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EXTREME VALUES IN THE WORLD POPULATION MAP

The greatest problem of the world population map in the 1/M scale arises in densely populated areas. Where only the geographical distribution of localities is involved, the difficulties are rather of a graphical character. However, even in Bengal, for instance, those 80,000 villages can be drawn upon a space covering 20 dm^2, while respecting, roughly at least, the geographical situation. The problem arises there where one has to make drawings that give a proportional idea of different sizes of the various communities as these vary greatly.

The statistical distribution of the population, as seen within the framework of communities or villages, is extremely unsymetrical reminding one branch of the rectangular hyperbola. Even if one placed the lowest possible limit on the largest unit and used it for all towns having more than one million inhabitants, one would have to divide the variation array against all rules into at least 200 classes in order to do justice to the actual variety. The maximum value would then show less than 100 cases while the minimum one, representing in this case, communities with less than 5000 inhabitants would show more than a million cases. Such a variation is, however, very difficult to draw uniformly on the millionth map.

In geographical literature the most attention has been paid to drawing the above-mentioned minimum units, that is, the rural communities. This is certainly due to the fact that they occupy a vast majority of the Earth's surface, as well as being due to the occurrence of very variegated forms of geographical distribution in which geographers are always more interested than in the abstract conception of size. But also the conference of UN European statisticians, preparing the 1960 census of the population, devoted its attention, first of all, to these smallest communities (2).

It is however true that the largest communities, that is, the cities having more than 1 million inhabitants, gather together only about 6 per cent of the world's population but these cities represent the greatest work of man on the Earth's surface and are doubtless the main centers of the economic and political activity. We should, therefore, try to draw them as geographically as possible even on the millionth map. It seems, however, that most geographers here are satisfied with a geometrical illustration as used by Steen de Geer in 1919 (3). The disproportion between the size of population and the space reserved for it on the map is here partly overcome by spheric expression, that is to say, by means of a fictitious third dimension. This manner of representation is declared to be a "graphical necessity" (A. Libault, 1952), and was also given preference by the Special Commission on a World Population Map at its session in May 1959 (6).

I plead for a more geographical depiction and a departure from the fiction of the third dimension. As for this, I accept W. Zelinsky's conception, suggested at the 17th International Geographical Congress (7) but would render the suggestion more accurate as to its quantitative aspect, and above all would try to express a uniform limitation of the area of great cities. As for the quantitative aspect I follow H. Smed's suggestion passed in 1952 at the same Congress (5).

It is known that no suggestion referring to the world population map was passed at the 18th geographical congress. H. Smed's proposal was to make a circle, 0,5 mm in diameter, representing 500 persons, stand for the unit of the cartographic picture of the population in the millionth map. This ratio is, first of all, suitable because it represents roughly a millionth of the world's population on a surface of 1 mm^2. It further represents the average density of population on a surface of 2500 inh/km^2. This is a relatively thinly populated surface as the dotting method here in question substantially represents the population of a built-up area. Its general average cannot be ascertained even in Europe but it seems that the number 2500 roughly corresponds to the population of the built-up areas in rural regions. For instance, for the most eastern region of Czechoslovakia (Prešov) the number for 1950 is about 3300 if we subtract its only town of 25,000 inhabitants.

That is why with great towns, the proportional circle will reach far beyond the suburban zone. In case of Moscow or Paris the diameter will be something more than 25 km reaching thus the river Kljazma or Oise respectively. This does not matter so much with such inland cities but it will be incorrect with towns situated on the coast where the majority of cities, having a million inhabitants, are located. Besides, such a circle will enter the area of many communities the number of whose inhabitants is not included in the number represented by the circle.

I tried to remove this disparity in my paper, presented at the 18th International Geographical Congress, according to which the analogical circle should include all the population living in the area covered by the circle on the map. This suggestion has further the following leading ideas: i) the size of the cartographic symbols should be governed by the largest city of the area under investigation; ii) the size of the symbol should not be chosen arbitrarily, but only according to the real ratio of that town's population with the population of its wide hinterland. This ratio can best be found out in Scotland or in Bohemia. The population conditions in Bohemia correspond better than in Scotland to the European average, and that is why the size of cartographic symbols should be proportionately determined according to Prague (4).

