Spatial interaction

Although the notion of spatial interaction plays a central role in the definition of contemporary geography, it is extremely difficult to define, so various are the definitions that have been proposed for it. An attempt may however be made to make a rough classification of these definitions in order to distinguish between what constitutes the heart of the notion, and what points to extensions of it and the theoretical issues it raises.

-1. The spatial interaction and gravity model. A definition quite frequently used in Anglo-Saxon literature reduces the notion of spatial interaction to the phenomenon of the decrease of flows with [distance](). Observation of migrations at the end of the nineteenth century quite early led several authors to bring to light empirical laws (Ravenstein) which were later related by analogy to laws of universal gravitation. Gravity models which suppose that the volume of interaction between two places depends upon the weight of emitting and receiving places and upon the inverse of square of distance between them (Stewart) may be considered as precursors of a more general theoretical formalisation of flows, currently gathered under the term 'spatial interaction models'.

-2. Interaction models and position models
Whereas strictly speaking, spatial interaction models concern the study of actual flows that are developing between territorial units during a period of time, many authors tend to link them with a set of position models (Fustier) which do not describe relationships between two places, but rather the relative position of a place with respect to other places. Computation of the potential of a place relies of course on consideration of an assumption of spatial interaction (a form of decrease in the probability of relationship according to distance), but fundamentally it constitutes an accessibility measure aimed at assessing the variation of the amount of relation opportunities as a function of position. Reilly and Huff models, which aim at determining the theoretical market areas of a set of central places, also belong to the category of position models, as their purpose is to describe places (belonging to a market area) rather than directly depicting relationships between places.

-3. Spatial interaction and territorial interaction
For some time, the first interaction and position models postulated that there was a simple mathematical relation between the physical remoteness of places (measured by a continuous metric) and the volume or intensity of relationships which did or could develop between them. The spatial interaction functions that are most often used to describe the influence of distance remain the functions with negative power (of Paréto, so-called) and negative exponential functions. The postulate of unicity of distance introduced in spatial interaction models and of continuity of the spatial interaction function that describes decrease of relationships with distance was not questioned until relatively recently. Even if there was a fairly early awareness that many phenomena were better described by distances expressed in terms of kilometres on a network, of time or of cost, than by the mere consideration of Euclidian distance, it is apparent that many authors are reluctant to introduce simultaneously several measures of remoteness into spatial interaction models. Barrier phenomena, which are in fact an indication of the influence of the territories to which places belong, were for a long time considered exceptions to the laws of spatial interaction, and their study was only envisaged in the framework of residuals analysis of those models. This territorial 'belonging' may nonetheless be considered to be the expression of a discrete proximity measure whose simplest expression is a Boolean metric taking the value 0 if two places belong to the same territorial cell and the value 1 if they are separated by a limit between territorial cells. The term 'barrier' or 'territorial interaction effect' can be defined as the fact that two places belonging to the same territorial cell have on the average more relations than two places belonging to two different cells. Territorial interaction appears then as a particular form of spatial interaction more generally defined as the fact that two places spatially close to each other have on the average more relations than two spatially distant places.

-4. Spatial interaction and spatial relation
For many authors, the definition of spatial interaction as the study of the influence of spatial proximity of places on intensity of relations that may develop between them does not necessarily refer to the study of actual flows (interaction models) or potential flows (position models). If a general meaning is given to the term relations, the notion of spatial interaction may also designate the existence of causal relations in space (what happens in a place exerts an influence on what happens in other places and varies according to their proximity), the existence of spatial diffusion processes (there is a strong likelihood that an innovation appearing in a place will propagate toward neighbouring places, whether proximity is measured in a continuous or a hierarchical manner), or even the existence of spatial autocorrelation forms (i.e., the fact that two places close to each other bear a closer resemblance than two distant places). Even if logical links exist between all these fields of analysis (flows can generate diffusion processes that generate spatial forms that will have effects in return on the intensity of flows, etc.), one might expect such an extensive definition of spatial

interaction to result in its being a synonym for the term 'spatial analysis', one could even say of geography as a whole.

-5. Spatial interaction and social relation

The expression of relations between places that underlies all proposed definitions of spatial interaction definitely constitutes a central stumbling block, which largely explains hostile reactions raised in the past and still today against spatial interaction models. While this notion of relation between places does not cause particular difficulties in the domain of physical geography, where it may refer to concrete phenomena such as the movement of air masses or the transfer of a solid load by water courses, this is not true in the domain of human geography when one claims to describe social phenomena by means of general laws of human behaviour. In human geography, relations between places, whether these are cities, regions or States, do indeed often concern social or economic localised aggregates, most of the time heterogeneous, made of individuals (persons, households, firms,...) which do not have the same income, the same mobility capabilities, the same information about the possibilities in distant relations. Spatial interaction models then postulate, most of the time implicitly, a twin hypothesis of the relevance of the constituted social and economic aggregates and the existence of a standard type of behaviour that makes it possible to synthesise the behaviour of individuals belonging to these aggregates. Consequently, spatial interaction models also postulate the hypothesis of the relative independence of spatial determinants of interaction (location attributes of individuals and groups) with respect to other social or economic determinants (individual or collective attributes independent of spatial position). In case this hypothesis is not verified - which is the most frequent case - there is a risk of attributing to differences in spatial position the effect of other forms of difference of position within society and to create confusion in the interpretation of phenomena. Rather than considering spatial interaction phenomena as an exogenous component of social behaviour, it seems on the contrary more useful to consider that they represent a global resultant that is interesting to view as such. The most relevant justifications of spatial interaction models are precisely those which demystify the effect of distance and link its influence to processes that may be economic (Reilly), sociological (Stouffer) or cognitive (Hägerstrand)

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