

Chapter 26

A Plea for Modelling Geographical Spaces—Because They Do not Exist as Such



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Abstract The aim of this paper is to explain the nature of geographical spaces as simultaneously material, relational and semantic. Given this functional characteristic, it is stated that such spaces do not exist—as such—materially or empirically. Instead, they are transformed and transferred as elements of communication in social systems. Models play a central role in the process of transformation and transfer as they are capable of creating geographical spaces in a comprehensive albeit non-holistic way.

Keywords Materiality · Topology · Semantics · System theory

Introduction

Social-geographical space in particular and geographical space in general does not exist as a materially empirical fact. Neither human beings nor communities or societies are determined in their activities by geographical space—just as they are not determined by historical time. Contemporary modern societies can be described adequately as functionally differentiated social systems working on different scales whose central operating mechanism is communication and which is the source of social phenomena.

The emergence of these social phenomena is—quite often—epistemologically explained and methodologically explored without any reference to geographical space or to simplified abstractions of it at best. Neumann [17], for example, approaches social norms by emphasising their individual (belief) and social (shared interaction) components. Neither the creation of norms nor the mechanisms of their compliance seem to need any contextualisation in space. Giardini et al. [6], in a similar vein, acknowledge the presence of actors in the creation, alteration, and loss of reputation. Issues of geographical space, however, play only an implicit role if at all (more examples are presented in the book *Simulating Social Complexity* by Edmonds and Meyer [4], and Edmonds et al. conclude the book with a couple of challenges

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modellers have to cope with; an explicit consideration of geographical spaces has not been mentioned, perhaps because of its less significant role in understanding social facts).

On the other hand, there is also well-known empirical knowledge that social interactions take part in space and time, and even that ‘space matters!’. A lot of sophisticated approaches in geography and related sociology have been developed to analyse, represent, and understand geospatial characteristics in social contexts (see, for example, Kohler and Gumerman [10], Krzanowski and Raper [11], Lantuéjoul [12] or Stimson [19]). Sometimes a deliberate distinction between different forms of spatial connotation is carried out in socio-spatial analyses, as is the case by Torrens [20]: “Often simultaneously, these spaces can take a variety of forms, including mathematical, social, cognitive, physical, urban, architectural, visual, and spaces of the body”.

More often, however, a fuzzy and confusing commingling of social and spatial properties prevails, such as the idea that social systems are regarded as equal with spatial systems, i.e., cities, or that spatial systems are anticipated as over-complex— “[...] everything within a city, region or country is connected to a place” [2]—in the belief or hope of comprehensively explaining the link between the social and the spatial (the book *Agent-Based Models of Geographical Systems* by Heppenstall et al. [8] provides further examples of how difficult it is to connect the two basic realms).

The proposal suggested here, to tie together the two antagonistic natures of geographical space, is—at the theoretical level—to conceptualise space as a system type which interrelates with social systems. The medium to realise the interrelation between the two system types (actually, there are more than two system types incorporated, which will be not discussed here, however) is given, alongside language in general, with models. This will be discussed briefly as the methodological part of the proposal. We start with a short description of the three core characteristics of geographical space.

The Material, Relational and Semantic Domains of Geographical Space

A large part of the problem with geographical spaces as dialectically existing and non-existing is due to a selective and imbalanced use of the three core domains. This quite often induces the equalisation of geographical space with one of the three domains without indicating it explicitly. This does not mean that all three domains have to be implemented equivalently. In fact, an implicit imbalance is given with the semantic domain regarded as prior compared with the material and topological domains.

The material domain of geographical spaces recognises the fact that any kind of sociality is, beyond social construction and emergence, grounded in its materiality.

Critical realism emphasises that social collectives are surrounded by material artefacts—houses, workplaces, tangible infrastructure, devices, etc.—that influence the ways in which we perceive and (inter-)act within our socio-material environment [16]. Marginalising material spatiality implies the risk of discounting socio-ecological requirements in order to preserve a liveable and healthy environment. Overvaluing material spatiality may lead to a geo-deterministic thinking that reduces social interaction to passive, fatalistic behaviour. Furthermore, it confuses material objects with geographical space, which results in a misleading reification.

