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THE 1837 MAPS OF HENRY DRURY HARNESS

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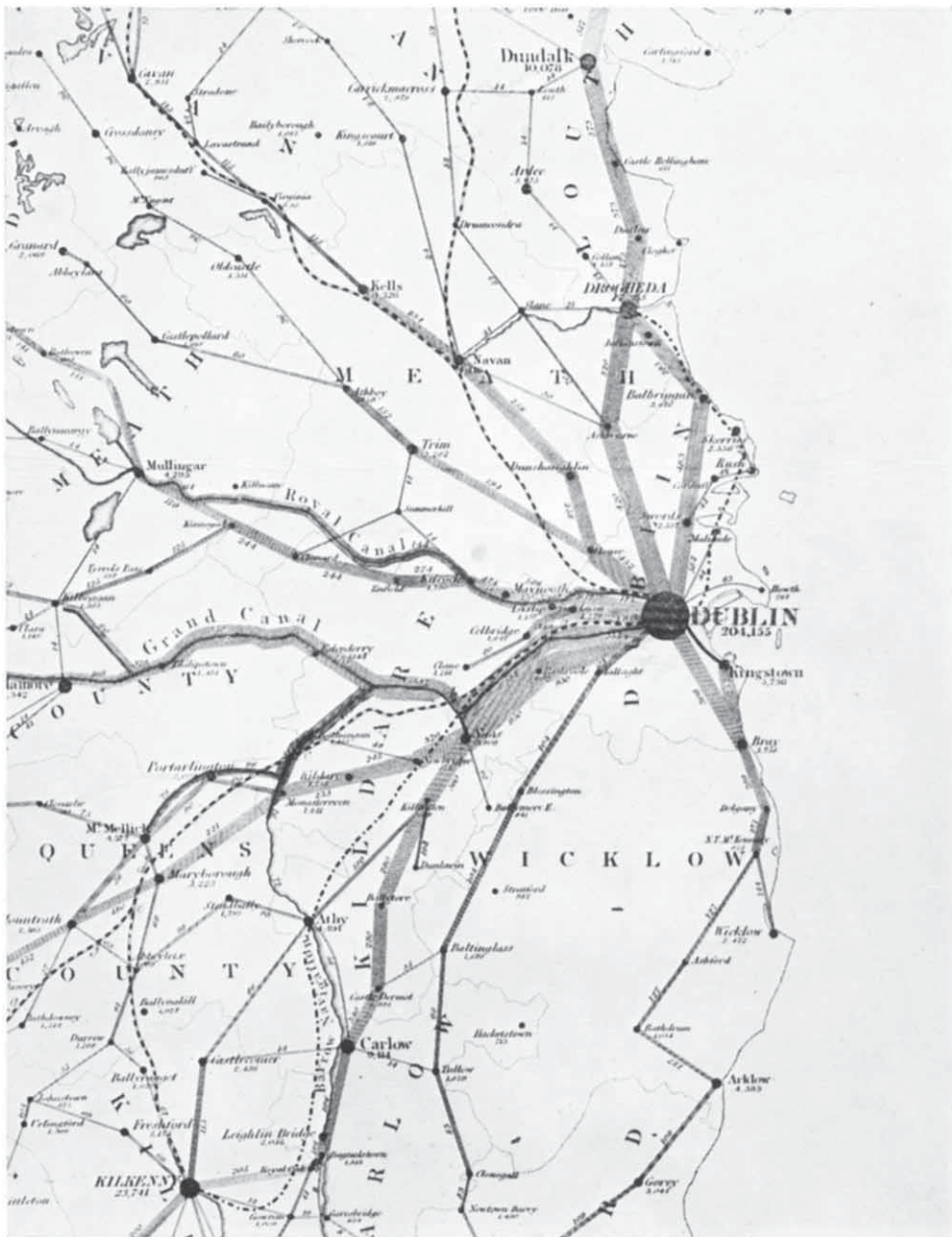
HISTORICAL CARTOGRAPHY usually concerns matters prior to 1800 and as a consequence the story of the beginnings of modern cartographic technique largely exists only in fragmentary outline. There have been, to be sure, numerous chronicles of the development of modern survey and the detailed mapping of the land, but the birth and growth of small scale or "geographic cartography" and its relation to other cultural change is fully as fascinating as the other elements of cartographic history. The methodology of small scale cartography is commonly assumed to have had a slow and steady development from crude beginnings to its present supposed high state. A cursory examination shows this not to be the case.

