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Andrzej Gocłowski

A METHOD FOR ASSESSING RELATIONS BETWEEN THE PHYSICOGEOGRAPHICAL BOUNDARIES AND LOCATION AND GROWTH OF SETTLEMENT

Positive correlation between the course of physicogeographical boundaries and location as well as growth of the settlements has been known from time immemorial. The highly diversified natural environment[1] is often regarded as one of the main reasons why settlements lying close to such boundaries tend to develop better than others. This standpoint seems to be greatly right and well justified, but owing to methodological hardships of which geographers are generally well aware attempts to undertake even a simplified measurement of the strength such bonds are likely to have appear extremely seldom.

In Poland detailed cartometric and statistical research into some aspects of this area took effect primarily in the prewar time (e.g. on morphological and „fluvial" boundaries).[2] Later synthetic studies by M. Janiszewski having a much wider territorial extent (1968, 1973, 1982 etc.) contain, among other things, a pretty successful attempt to provide an overall evaluation of the strength the said bonds may exhibit by analysing the actual level of development of various towns against a background of their natural environments. Research by B. Dumanowski (1968, 1974, 1985) based on a specially designed method, cartometric and mathematical in its character, revolved about the effect mutability (i.e. differentiation) of the natural environment is likely to have on the density of population and settlements, taking Africa as an example.

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[1] Compare i.a. E.Ch. Semple (1911), G. Taylor (1951), M. Janiszewski (1968, 1973, 1982), B. Dumanowski (1968, 1974), K. Seibert (1978), cited partially from A. Gocłowski (1984); see references at the end of the article.

[2] Results of these studies corroborated, in general, particular position physico-geographical gradient zones had for settling (see e.g. B. Świderski, 1948).

Lake and river bank lines are regarded as „fluvial" boundaries provided they are within map scale delineations (where linear signs have been used for rivers, their centre lines must be used as a substitute), since they represent for man important boundaries separating two environments as a point where the level of water is meeting with the ground surface.

This method was later on used in the Department of Regional Geography, University of Warsaw, to elaborate a number of M.A. theses. These studies tend to corroborate, in general, that bonds postulated do exist in reality and make it possible, at the same time, to try to perform an initial hierarchization of the natural environment elements from the viewpoint of their spatial correlation towards the density of population and existing settlements.

In this paper a bit different, but very simple, method is proposed to grasp the relation that exists between physicogeographical boundaries and human settlements, based on the use of equidistant measurements on both sides of such boundaries. Within the reach of the established equidistances, measurements are taken of the quantities and values of interest, such as e.g. number of settlements, their density, etc. The physicogeographical boundaries of separate elements of the natural environment are assumed from maps covering such component elements, as the type and the number of separations being suited to fit our research. Accordingly, we are choosing first of all boundaries that represent in themselves striking gradients between areas separated, and also such as seem to influence settlements for some other reasons as well. Thus, for instance, when pondering geological boundaries, lithological criterion will weigh more than a stratigraphic one. Such a choice cannot, undoubtedly, lack a flavour of some bias, but it is hardly to be avoided in geography as such. What remains to be done under these circumstances is to follow only one's common sense with all the awareness of errors and falsifications likely to result from such a method of approach. While assuming thus modified boundaries, we are freeing ourselves from the hardships of their delineation. It does not free ourselves, by any means, from the need of considering the very essence of natural boundaries, as regards their spatial and time-related mutability in particular.

As it is well known, the physicogeographical boundaries exert pronounced impact on their natural environment within a specified, pretty wide belt (see e.g. Neef 1980, p. 84-87) thus giving as if a rise to a characteristic zone of influences. We think that a similar sort of interaction is also taking place between boundaries themselves and the anthropogenic phenomena, thus advancing territorially far beyond the map-established lines being actually nothing else but only the truly existing zone-to-zone delineation confines. That is why examining the ties human settlements may have with the physicogeographical boundaries, by means of an equidistant zone, is logically self-evident. The width of such a zone, say, of an order of a couple of miles, will largely depend on the actual scale of maps employed, on the accuracy of delineation and density of the bounding lines, etc. It has little in common with the zonal boundary whose width is, in addition, continually changing. To adopt such a zone of measurement is moreover advantageous in that all calculations may be refferred to the surface area, being thus comparable with other areas as well.

While proceeding with the research, an identical initial approach is assumed in regard to each component of the nature and its boundaries, as if each of them were identically important for the act of settlement. Later on, while basing on possible spatial coincidence of both phenomena under consideration, it will be possible to carry out hierarchization of such boundaries from the viewpoint of part they have been performing for the settling action.

It might seem obvious that, on the whole, the strength with which boundaries affect the settlement ought to be inversely proportional to the distance in which a colonist has built his settlement unit away from the boundary. Accordingly, if we set about investigating this phenomenon within a zone of even an arbitrary width, we should, in the majority of all cases, arrive at a confirmation of the postulated ties or bonds. In compliance with our guess, the arbitrarily demarcated equidistant zone ought to prove itself—in relation to the rest of the area under test—a developmentally preferable piece of the settlement land from the viewpoint of natural conditions. In fact, measurements taken have proved thereafter that the highest density of settlement occurred in those places, where the assumed zones of measurement had been the narrowest. The introduction of such zones, however, carries with it some serious inconveniences, too. The risk of committing measuring errors increases a lot, and the size of the set under investigation is getting narrower, with the effect that more erroneous results may thus be produced by incidence.