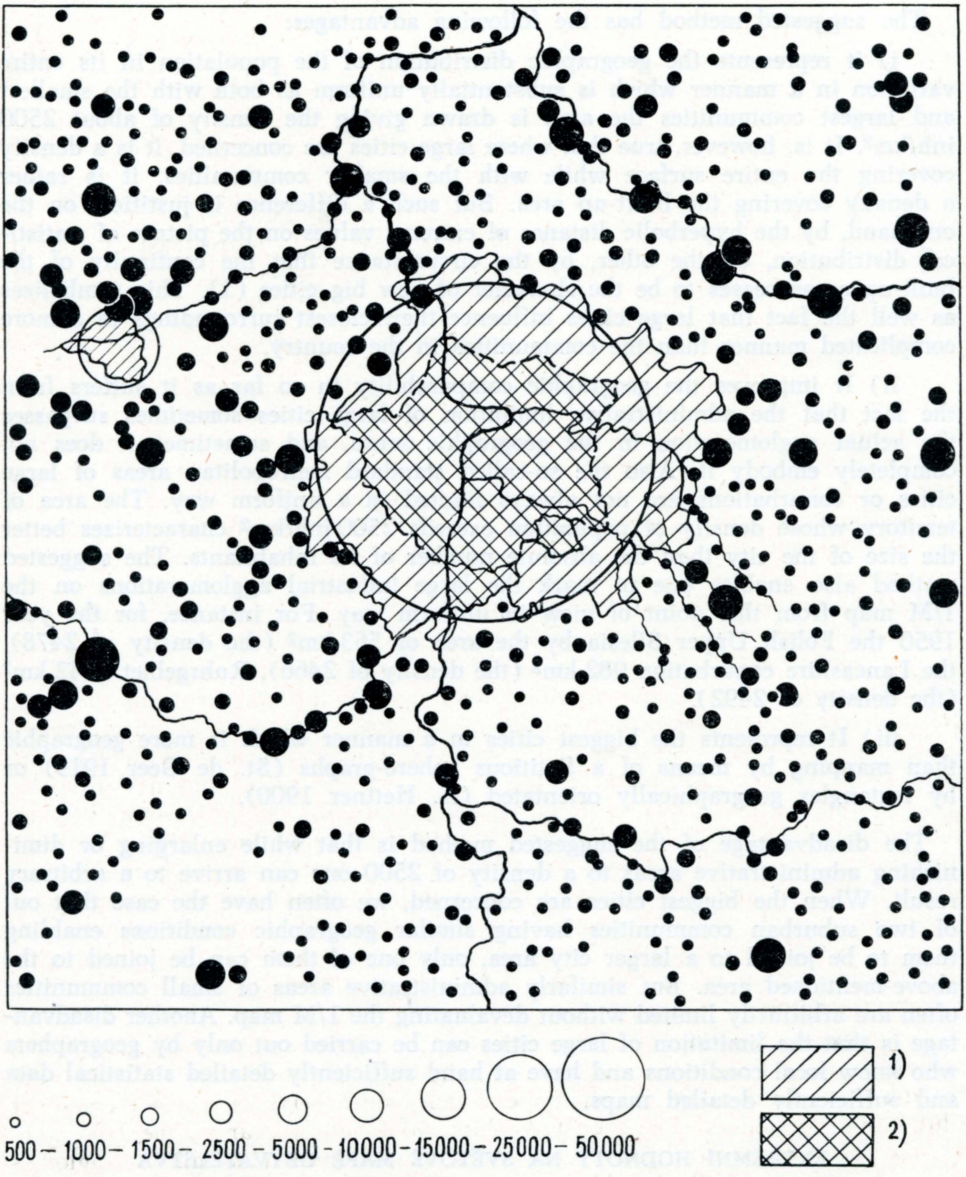
I consider the above-mentioned way to be correct from the statistical point of view for the average density of areas, limited in this way for 37 of the greatest Czechoslovak towns, shows an almost symetrical statistical distribution which is not attained with the usual indicators of density. This method, however, is not satisfactory from the geographical point of view for it schematizes the geographical reality through the geometric form of the circle so that it is difficult for it to be used with sea-side towns or towns on the frontier.