The period 1835-1855 might well be termed a "golden age" of the development of geographic cartography. Certainly this period witnessed one of the more remarkable "spurts" in development that has occurred in recent cartographic history. During this twenty-year period almost every technique now known for representing population numbers, distribution, density and movements seems to have come into being. The combination of the industrial revolution, the rise of mechanical transportation, the initiation of the great topographic surveys, the institution of censuses, and the proliferation of physical and social science investigation and education all combined to produce an environment in which geographical cartography would naturally flourish. This paper is not the place to examine in detail the origins of statistical and population cartography, but a short résumé of the status of our knowledge is appropriate.¹ Secondary sources are few and by no means complete.² For example, they tell us that no map of population distribution or density is known before almost mid-nineteenth century; flow maps are said to have originated in 1844, graduated circles on maps somewhat later; the dasymetric technique is supposed to have originated towards the end of the nineteenth century; and, with but a few exceptions, the statistical cartographic techniques are stated as having their origin on the continent. We can now trace our origins back somewhat further in these respects (and others), for each of these techniques was employed earlier in England on a series of maps which, in my opinion, qualifies as one of the more remarkable sets of maps ever made. They were constructed in 1837 to accompany the Second Report of the Irish Railway Commissioners.³

¹ This study was supported by the Graduate School of the University of Wisconsin. Research of this kind, conducted away from the main repositories of the source materials, is dependent upon the help of others, viz., Richard Dahlberg, research assistant, the reference staff of the University of Wisconsin Library, Professor Andrew H. Clark, and Professor Emeritus Howard Robinson. Especially helpful was Mr. R. A. Skelton, Superintendent of the Map Room of the British Museum.

² The best, to my knowledge, are: H. G. Funkhouser, "Historical development of the graphical representation of statistical data," *Osiris*, 3 (1938) 269-404 (contains a large bibliography); Max Eckert, 'Die Kartenwissenschaft' (2 vols.), Berlin and Leipzig, 1923-5; Étienne Jules Marey, 'La méthode graphique dans les sciences expérimentales et principalement en physiologie et en médecine,' 2nd Edition, Paris, 1885.

³ 'Atlas to accompany the Second Report of the Commissioners appointed to consider and recommend a General System of Railways for Ireland, Presented to both Houses of Parliament by Command of His Majesty,' H.M.S.O., Dublin, 1838. Two copies of the atlas are known to me—one in the British Museum and another in the Library of Congress.



Harness' Passenger Conveyance Map, 1837. Original, 1 inch to 10 miles: Brit. Mus.

Soon after the steam railway was shown to be a practical method of communication there occurred a rapid expansion of lines and branch lines, particularly in England and Scotland. Considerable confusion with respect to financing and the rôle of the state resulted. Thomas Drummond, Under Secretary of State for Ireland, suggested that a Railway Commission be established to study the matter for Ireland. In October 1836 the Commission was appointed with Drummond as its Chairman. The other Commissioners were Sir John Fox Burgoyne, Chairman of the Board of Works, Richard Griffith, the well-known geologist and engineer, and Peter Barlow, Professor of Mathematics in the Royal Military Academy at Woolwich. The Commission made a short progress report in 1837 and issued its final report in 1838. The Second Report was accompanied by an Atlas, which appeared late on account of engraving difficulties. It contained maps of various kinds among which were some described as follows: ". . . with a view of placing, as it were, before the eye a picture of the country, representing the distribution of its population and its traffic, whether of goods or of passengers, illustrative maps, *on a new design*, have been prepared, of which the construction shall be explained in treating of the subjects to which they relate."¹ In addition to the population and traffic maps referred to, the Atlas contained a smaller geologic map and two general maps of Ireland at a larger scale of 4 inches to 1 mile. One of these was hachured and contained boundaries of geological formations and the other was contoured, and they too are the first of their kind.² Everything considered, the maps made to accompany the Second Report of the Railway Commissioners were a remarkable group, but we shall pass over the ones which have received more appropriate recognition and concern ourselves with the three population and traffic maps which have been all but forgotten. Of these three maps our major concern in this paper is with the population map.

The author of these maps was Henry Drury Harness, R.E., who had a long and distinguished career of military and public service. During their preparation he was associated with some remarkable men and the time was one of rapid scientific development. Before considering more closely the author, his associates, and the cartographic environment in which the Harness maps appeared, we shall first examine the maps themselves.

The Harness Maps.—Harness prepared three maps for the Second Report of the Railway Commissioners, two of which were concerned directly with the population of Ireland. The third presented information concerning the movement of goods. All three maps are unusual in that they are, to my knowledge, the first to use several cartographic techniques, which have been improperly credited to others, and in any case the maps themselves have received almost no mention in the geographical or cartographical literature. That these maps had some influence upon the work of later cartographers seems most likely.

¹ Second Report, *op. cit.*, p. 3 (italics in quotation mine).

² The geologic map was the first of Ireland, see J. W. Judd, "The Earliest Geological Maps of Scotland and Ireland," *Geol. Mag.*, New Series, Decade IV, 5, 4 (1898) 145-9. The Commissioners felt the need of a general map since the triangulation for the National Survey of Ireland was complete at this time, but only about a third of the island has been covered with maps. Lieutenant Thomas A. Larcom, R.E., then the local superintendent of the Irish Survey at Mountjoy, was entrusted with the preparation of a general map at a scale of 4 miles to 1 inch and "it was due to him that the continental system of delimiting contours on maps was introduced into the Survey of the United Kingdom for the first time." See T. Pilkington White, "The Romance of State Mapping," *Blackwood's Edinburgh Magazine*, 144 (1888) 384-98, 548-64, reference on p. 556.