The relational domain of geographical spaces considers the relationship among spatial-material objects, and between them and social units (from dyadic to large collective structures). Besides enabling structural visibility, relations also allow for an incorporation of socio-spatial mechanisms and processes, not to forget power relations embedded into these. The relational (topological) domain is prominently represented in Actor-Network-Theory [13] which connects human beings with material artefacts in order to detect traces of social relationships by relocating and redistributing the effects of social interactions mutually from the global to the local level and vice versa. Also, relational spatiality is a premise in the investigation of economic, social, cultural, and symbolic capital which is transferred between social members to gain trust, repetition, and solidarity, and herewith mechanisms of exclusion and inclusion [1].

The semantic domain of geographical spaces focuses on space as a theoretical social construct and thus as an abstraction in social communication. This domain is the closest to strong thinking in social systems as it refers space and spatiality exclusively to their meanings within social systems and denies any real-world existence. According to Hard [7], a social scientific enquiry about space has to ask (i) which functions spatial abstractions have in social reality, and (ii) which social systems produce what kind(s) of spatial abstraction with which purpose? The predominant justification for this perspective is that spatial indicators such as ‘materiality’ or ‘distance’ do not generate an explanatory power in the understanding of social phenomena since they are contingent in their effects. ‘Materiality’ can, but need not necessarily, exert an influence on social structuring or mechanisms.

Marginalising semantic spatiality contributes to a similar confusion as mentioned above as it confuses notions with material artefacts; ‘homeland’, for example, is just an expression for a feeling of belonging, but has no real geographical existence. Overvaluing semantic spatiality neglects the material rootedness of human beings as also biological beings and of social collectives as also socio-ecological collectives. Climate change adaptation is one striking example of this interdependency between the social and the biological/material world. Housing in its capitalistically materialised form (profit-oriented accumulation) may serve as another example.

To conclude: any reductionism towards one or two of the three domains is problematic and partly even impossible because without semantic representation (language and models) we are unable to communicate about the meanings of geographical space in social contexts. One approach to cope with all three domains is given with an extended system theoretical approach, taking social and spatial facts in two distinct system types into account.

Social and Spatial Systems

The theoretical argument of conceptualising geographical space in a system theoretical manner is justified by the problem that none of the three domains, on its own, is sufficient to adequately explain the multilevel and multidimensional composition of it [18]. In fact, geographical space is not identical with the material objects, a geometrical representation of a city, or an urban cartographic plan. Instead, all three components (and many more of these such as networks, territories or landscapes) interdependently refer to each other.

Social system theory rests upon the idea that communication is the core principle responsible for the emergence and maintenance of social collectives on all scales, ranging from small interaction systems to organisations and to large, functionally differentiated systems like the economy, politics or science [15]. Data, information and knowledge about geographical spaces are incorporated from the respective environment(s) of the respective social system(s). Companies as organisations, for example, establish programmes on how to organise their business, and one part of such programmes is dedicated to tailoring the business spatially (e.g., the allocation of branches). Likewise, all other social systems operate by implementing a kind of a communication structure, including its spatial component. One aim is to gain social control over potential disturbances.

In order to achieve successful communication with low levels of accident-sensitivity, the nature of spatial systems must have a minimum ability of translating properties from their system type to the social system type (and we should keep in mind that this ability has changed from the ancient world up to contemporary societies, and will continue to do so in the future). One way to organise information transfer is to address materiality with regard to the individual. Material objects (clothing, housing, transportation, shops, electronic devices, etc.) influence the behaviour of the individual. At the level of social systems, the many and manifold individually internalised engagements with the material world(s) are then connected to specifically selected (though only temporarily fixed) relationships within the spatial systems. These relationships create a subset of particular locations out of a population of potential places. Those spatial networks may endure as long as the social system under investigation exists. And the networks of material objects, together with their locations, will then be assigned to a notion or a phrase.

