first mention of their titles; in others, the connection must be sought through a careful consideration of the reason of the case, and often by a series of tentative comparisons.

No reference has been made to the use of the Physical Maps in Part I, in explaining the facts of vital, social, and industrial concern which are represented graphically in Parts II and III. To exhaust this subject would require a volume; only to open it, an extended article. The relations to animal life and health, to vegetable growth and reproduction, and even to industrial development, which are sustained by temperature and humidity, both in their mean and in their extreme range and variability, by the pressure of the atmosphere and the movement of the air, by the character of the soil, its drainage and the extent of its tree-covering; these relations do not so much as need to be alluded to here, in justification of the inclusion, in a Statistical Atlas, of Maps illustrative of the physical features and meteorological conditions of the country. The Compiler trusts, not only that this juxtaposition of the two orders of facts will afford the true explanation of a vast number of phenomena seeming most strange and even contradictory of recognized causes in the political and moral constitution, but that an illustration, so large and varied, of the effects of physical influences upon the progress of population and the condition of society, may even serve to suggest to the physical geographer some possible modifications of his own generalizations.