Each of the three maps bears the main title "Map of Ireland to accompany the Report of the Railway Commissioners" and the subtitles are as follows:

1. "Showing the relative Number of PASSENGERS in different Directions by regular PUBLIC CONVEYANCES."
2. "Showing the relative Quantities of TRAFFIC in different Directions."
3. "Showing by the varieties of shading the comparative Density of the POPULATION."

Beneath the title each map bears the statement "Constructed under the Direction of the COMMISSIONERS, by Henry D. Harness, Lt. Royal Engineers, 1837." The maps are drawn to the same size, approximately 26 × 32 inches, and to the same scale of 1/633,600 or 10 miles to 1 inch. The representative fraction does not appear. They were engraved by J. Gardner, Regent Street, London.

The background or base data of the maps is similar. Each contains the county boundaries as well as the principal towns and cities, all of which are named. The populations of towns having more than a few hundred inhabitants are also listed under the town names. Except for the very small ones, each town and city is shown by a shaded circle whose size is proportional to the population in 1831. Each of the maps has a legend, or "References," and a scale of statute miles. The legend is primarily for the purpose of making clear the distinctions between the symbols for the three categories of existing or projected railway lines which appear on each map as background data. The three maps are neither identified by number on their faces nor are they referred to in the Report in any way other than by title. Our primary interest at this time is in the population map but, before turning to it, it would be well to take a brief glance at the Conveyance and Traffic maps.

The Conveyance map was ". . . intended to exhibit . . . the relative number of travellers . . . conveyed in different directions throughout Ireland."¹ Plate 1 is a portion of this map showing the region in the vicinity of Dublin. The flow lines are shaded and the varying widths are properly proportional to the numbers that appear along them. These numbers are, in the words of the legend on the map, ". . . the average Number of Passengers conveyed in one Direction Weekly." The flow lines are, in general, drawn directly between connecting points, thus showing only travel between them rather than the actual route followed. This is a map of remarkably modern appearance, and it may come as somewhat of a surprise to contemporary traffic engineers that such a map was prepared over a century ago.

That Harness, or at least someone associated with the construction of these maps, was unusually ingenious is shown by the manner in which the data were derived for this traffic map. Harness wrote in his explanation that the map ". . . was constructed, almost exclusively, from data supplied by the Constabulary."² These data were gathered by means of what Harness called "blank returns," i.e. questionnaires. These questionnaires were distributed to each constabulary district and requested a description of the public conveyances noted as well as the average number of passengers in each for a one-week period. These were then evaluated against one another, since each report was duplicated by at least one other police station. In addition Harness obtained a list of the public conveyances in Ireland and

¹ "Report from Lt. H. D. Harness, R.E., Explanatory of the principles on which the Population, Traffic and Conveyance Maps have been constructed," Appendix III to the Second Report of the Commissioners . . . etc., *op. cit.*, p. 41 of Appendices.

² *Ibid.*

used the reports from the three largest "coach and car proprietors" in Ireland as a control. In his summary Harness stated that:

"... it is believed that the numbers given on the map are a tolerably correct average of the number of passengers conveyed weekly . . . and as the number of such passengers may be considered a very fair proportional measure of the whole number of travellers in any direction, the streams of shade [the flow lines], of which the breadths have been proportioned to those numbers, may be considered as conveying a faithful picture of the relative amount . . ." ¹ He did not allow the extremes of his data to ruin the visual effectiveness of his map, as has been the case with some modern counterparts. For example, he did not attempt to symbolize the extraordinary number of passengers travelling weekly between Kingstown and Dublin, but instead placed a note about it in the legend.

The Traffic map (Plate 2) is similar to the Conveyance map in design. The map shows internal and external traffic in merchandise by means of lines of variable width. Harness was, however, considerably less sure of his data compared to those for the previous map. He explained his procedure as follows:

"The returns employed for determining the inland traffic were obtained from the Constabulary; . . . Since, generally speaking, no reliance could be placed upon actual amounts . . . the direction of the trade was at first alone attended to, and a line for each stream of trade as reported by a Constable . . . was drawn upon a map; many towns, uniting to send their produce in the same direction, made these thick . . . and . . . the streams of produce on the Grand and Royal Canals, which were found to bear very nearly the same proportion to each other, that their traffic does, as exhibited in Porter's Tables, were taken as equivalent to the number of tons shown by those tables, to be conveyed by them; this supplied a scale; those streams for which anything like definite information respecting weight had been obtained, had their breadths corrected by that scale, and others were left unaltered." ² Thus wrote an honest cartographer.

The Population map (Plate 3) contains the same base data that appear on his other two maps and shows in addition the barony boundaries but without names. The rural population from the 1831 Census, or to be more exact, the non-city population, is shown by aquatint shading, the darkest being the most densely populated. About one hundred population density figures, e.g. 230, 280, etc., are scattered over the map in addition to the shading, in order, according to the legend, ". . . to denote the average Population per square mile on the parts where they are placed."