To measure settlement preference of the equidistant zone, we propose that dual-variant-indicators ($R_{1,2}$) are adopted for the purpose. They are built by calculating the ratio in which the density of settlement in the equidistant boundary zone (D_B) remains to its density in the remaining area (D_R; R_1), or to an average density of settlement for the territory under investigation taken as a whole (D_M; R_2). Indicators are therefore expressed by positive numbers with a theoretical span ranging from O.O to infinity and show how many times the density of settlement in the boundary zone is greater or smaller than that over other comparable areas. Corroboration of the hypothesis is hence taking place, when the resultant values exceed number one (e.g. $R = 1.3$; 5.0; etc.), and the higher are these values the more distinctive is this corroboration. No bonds demonstrate values close to ONE (e.g. 1.02; 0.96; etc.). Once the below-one values start to come near zero (e.g. 0.02), we have then to do with the inverse relations.

Indicators depend largely in their level on the width of the test zone. Comparative investigations of various areas ought to be performed therefore, among other things, by using zones of an identical width. Another postulate linked with it is that comparable cartographic materials ought to be used and that areas of an identical size possibly be compared. However, although no direct comparison of concrete values of indicators established for different areas is possible by using zones differing in their widths, it is possible to compare hierarchizations of importance particular boundaries may have for the settlement as indicating only order of succession in which the given type of boundary is listed for such areas hierarchized independently from each other.

The method presented herein has been verified against examples of areas resembling each other in their size (as e.g. Czechoslovakia, Hungary, the Soviet Republics of Azerbaijan and Armenia), by using maps of similar

Table 1

Index R_1 for Towns in Chosen Countries

Area \ Bounds	Rivers	Vegetation	Morphology	Lithology	Soils	Climate	Test Zone Width
$Armenia_a$	c	4.2	4.2	1.0	1.4	3.8	0.35 km
Azerbaijan	c	7.3	7.7	7.8	5.6	4.8	0.75 km
$Armenia_b$	9.45	1.4	3.1	2.2	1.2	0.9	2.35 km
Hungary	4.25	3.25	2.75	1.3	1.5	1.6	2.50 km
Czechoslovakia	3.5	2.2	1.5	1.4	1.4	0.9	4.00 km

a, b: Measurements taken for two different equidistant zone widths;
c: No data measured.

scales.[3] These countries differ a lot from one another as regards their natural, social and cultural background. Different widths of the test zones have been tried out as well. Table 1 presents, by way of example, the values of indicator R_1 as found for the towns in countries mentioned. Despite differences cited between these areas, there are also striking regularities speaking for the benefit of this method. One can feel everywhere the conspicuous role „fluvial" boundaries are playing in

[3] Chiefly against National or Regional Atlas data. Studies cited were completed under my direction by students of the Department of Regional Geography in 1981—1985: A. Bieszyńska, J. Golik, M. Grad and D. Smakulska-Kołeczek, who did this in connection with their M.A. theses, typed copies of which can now be available in the Department's Library.

these areas and approximately the same hierarchization of the importance boundaries of particular natural components have in this case.

The sequence is as follows:

rivers → relief/lithology/vegetation* → soils/climate*

* Varying order of succession within the same member.

Where also villages have been investigated (Armenia and Hungary), their ties with the natural boundaries are much less conspicuous than those in the case of towns, which seems to illustrate the towngenerating role of the boundaries (Table 2).

Table 2

Index R_1 for Total Settlement in Chosen Countries

Area \ Bounds	Rivers	Vegeta-tion	Morpho-logy	Lithology	Soils	Climate	Average for	
							Total sett-lement	Towns only
Armenia$_b$	3.25	0.85	1.7	1.8	1.0	1.15	1.6	3.1
Hungary	3.6	2.0	2.7	1.5	1.8	1.3	2.15	2.4

Having grouped the settlements according to the number of boundary zones for various components of the natural environment, passing through the settlement under observation, one can see how many of them are situated close to three or even more boundary zones. (Table 3). It appears that under all the factors that affect these values much to say has the density of boundaries in each area having been mapped (see table 3). A tendency should therefore prevail to try to compare materials that resemble each other in this respect.

Table 3

Towns in Chosen Countries against Boundaries of Natural Environment Components

Area \ Boundary Towns (per cent)	Number of Component Boundaries							Density of Boundaries, average km/100 sq.km
	0	1	2	3	4	5	6	
Hungary	2.9	4.5	19.4	16.4	20.9	28.4	7.5	15.8
Azerbaijan	7.1	24.4	22.8	20.5	18.1	4.7	2.4	13.6
Armenia$_b$	7.7	23.1	20.5	23.1	15.4	10.2	–	9.5
Czechoslovakia	12.6	28.8	29.4	17.5	7.4	4.3	–	5.4

The author of this paper is well aware of the numerous imperfections and drawbacks connected with the method presented herein. He believes, at the same time, that it is nevertheless of some value as an initiation of further research which with the lapse ot time, is likely to produce, much more unbiased and accurate results.

In the light of considerations so far it seems that despite major methodological hardships it would be worthwhile contemplating the ways of investigating into complex physicogeographical boundaries and into the effect they exert on human activities. It might also be interesting to see how these relations used to change in time and how they tend to accommodate, affected by the current social, economic and cultural circumstances.

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