

# Distance

Interval to cover in order to go from one place to another, distance has a meaning of separation, its covering requires effort, expense of energy. The mathematical definition of distance is restrictive: a measure of gap between objects is a distance if it is symmetrical, if it is not negative, if it is null only when two objects merge, and if it verifies triangular inequality. A space endowed with distance in the mathematical meaning is a metric space. Observed or cognitive geographical spaces are not metrical spaces most of the time (for example, the property of symmetry of the gaps between two points is not respected if there is a slope to cover, or if one-way regulations are imposed to traffic). The notion of distance in the broad meaning nonetheless remains used in order to designate gaps between places in geography.

Distance is measured by reference to a marker (distance to a centre, distance to a traffic route) or characterises pairs of places (spacing). It is one of the basic properties of geographical space: it allows defining situations of objects with regard to each other (relative position).

Most often, distance is estimated in terms of length units. But actors decisions are sometimes more affected by economic considerations: cost-distance is measured through transport cost, time-distance is evaluated in function of the duration required by a travel (around a centre, it may be represented by a set of isochronous lines). As geographical space is not isotropic, cost-distance and time-distance are generally not equal to the physical, kilometric distance.

In studies about mobility or diffusion, proximity is less measured in terms of physical distance than in terms of possibilities of contact, of information or of familiarity with places. Distance is then revealed by behaviours rather than established a priori according to a scale identical for all individuals (perceived distance). In general, distances in less well-known countries seem shorter than they do in familiar areas, perceived distance then varies in function of the logarithm of real distance. Perceived distance belongs to cognitive (or mental) distances, which are individual or collective psychological representations. In the same way, difficulties of contact between members of sociologically, culturally or ethnically different groups may extend distances: social or cultural distances may be expressed on maps by abrupt discontinuities of exchanges between places, on either side of quasi-insurmountable barriers. Topological distance is measured on a network reduced to the abstract outline of a graph, by means of the number of edges needed to go from one vertex to another. It is used in order to find which is the shortest path inside networks, or in order to look for an optimal location for service facilities.

Those different measures of distance may thus be used in order to define and measure accessibility of a place, as the sum of distances that separate it from all other places, weighted by cost, time or difficulty to cover each of them.

All human activities compose with distance: "deux objets ne pouvant occuper la même place, il y a une obligation d'espacement" (H. Reymond, 1981). The compromise between the desire for accessibility to a place in order to use its resources and the effort needed to cover the distance to attain it, determines a maximal reach of activities, which in turn generates a characteristic spacing between places that concurrently exert the same type of activity. This is for example how the central place theory explains regularity of spacing of cities, of average distances between urban centres fulfilling functions of the same level.

Through the expense of energy it implies, distance has as effect to limit frequency of travels. The cost of distance may represent physical hardness as well as consumption of energy or of time, its relative importance is as much greater as there are no rapid and powerful transport means available: the peasant who goes to cultivate his field, the one who goes to sell its production on the market most of the time follow the "principle of least effort" (Zipf, 1949) which enjoins to go to the closest place. For centuries, this "tyranny of distance" has weighted on all travels of humans. Still today and in many cases, despite the considerable growth of speed and of communication means, and despite the lowering of their relative cost (reduction of time-distances or contraction of time-space), mobility, exchanges, interactions, become all the more rare as the considered places are more apart.

Generally, frequency or intensity of interactions decreases more quickly than in linear function of distance (decrease following an exponential function or in function of a negative power of distance).

The dissuasive effect of distance on travels has as consequence formation of gradients of decreasing intensity. Many distributions which represent cumulated effects of past spatial interactions have concentric configurations, with an intensity very quickly declining in function of distance to a centre: this is for example the case with the curve of population densities or with the curve of land prices in an urban area.

## Bibliographie

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