I suggest, therefore, that on the world population map another method be used for representing large cities than for other communities. These communities would be marked by the dotting method while the size of the circle would correspond to the ratio as suggested by H. Smeds. On the other hand, large cities, having more than 100,000 inhabitants, eventually 50,000 inhabitants, would be represented by choropleths within the framework of the communities (parishes, townships) but in such a manner as would at the same time represent the average density of population about 2500 inh/km^2. This requires that the administrative area of the city within the framework of communities and according to geographic and economic conditions would increase or

decrease to such an extent as to reach an average density of the value amounting to 2500 inh/km². For instance, according to the 1950 census, Prague had a density of 5426 inh/km² within its administrative area so that this area would be enlarged by 55 communities on a surface of 437 km² thus reaching an average density of 2531 inh/km². Similarly, as in Arhus for example, the administrative area would be enlarged by 65 km², in Buenos Aires by 1840 km², thus attaining an average density of 2461 and 2524 respectively.

On the other hand, Brno had in 1950 on its administrative area of 140 km² an average density of only 2042 so that this area would be reduced by four of the remotest suburbs on the east and south side thus attaining an average density of 2508 on a surface of 109 km². Similarly, for instance, Kraków, Hamburg, Los Angeles had in 1950 an average density of only 1862, 2149, 1686, so that their administrative area would be proportionately reduced for the suggested cartographic representation. To which extent this would occur, I cannot determine because of my lacking such detailed data or map. In certain cities the published statistical data may concern so great an area of administrative territorial unities, that looked for area with a density of about 2500 inh/km² will not be obtainable by addition or subtraction of disponible data concerning the area and the population. In this case it will be necessary to delimit on the map one or two of the largest unsettled areas on border of the city and to measure the area planimetrically. Such is the case of Bratislava. The centre of the administrative area for which the data for 1950 are published is so large (81 km²) that even its population does not exceed the density of 2500 inh/km². Such a density can be attained at only on a area of 58 km² which may be obtained by subtraction of the unsettled woodland on the northern and the agricultural territory on the eastern border of the city. In the case of certain towns it will be possible to take the administrative area without changing them for the year 1950. Odense, for instance, has on the surface of 41 km² a density of 2577, Mainz on the surface of 46 km² a density of 2482, while Helsinki 2488 on the surface of 162 km². Thus the difference between areas limited in such a way and having an average density of about 2500 inh/km² would be marked by shading. Where cities having more than a million inhabitans are concerned, it would be suitable to mark the difference in area and density of about 5000 inh/km² by a denser shading. One should, of course, point out in the explanation that the population of this area has already been comprised in the area having a lighter shading.

As an example of the suggested mapping procedure we enclose a map of the surroundings of Prague on a scale of 1 : 500 000. We chose this scale in order to be able to mark more clearly those details which serve only the purpose of illustrating the suggested method but which would not appear on the 1/M map. It is a question concerning the representation of Kladno. This miners' agglomeration had about 50 000 inhabitants in 1950, and it is a question whether one should make use of the suggested method even for such a size. That is to say, in such cases, the area under consideration is composed only of a small number of administrative units (in the case of Kladno there are six incorporated communities) so that the limitation of the area looked for with a density of about 2500 will be rather rough, if not a planimetre will be used. On the map we mark Kladno by both methods. The administrative area is therefore marked by a proportional but transparent circle. For the purpose of comparison we draw a similar circle also in the case of Prague.



Geographical distribution of the population in region of Prague. Scale 1 : 500 000. Areas in circles proportional to the number of inhabitants in the community. 1 — density of population about 2500 inh/sq.km, 2 — density of population about 500 inh/sq.km, interrupted — administrative boundary of Prague.

Zeměpisné rozložení obyvatelstva v oblasti Prahy. Měřítko 1 : 500 000. Plochy kruhů odpovídají počtu obyvatel sídla. 1 — hustota obyvatel okolo 2500 obyv./km², 2 — hustota obyvatel okolo 500 obyv./km², přerušovaně — administrativní hranice Prahy.

Географическое разделение населения в области Праги. Масштаб 1 : 500 000. Площади кругов соответствуют количеству жителей в населённом пункте. 1 — плотности населения около 2500 жителей на 1 км². 2 — плотности населения около 500 жителей на 1 км², прерывавная линя — административная граница Праги.

