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Keywords :

The relation between transportation networks and territorial development cannot be ignored by most approaches in territorial science, but remains poorly understood in a quantitative way : the example of *the myth of structural effects of transportation infrastructures* Offner (1993) shows that simple causal assumptions do not hold when trying to explain the "co-evolution" between transportation network and static components of territorial systems. Dynamical modeling including both evolutions on long time scales has been emphasized as a cornerstone for tackling such research questions in the case of cities systems on long time scale (Bretagnolle (2009), p. 152-163). However, a broad interdisciplinary state-of-the-art, based on algorithmic systematic review, done in Raimbault (2015) shows the quasi-absence of simulations models of that type. At different spatial and temporal scales, various models were proposed, such as e.g. LUTI models at a middle scale where networks are considered static Iacono et al. (2008), or network growth models on a longer time scale Xie and Levinson (2009), none of which including both network and territory in a dynamic way. The purpose of this communication is in a first part to develop results obtained through a first family of models of simulation that are agent-based toy-models, and then to propose a theoretical framework

A first family of model explores the weak coupling between an population density generation model that is a generalization of the diffusion-limited aggregation model Batty (2006), and network generation heuristics for which biological network generation Tero et al. (2006) and generalized gravity potential rupture are tested.

The conclusions of these first modeling experiments unveil or confirm requirements for a theoretical framework aimed to understand territorial systems. They include in particular a framing of the notion of coupling between subsystems, a precise definition of scale and an emphasis on emergence to take into account multi-scale aspects of systems, the superposition of heterogeneous views and components of a system. Starting from a perspectivist point of view Giere (2010), we consider a system as a set of perspectives consisting in ontological sets Livet et al. (2010) associated with dataflow machines Golden et al. (2012). Formal pre-orders between subsets of ontologies, constructed from emergence relations Bedau (2002), yield after a canonical reduction an unique forest representing the structure of the system. Strong coupled components reside within nodes, whereas a temporal scale and "thematic" scale (scale for a state variable) can be associated to each level of the forest by construction from dataflow machines timescales. This framework is formally self-consistent and meets our requirements.

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