

# Spatial system

A system is a set of sets : set of elements linked with each other through relations which form a set of interactions ; presence of positive and/or negative retro-action loops is an indispensable element of a system definition. Defined in this way, a system forms a totality, whose limits may be defined. Most systems in which human sciences are interested are open; they maintain relations with a part of the outside world which constitutes their environment. Inputs in the system condition its existence, outputs are resulting from its working.

Systems may be formalised in various languages, as long as these allow to express circular causalities. They are often represented in the form of arrow-based diagrams (simple diagrams or more sophisticated representations proposed by Forrester, based on an analogy with hydrology). They are obviously susceptible of being formalised by mathematical or computer methods, using systems of equations or of logical rules.

Systems experience evolutions. They appear *systemogenesis*, evolve, by changing from a state to another, and may disappear *systemolysis*.

Description of the states of a system involves complex notions. Systems may reach a balance, or retain some persistence far away from the equilibrium, due to processes of self-organisation. They may maintain their structure while evolving, and so doing manifest resilience, or on the opposite show fragility.

Appearance or disappearance of systems, as well as their more or less rapid changes of state constitute significant cases of bifurcations in a spatio-temporal process, which may be due for a large part to the intervention of fluctuations of limited amplitude around critical thresholds. Compared to other relations considered in systemic analysis, these fluctuations of limited amplitude may take the appearance of random components.

The succession of systems and some fundamental bifurcations are situated in a temporality that differs from the one at play in the internal working of each system, i.e. the duration of a retro-action loop. For the temporalities of the second category, that of short periods, the time arrow may be neglected, which is impossible for the first ones.

Systems are tools for the explanation of locations and of space differentiation. It is possible to consider spatial systems, *stricto sensu*, whose elements are spatial objects (spatial entities, portions of spaces doted with attributes), and whose relations are material or immaterial flows. But it is also possible to use in view of geographical explanation some logical systems, sets of causality links between elements that are abstract entities. The introduction of systemic in geography is thus not limited to consideration of spatial systems.

A geographical location is explained as far as this place is an element of a system doted with some kind of persistence (stable state, meta-stable state, balance, resilience). A complete explanation implies that the presence of the system itself is explained by studying its genesis, and by linking it with its inputs.

## Bibliographie