The suggested method has the following advantages:

i) it represents the geographic distribution of the population in its entire variation in a manner which is substantially uniform as both with the smallest and largest communities the area is drawn giving the density of about 2500 inh/km^2. It is, however, true that where large cities are concerned, it is a density covering the entire surface while with the smaller communities, it is rather a density covering the built-up area. But such a difference is justified, on the one hand, by the hyperbolic distance of extreme values on the picture of statistical distribution, on the other, by the circumstance that the continuity of the built-up areas ceases to be the character of new big cities (1). This symbolizes as well the fact that large cities influence their closest surroundings in a more complicated manner than the communities in the country.

ii) It improves the geographic comparability in so far as it suffers from the fact that the administrative limitation of large cities sometimes surpasses the actual agglomeration in the geographic sense, and sometimes it does not completely embody it. Also the so-called standard metropolitan areas of large cities or conurbations are not always limited in a uniform way. The area of territory whose density of population exceeds 2500 inh/km^2 characterizes better the size of the city than the absolute number of its inhabitants. The suggested method also enables one to mark the large industrial agglomerations on the 1/M map from this point of view in uniform way. For instance, for the year 1950 the Polish Upper Silesia by the area of 563 km^2 (the density of 2478), the Lancashire conurbation 982 km^2 (the density of 2466), Ruhrgebiet 1342 km^2 (the density of 2492).

iii) It represents the biggest cities in a manner which is more geographic than mapping by means of a fictitious sphere-graphs (St. de Geer 1919) or by rectangles geographically orientated (A. Hettner 1900).

The disadvantage of the suggested method is that while enlarging or diminishing administrative areas to a density of 2500 one can arrive to a arbitrary result. When the biggest cities are concerned, we often have the case that out of two suburban communities having similar geographic conditions enabling them to be joined to a larger city area, only one of them can be joined to the above-mentioned area. But similarly administrative areas of small communities often are arbitrarily limited without devaluating the 1/M map. Another disadvantage is that the limitation of large cities can be carried out only by geographers who know local conditions and have at hand sufficiently detailed statistical data and sufficiently detailed maps.

EXTRÉMNÍ HODNOTY NA SVĚTOVÉ MAPĚ OBYVATELSTVA

V referátě jde o to, jak na mapě 1 : 1 mil. zvládnout příliš velké rozdíly mezi nejmenšími a největšími sídly. Speciální komise Mezinárodní zeměpisné unie se ve svém zasedání v květnu 1959 vyslovuje pro metodu St. de Geera (1919), ale takové znázornění je málo zeměpisné. Lépe vyhovuje koncepce W. Zelinskyho (1952), ale po stránce kvantitativní je třeba ji doplnit. Vycházím v tom ohledu z návrhu H. Smedse (1952), aby jednotkou kartografického znázornění byl kruh o průměru 0,5 mm představující 500 osob. Tento poměr je vhodný také proto, že na ploše 1 mm^2 představuje zhruba miliontinu světové populace. Představuje však poměrně řídké zalidnění zastavěné plochy, takže u velkých měst proporcionální kruh zasáhne daleko za zónu předměstskou; u Paříže např. až k řece Oise, u Moskvy až k řece Kljazmě. Zasáhne do sféry mnoha obcí, jichž obyvatelstvo není zahrnuto do počtu, který tento kruh představuje. Kruhové znázornění je pak vůbec nesprávné na pobřeží, kde je většina milionových měst.

Navrhuji tedy, aby pro města s více než 100 000 (popřípadě 50 000) obyvatel se užilo metody relativní, ale fixované na hustotu zalidnění 2500 resp. 500 obyv./km². Areál města by se (podle obcí) zvětšoval nebo zmenšoval na tolik, až by průměrná hustota dosáhla hodnoty kolem 2500. Např. pro rok 1950 se u Prahy této hodnoty dosáhne až na ploše 437 km², tedy po připojení 55 obcí. U Brna nebo Bratislavy bude nutno administrativní areál naopak zmenšit na plochu 109 resp. 62 km². U Bratislavy se to nedocílí pouhým odečtením nějakých katastrálních území, ale bude nutno oddělit některá neosídlená území a jejich plochu vyměřit planimetricky. U některých měst bude možno pro rok 1950 převzít administrativní areál beze změny, např. u Helsinek (162 km²).