Harness intended that the shading should exhibit four categories of population density,³ but the lack of control over the aquatint process unfortunately caused the categories to shade somewhat into one another. For example, in County Meath the value 170 is placed on three different densities of shading, and the value 200 in County Wicklow is darker than 200 in County Wexford. Over much of the map the density class boundaries are sharply drawn and the intention of Harness is clear: but in other instances the density classes grade imperceptibly from one to another, and the boundaries separating them are consequently ill-defined. The figures of population density on the map were tabulated and plotted on a frequency diagram. A study of this diagram and a comparison of it with the map failed to reveal the class limits.

¹ See note 1, page 442 (opposite).

² *Ibid.*, p. 42.

³ Second Report of the Commissioners . . . etc., *op. cit.*, p. 3.

The density classes are placed upon the map by the dasymetric method. This method of representation employs areal symbols, e.g. shading, which are bounded by lines which neither correspond with administrative boundaries nor are isopleths. In the preparation of a dasymetric map one proceeds as follows: the administrative area (barony in this case) wherein there are obvious differences in density is divided in two parts. An assumption is made as to the density of one part and then, by a relatively simple equation, one solves for the density that must be accorded the remaining part in order that the two values so derived are consistent with the average density of the whole administrative division.¹

The positioning of the density class boundaries is inconsistent. In some areas the density class boundaries bear no relation to administrative boundaries, which is to be expected when the dasymetric technique is utilized. In other places, however, the class boundaries clearly coincide with administrative boundaries, as is usual when the choroplethic technique is used. Moreover, in certain instances the boundaries are irregular and appear not to follow administrative boundaries, but a comparison with a more detailed administrative map suggests that the method was perhaps actually choroplethic even though the lesser administrative boundaries do not appear on the Harness map. Whatever the appearance of the map may be, there is no question whatever that Harness employed, or tried to employ, the dasymetric technique. His own explanation states clearly the procedure he followed:

"The first map is intended to convey, at once, to the mind, an idea of the manner in which the population is distributed over the country; and for this purpose, the depth of shade applied to each part has been regulated by the density of population. The Parliamentary Census of 1831 gave the number of inhabitants; the Ordnance Maps, so far as they are published, gave the acreage of each barony; and for those not surveyed the Commissioners supplied the supposed areas. From these data, the number of inhabitants, per square mile, in each barony was determined, after deducting the population of the towns intended to be shown upon the Map, and the relative depth of shade for each barony was expressed by the numbers thus obtained. The towns are represented by dark spots, of which the areas are regulated by the number of their inhabitants.

"It was at first proposed to abide throughout by the principle just described; but the Commissioners having expressed a wish that something more detailed than shading, by baronies, according to their average population, should be attempted, they marked upon a map, such barren tracts of bog and mountain as they knew to contain but few inhabitants; assigning also, from their general acquaintance with the country, what they supposed might be assumed as the population, per square mile, in such parts. The population of each barony, containing a portion of these boggy and mountainous tracts, was therefore considered, after allowing a few inhabitants to the barren parts, to inhabit the remaining portion, and the population, deduced for that part, from the data thus furnished.

"In order that definite information, respecting the population of the country, may also be afforded by this map, the number of inhabitants, per square mile, in different parts, has been engraved upon it in figures, and also the population, in 1831, of the different towns."²

¹ See John K. Wright, "A method of mapping densities of population with Cape Cod as an example," *Geogr. Rev.* 26 (1936) 103-110, or Arthur H. Robinson, 'Elements of cartography,' Chapman and Hall, London, 1953, pp. 187-90, 239-41.

² "Report from Lt. H. D. Harness, R.E., Explanatory of the principles on which the . . . Maps have been constructed," *op. cit.*, p. 41.

The city populations in 1831 are shown on the map by figures under the names, and are also symbolized by spots or circles whose areas are proportional to their populations. This procedure does not apparently extend to the entire range of cities, for the very small ones are shown by what appear to be circles too large to be in proper proportion, and in addition many small places do not have population figures appended.

In spite of its defects this is a thoroughly remarkable map, as are the other two in this set, for when placed in the perspective of the period when they were constructed they stand as monuments of ingenuity.

Henry Drury Harness and others connected with the Railway Commission Report.—Henry Drury Harness was born in 1804.¹ He graduated from the Royal Military Academy at Woolwich in 1824, but no commissions being available in the Royal Engineers he went to Mexico as an engineer with a silver mining company. When a commission became available he returned in 1826 to accept it. He was a student at the Royal Engineers' School at Chatham for a short time and then went to Bermuda with the Royal Engineers until 1834. He was raised to the rank of Lieutenant in 1832 and in 1834 was appointed instructor in fortification at Woolwich, which post he held until 1840. In 1839, after his service with the Railway Commissioners, he was offered, and declined, the post of Surveyor General of South Australia. He was appointed Instructor in surveying at Chatham in 1840. Thereafter he served as Deputy Master of the Mint, Commissioner of Public Works of Ireland, Officer in charge of the Fortifications Branch of the War Office and Director of the Royal Engineers' School at Chatham. He was a man of amazing vitality and unusual integrity, and was frequently called upon to serve the government in tasks requiring these attributes, such as reorganizing the Mint or acting as referee in allocating funds in railway post office matters. He died in 1883 as General Sir Henry Drury Harness, K.C.B.

Other than the three maps which are the subject of this paper Harness' bibliography contains no entry which concerns cartography, geography, or statistics *per se*.² Certainly there is nothing in his background which would indicate any competence in small scale cartography. Why he was chosen by the Railway Commissioners to undertake the three maps is not known, but it is possible that it was a consequence of the appointment as a commissioner of the well-known investigator and mathematician Professor Peter Barlow. Professor Barlow and Lt. Harness were both teaching at Woolwich at the time. I have been unable to find any reference to Harness having exhibited any unusual statistical or cartographic talents prior to this time. In any case Lt. Harness performed his duties relative to the Railway Commission's maps with dispatch and apparently they were pleased with his work. In March 1838 he received a letter from the Secretary of the Railway Commission stating in part, that ". . . they [the Commissioners] have expressed

¹ Accounts of the life and accomplishments of Henry Drury Harness are contained in the Dictionary of National Biography, London, 1917, Vol. 8, pp. 1298-1300; T. B. Collinson, 'General Sir Henry Drury Harness, K.C.B., Colonel Commandant Royal Engineers, Royal Engineers Institute Committee,' London, 1903; Obituary: "Sir Henry Drury Harness," *Mon. Not. R. astr. Soc.* 44 (1884) 133-5; Memoir: "General Sir Henry Drury Harness, R.E., K.C.B.," *Roy. Engrs' J.*, 2 April 1883; also abridged in *Min. Proc. Instn. civ. Engrs.*, 1882-3, Part III.

² "On Contoured Plans and Defilade," *Papers on Subjects Connected With the Duties of the Corps of Royal Engineers*, 2 (1838) 75-90; "Description of a Small Observatory erected at Chatham, for the Use of the Officers of the Corps of Royal Engineers," *ibid.*, Vol. 7, 1845, pp. 64-8; "On Suspension Bridges," *ibid.*, Vol. 9, 1847, pp. 145-8. He was also author of a text-book on fortification popularly known as "Harness' Papers."

themselves highly pleased with the manner in which you have executed the maps, which cannot fail to be documents of high interest to everybody connected with Ireland.

"... The Commissioners have desired me to place to your credit . . . the sum of £200 which they think very reasonably due to you."¹ Such remuneration seems unusual to say the least, for £200 was the equivalent of many an annual salary in 1838. We may suppose that Lt. Harness was put to considerable expense in connection with his work, but unfortunately it has been impossible to examine the Corps records, the records at Woolwich, the Ordnance Survey records, or the record of disbursements of the Railway Commission. In any case the letter above was included in the lengthy memoir as evidence of the gratitude of the Commissioners and not as payment of expenses. If this be true Harness set still another precedent with respect to cartography that unfortunately has not been consistently followed—he was handsomely paid for his services.

Two questions present themselves: what was the state of small-scale statistical cartography at this period, and the corollary question, how could Henry Drury Harness prepare the maps he did in 1837? The early part of the nineteenth century saw the beginnings of national censuses and it is to be expected that the techniques of their cartographic presentation would have been crude. Contemporary textbooks on cartography ignored statistics, and wherever one looks, one rarely encounters even the simplest of statistical presentations. The decade of 1830–1840 saw the birth of many of the scientific and statistical societies in the British Isles, and, so far as I can determine, by 1837 none of them had published anything in its journal which might remotely have given guidance to one looking for cartographic ideas. The International Statistical Congress, which did concern itself somewhat with cartography, did not come into existence until the following decade. Prior to 1837 there had been published, to my knowledge, only a few statistical maps and none outside the continent. These few were crude and in no way match the sophistication of the Harness map.²

It is much more likely that the Harness maps were essentially new ideas, arrived at independently. It also seems reasonable to postulate that the design of the maps and the techniques used thereon were more a result of cooperative discussion and planning by the commissioners and their associates than the product of Harness alone. It must be emphasized that there is no direct evidence of this, but the commissioners and their associates were such an unusual group that it seems most likely.

Thomas Drummond, First Commissioner, was noted for his mathematical ability and ingenuity in connection with many things, such as, for example, the "Drummond Light" for geodetic work, or the devising of indices for proportional representation purposes for the Reform Bill of 1831.³ If Drummond had designed such maps, one would not think it unusual. Professor Barlow, "The representative on the Commission of the Science of the day,"⁴ and perhaps Mr. Richard Griffith,

¹ Letter dated 6 March 1838 to Harness, Lt. H. D., R.E., Woolwich, from Harry D. Jones, Secretary, Railway Commissioners, quoted in T. B. Collinson, *op. cit.*, p. 36.

² The first by Dupin appeared in 1819 followed by those of Balbi and Guerry in 1829 and Quetelet in 1832 and 1835. So far as is known there were no others. See H. G. Funkhouser, *op. cit.*, pp. 269–404, reference p. 298 ff.