Takto vymezené areály by se na mapě odlišily šrafováním, u milionových měst by bylo vhodné odlišit dvakrát hustším šrafováním ještě plochu s hustotou kolem 5000 obyv./km². (Viz připojenou mapku, kterou zpracovala D. Chroboková.) Výhody navrženého postupu jsou: a) co nejvíce se zlepší zeměpisná srovnatelnost, která trpí tím, že administrativní vymezení měst není jednotné, stejně jako to nejsou ani tzv. metropolitní areály největších měst; b) správně se uplatní také velké průmyslové aglomerace, např. Horní Slezsko plochou 563 km², Lancashire conurbation 982 km², Ruhrgebiet 1342 km²; c) velikost území, jehož hustota zalidnění přesahuje 2500 obyv./km² charakterisuje velikost města lépe než prostý počet obyvatelů.

Rozpor z toho, že velká města se znázorňují jinak než ostatní obce, se netýká podstaty, neboť v obou případech se znázorňuje hustota 2500. Určitá metodická odlišnost je ospravedlněna hyperbolickou vzdáleností extrémních hodnot na obraze statistického rozložení.

ПРЕДЕЛЬНЫЕ ВЕЛИЧИНЫ В ИЗОБРАЖЕНИИ ЧИСЛЕННОСТИ НАСЕЛЕНИЯ НА КАРТЕ МИРА.

Статья решает вопрос, каким образом изобразить на милионной карте слишком большие различия между наиболее мелкими и крупнейшими населенными пунктами. Специальная комиссия Международного географического союза высказалась на своем заседании, состоявшемся в мае 1959 г., в пользу применения метода Стан-дэ-Иер (1919 г.). Но изображение по этому методу не удовлетворяет с точки зрения географической. Более подходящей является концепция В. Зелинского (1952 г.), но она нуждается в количественном дополнении. В этом отношении я придерживаюсь предложения Г. Смедса (1952 г.) принять в качестве основной единицы картографического изображения круг радиусом в 0,5 мм, представляющий 500 человек. Это соотношение удобно также потому, что на площади в 1 кв. мм получается примерно милионтая доля населения всего мира. Но оно соответсвует сравнительно небольшой плотности населения на застроенных участках; у крупных городов соответсвующий круг выходит далеко за пределы пригородной зоны: в случае Парижа до р. Уазы, в случае Москвы вплоть до р. Клязьмы. Он перекрывает ряд населенных пунктов, население которых не включено в число жителей, изображаемое данным кругом. Применение этого метода является совсем неправильным для изображения населения в прибрежной местности, где находится большинство милионных городов.

Поэтому я предлагаю применить для городов с числом населения свыше 100 тыс. (или же 50 тыс.) жителей относительный метод изображения, исходящий из плотности заселения 2 500 чел. на кв. км или же 5 000 чел. на кв. км. Таким образом, границы города перемещались бы (в соответсвии с границами административных единиц) так, чтобы срадняя плотность внутри ареала составила примерно 2 500 чел. на кв. км. Так, например, в случае Праги этой плотности было достигнуто на площади в 437 кв. км (1950 г.), после присоединения к городу 55-ти населенных пунктов. Напротив, при изображении городов Брно и Братислава, необходимо их площадь уменшить до 109 и 62 кв. км. соответсвенно. В случае Братиславы недостаточно просто исключить некоторые территории, но необходимо выделить незаселенные участки, определить их площадь с помощью планиметра. При изображении некоторых городов можно перенять прямо площадь определенную административными границами без каких-либо изменений (напр. в случае гор. Гельсинки — 162 кв. км).

Таким образом определенные площади можно отличить на карте штриховкой; при изображении милионных городов было бы полезным дополнительно отличить с помощью двойной штриховки также площади с плотностью населения около 5 000 чел. на кв. км. (См. карту, сделанную Д. Хробоковой).

Преимущества предлагаемого метода: а) резко улучшается географическая сравнимость, страдающая от того, что административные границы городов не исходит из единых принципов, что в одинаковой степени верно и для наз. метрополий в составе

крупнейших городов; б) станет возможным улучшить изображение крупных промышленных комплексов, напр. Верхней Силезии, площадью в 563 кв. км, Ланкаширской конубрации площадью в 982 кв. км, Рурской области площадью в 1342 кв. км.; в) размеры территории, в пределах которой плотность населения превышает 2 500 чел. на кв. км иллюстрирует величину города более рельефно, чем простая цифра численности населения.

Противоречие между изображением крупных городов и остальных населенных пунктов не затрагивает существо проблемы, так как в обоих случаях на карте изображается плотность населения в 2 500 чел. на кв. км. Некоторые методические различия вполне оправданы наглядностью изображения контрастов между предельными величинами статистической основы.

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