³ Larcom, Thomas A. "Memoir on the Professional Life of the late Captain Drummond," *Papers on Subjects Connected with the Duties of the Corps of Royal Engineers*, 4 (1840) ix–xxiv.

⁴ *Ibid.*

could have had such novel ideas, but it intuitively appears more than likely that Harness may have received his greatest guidance from Thomas A. Larcom, then in charge of the Ordnance Survey Office at Mountjoy.

The evidence at hand does not permit this assumption, and consequently no purpose would be served by a complete listing of all the attributes and accomplishments of Sir Thomas Aiskew Larcom, K.C.B.¹ Born in 1801, he too was educated at Woolwich and joined the Corps of Royal Engineers. He began work with the Ordnance Survey in 1824 and went to Ireland in 1826. In 1828 he was made assistant to Colonel T. F. Colby, the Director of the Ordnance Survey. At the time the Railway Commission was performing its investigations Larcom was local superintendent of the Survey Office at Mountjoy, Phoenix Park, Dublin.² He was the cartographic author of the six-sheet general map and the geologic map prepared for the Railway Commissioners.³ This was ". . . the first general map ever made in Europe on which the ground was completely delineated as one whole."⁴

Larcom appears to have been a most unusual man. He was devoted to statistics and their quality, and his ingenuity in a variety of fields ranging from statistics to map reproduction, suggests that he is the most likely person to have advised Harness, not only on the cartographic techniques but on the statistical procedures as well.

It is not, on the other hand, the purpose of this paper to depreciate Henry Drury Harness who would have been, and was, a remarkable man had he never made the maps for the Railway Commission. Nevertheless, it hardly seems possible that one individual, who had no statistical or small-scale cartographic background, could by himself be the originator of so many new techniques all at once. Yet to my knowledge nothing remotely like these maps preceded them, nor is there any evidence whatever that anyone, including the commissioners and Larcom, advised or helped him beyond the obvious fact that they must have been closely associated in the Railway Commissioner's task.

Reactions to the Harness Maps.—The Second Report of the Railway Commissioners attracted considerable attention both as a document touching upon matters of great current interest (especially in Ireland), and as an example of careful and detailed investigation of a complex subject. The maps by Harness came in for their fair share of attention, and apparently there was, at the time, some appreciation of their novel character.

The Report of the Railway Commission was abstracted and presented to the Statistical Section at the Eighth Meeting of the British Association for the Advancement of Science, but in the printed abstract no mention of the maps was made.⁵ The same author prepared a much longer communication for the Statistical Society

¹ See Dictionary of National Biography, Vol. 11, pp. 584-6, and other references noted therein.

² White, T. Pilkington, *op. cit.*, p. 556.

³ Portlock, J. E. "Memoir of the Late Major-General Colby, R.E., . . . etc., with a sketch of the origin and progress of the British Trigonometrical Survey," *Prof. Pap. Cps R. Engrs*, New Series, 3 (1853); 4 (1855); 5 (1856). Reference in Vol. 4, p. xxiii; also Transactions of the Geology Section, British Association for the Advancement of Science, Newcastle Meeting, 1838, *Rep. Brit. Ass.* 8 (1838) 81, which reports in part "Mr. Griffith exhibited his new Geological Map of Ireland which had been constructed at the Ordnance Survey Office, Dublin, by Lieutenant Larcom . . ."

⁴ "Obituary of Sir Thomas Larcom," *Proc. roy. Soc.* 29 (1879) x-xv.

⁵ Rawson, W. R. "Abstract of the Report of the Railway Commissioners in Ireland," *Rep. Brit. Ass.* 8 (1838) 171-2. (Author's initials reversed.)

of London.¹ In this, considerable mention of the Harness maps is made and the author evidently appreciated their quality and novel nature, for he explains that "In illustration of this part of the Report, some beautiful maps on a new plan are given, which places before the eye a picture of the country, representing the distribution of its population and traffic . . ." Although it is not certain that Rawson exhibited the maps to the Statistical Society he did describe them sufficiently to give some idea of their character.

In 1838 a report to the Royal Geographical Society by the Society's Secretary, Captain J. Washington, R.N., had a reference to the recently published Harness maps. Captain Washington reported that "A curious statistical map of Ireland has also been engraved by Mr. Gardner, from a design by Lieutenant Harness, R.E., showing by a great variety of shade, but without colour, the density of population in the different parts of the island."²

It is reasonable to suppose that Rawson's lengthy abstract for the Statistical Society would have had wide circulation, and that anyone working in the field of statistical maps would have come across it. Consequently it may be assumed that knowledge of the maps was probably widespread at the time, but except for the Memoir by T. B. Collinson, no other reference to the Harness maps appeared in print for almost a hundred years, in so far as I am aware.

In 1934 a symposium on population maps was held at a meeting of the Royal Geographical Society. At this meeting Professor Andrew C. O'Dell contributed some remarks in the course of which he commented upon the Harness population map and the printed account in the *Geographical Journal* reproduced a section of the map.³ Professor O'Dell came across the Harness population map "purely by chance" while he was looking up the Second Report as a source in railway history.⁴ Neither Captain Washington's report of 1838 nor Professor O'Dell's report of 1934 were indexed in the *Journal* in such a fashion as to show either the name Harness or his population map. The Library of the Royal Geographical Society has never contained any of Harness' works, so it is not surprising that they remained almost unknown for nearly a century. To Professor O'Dell, who stated that "the map is a pioneer of population mapping and a tribute to the ingenuity of the author," should belong the credit for bringing again to light this remarkable map. Although the map itself was subsequently buried there is reason to believe that its existence was neither immediately forgotten nor without effect in the decade or so following its publication.

The mid-nineteenth century population maps of Augustus Petermann.—To Augustus Petermann is usually given the credit for the establishment, in the geographical literature, of the techniques of many kinds of cartography, and there is no question that he richly deserves much of this. Nevertheless, a review of the population cartography of this period suggests that Petermann learned many of the techniques he employed while in England, and further, it is likely that the Harness map was either directly or indirectly the source of some of them. So far as can be ascertained Augustus Petermann made no population maps until after he arrived in London

¹ Rawson, R. W. "Abstract of the Second Report of Irish Railway Commissioners," *J. R. statist. Soc.* 1 (1838) 257-77.

² Washington, Captain J. "A Sketch of the progress of Geography; . . . and of the Labours of the Royal Geographical Society during the year 1837-8," *Journal of the Royal Geographical Society*, 8 (1838) 237.

³ Fawcett, C. B. *et. al.*, "Population Maps: A Discussion at the Afternoon Meeting of the Society on 17 December, 1934," *Geogr. J.* 85 (1935) 142-59, Map facing p. 144.

⁴ Personal communication to the author.

MAP
OF
IRELAND

Prepared for the
RAILWAY COMMISSIONERS

BY
HARNESS

POPULATION

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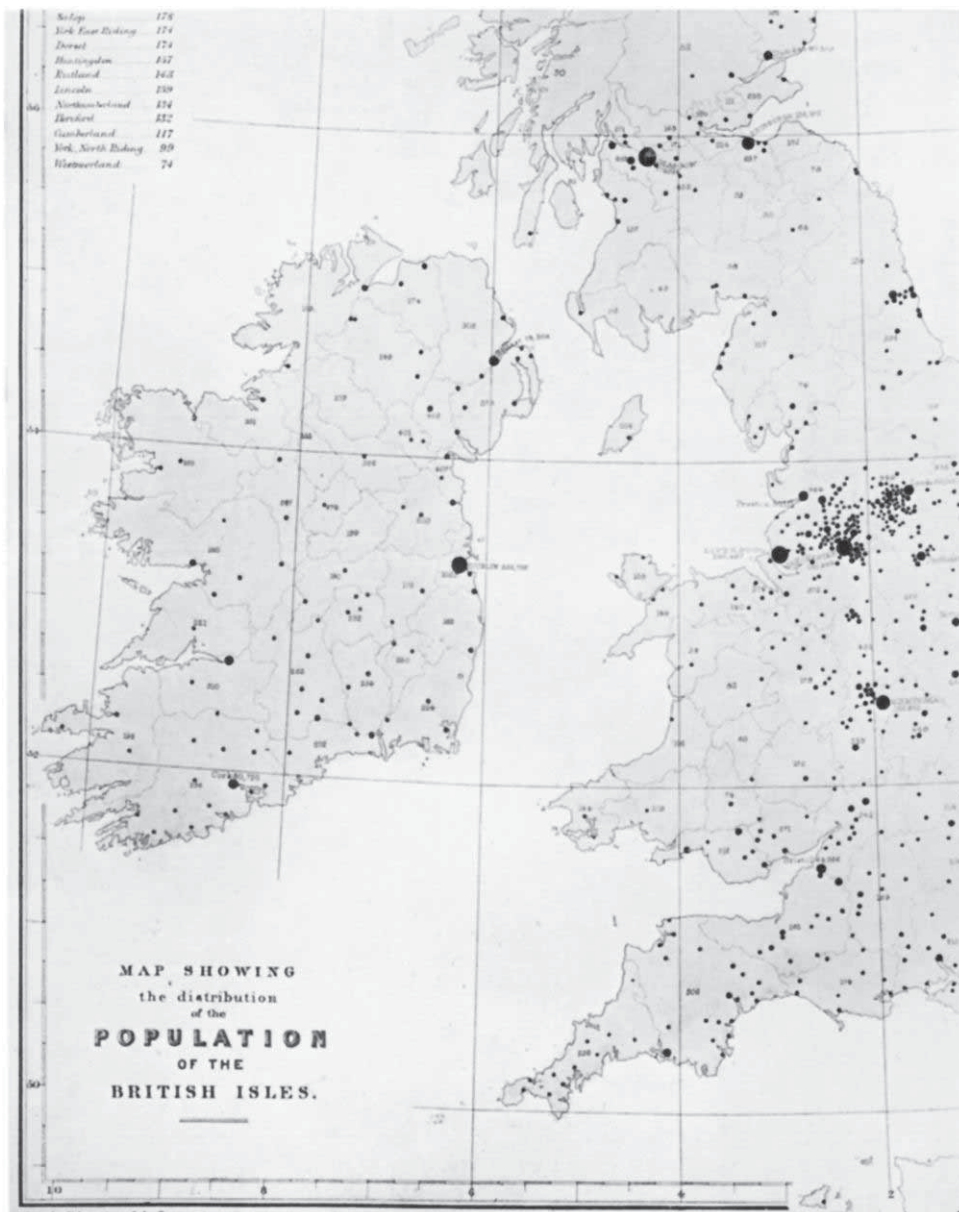
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Harness' Population Map, 1837. Original, 1 inch to 10 miles. Brit. Mus.



National Society's Map, 1851: designed by the Rev. Samuel Clark, drawn by Augustus Petermann. Brit. Mus.

from Edinburgh in 1847. His first population map was exhibited in 1848¹ and was published in 1849 as one of Petermann's Maps of the British Empire.² It is an engraved map with shading similar to the Harness map, and likewise has the densities noted on the map in addition to the shading. This is apparently the second shaded map of density of population ever to be published.

The next map of population to come from the pen of Petermann (Plate 4) was one which showed population densities of counties only by means of numbers inserted therein and showed city populations by dots ". . . the size of which is as nearly as possible proportioned to the population."³ The use of this technique of graduated circles for representing urban population on this map, and subsequent references to it, have resulted in Petermann's being erroneously credited with this innovation. In a footnote accompanying a later map of Spain on which he employed this technique, Petermann stated "All cities of the peninsula with over 5,000 inhabitants are indicated by black spots, the areal size of which corresponds as nearly as possible with the number of inhabitants." He points out the advantages of this technique ". . . which I first employed in the year 1851 . . . [on the National Society map.]"⁴ Later authors have construed this to mean that Petermann stated that he originated the technique on the National Society map. For example, Max Eckert terms such representation of urban population as being in the *Petermannscher Manier*, and cites the above source as evidence.⁵

Petermann may have learned of the techniques of graduating circles of city populations and shading by density categories in a variety of ways, assuming of course that he did not independently devise them. He may have learned of the Railway Commission maps by way of Rawson who presented the abstract to the Statistical Society of London. It may be assumed that Rawson and Petermann were acquainted since they served together as committee members of Section F (Statistics) for the Nineteenth Meeting of the British Association for the Advancement of Science at Birmingham, 1849. In any case, Petermann knew of the Railway Commission's larger general map because he used it in revising the map of Ireland of the Stieler Hand Atlas.⁶

¹ Petermann, Augustus, "On the distribution of the population of Great Britain and Ireland; illustrated by maps and diagrams," *Report of the Eighteenth Meeting of the British Association for the Advancement of Science* (Statistical Section), London, 1849, p. 113.

² 'Map of the British Isles elucidating the distribution of the population based on the 1841 Census,' Compiled and drawn by Augustus Petermann. Scale 1/1,600,000, Published by Wm. S. Orr and Co., July 1849. In the British Museum.

³ 'Map showing the distribution of the population of the British Isles,' Engraved by A. Petermann, 1851. Map VI, (b), in 'Maps illustrative of the physical, political, and historical geography of the British Empire . . .,' London, Published by the National Society for the Education of the Poor in England and Wales, London (probably 1852). The maps were also issued separately.

⁴ Footnote 1 (by Petermann) in T. E. Gumprecht, "Die Städte Bevölkerung von Spanien," *Petermanns geogr. Mitt.*, 2 (1856) 393. Author's translation.

⁵ Eckert, Max, 'Die Kartenwissenschaft,' Vol. 2, *op. cit.*, p. 156. It is clearly possible that Petermann may not have been averse to allowing the reader to infer that he was the first to use (on maps) the technique of the graduated circle (or *Schwarze Punkte*). The phrase he used ". . . die ich zuerst im Jahre 1851 . . . angewandt habe . . ." is ambiguous. But the chances are that if Petermann had wished to state that he originated the technique he would have italicized the *ich* or phrased it another way. Such an obvious ambiguity would not, it seems certain, have escaped him. In any case the credit for the innovation belongs, as far as I can determine, to Henry Drury Harness.

⁶ Petermann, Augustus, "Neue Karte von Ireland, im Masstabe 1/1,150,000," *Petermanns geogr. Mitt.* 8 (1862) 182.

Whether or not the techniques used on the Harness maps were carried forward by Petermann and others in no way detracts from the fact that the Harness maps, in the light of our present knowledge, stand as the first on which appeared a number of techniques. The list is impressive:

- (1) Graduated circles for city population.
- (2) Urban and rural populations on the same map.
- (3) Density of population (persons per square mile).
- (4) Flow lines to show movement.
- (5) The dasymetric technique.

It is not often that so many innovations have been presented simultaneously. It is, of course, entirely possible that other and earlier such maps have been similarly buried in government reports, but it is not likely that they attain the cartographic stature of the Harness maps.