This brief and coarse delineation of structurally coupling social with spatial systems serves to help understand the introductory statement that geographical spaces do not exist purely as a materially empirical fact. However, they exist as language (semantics) in its widest meaning, including models. This, in turn, justifies the central meaning of models in approaching geographical spaces both scientifically and in our daily life.

The Meaning of Models

If geographical spaces cannot be reduced to their material domain but should be understood as linguistic elements used in social systems, and if geographical spaces cannot be fully comprehended without their material and relational domain, then models can be seen as a proper and well-established tool in social communication (models are important tools also for the individual in gaining knowledge of and orientation in our complex world; here, I refer to the communicative function only). Models have been mostly appreciated by their function of representing artefacts in a simplified and purpose-based manner. As such they are imaginations that social systems use to deal with their respective environment.

Besides this representational function, and more important with respect to the idea outlined here, is their constructivist function. Models have the capability to make geographical spaces visible and tractable. This capability is not necessarily given with all models that claim to make geographical spaces visible and tractable; in fact, most models restrict themselves, sometimes explicitly, mostly implicitly to certain parts of spatial systems. For example, a raster map is used to represent the spatial distribution of population.

The point I want to make here is: models are not then only simplified representations of what is more or less already known, but offer opportunities to create new insights. Closely related to Lenhard et al. [14], it is a “pragmatic construction of reality”, whereby reality emerges inside the models. In a similar vein, Knuuttila [9] states: “Rather than being representations in themselves, models are often valued for the results they produce”. In other words, it is not *the* reality or an absolute truth we refer to in the process of modelling, and the aim and claim of modelling is not to represent reality as best as possible, simply because reality is not given as a single world. Instead, there is collaboration and/or competition of models concerning their use, utility, power of persuasion, and aesthetics (of those models we are aware of; how many do we not know?). And the decision about the selection of models will be made in the social systems. Models, thus, influence our thinking at least as much as our empirical perception does.

It is, furthermore, important to take the self-referencing characteristic of models into account. The theory of social systems, for example, has in part been developed through models that had their origin in biology. In addition, the theory refers to models that emerged in the process of theory creation which refer to other models within the theory. In so doing, models try to capture the mechanisms and structures of the theory.

Conclusion

Because geographical spaces do not exist materially and empirically, it is important to create and use models that help approach the comprehensiveness of what is communicated in social systems as geographical spaces. Therefore, we are convinced that ‘models do not behave badly’, as Derman [3] believes. He claims that theories “are attempts to discover the principles that drive the world”, while models are understood as “metaphors that compare the object of their attention to something else that it resembles” (ibid.: 6). Besides the problematic assumption that principles of the world have only to be discovered, it remains open how the principles will be discovered if not by models.

References

1. P. Bourdieu, Ortseffekte [place effects]. In: Bourdieu P., Accardo A. (eds.) *Das Elend der Welt*, pp. 159–167. Universitätsverlag Konstanz (1991)
2. A. Crooks, Agent-Based Modeling and Geographical Information Systems, in *Geocomputation*. ed. by C. Brunsdon, A. Singleton (Sage Publications Ltd., Los Angeles London New Delhi Singapore Washington, 2015), pp. 63–77
3. E. Derman, *Models Behaving Badly* (Free Press, New York London Toronto Sydney New Delhi, 2012)
4. B. Edmonds, R. Meyer (eds.), *Simulating Social Complexity* (Springer, Heidelberg New York Dordrecht London, 2013)
5. B. Edmonds, P. Lucas, J. Rouchier, R. Taylor, Human societies: understanding observed social phenomena, in *Simulating Social Complexity*. ed. by B. Edmonds, R. Meyer (Springer, Heidelberg New York, Dordrecht London, 2013), pp. 709–748
6. F. Giardini, R. Conte, M. Paolucci, Reputation, in *Simulating Social Complexity*. ed. by B. Edmonds, R. Meyer (Springer, Heidelberg New York Dordrecht London, 2013), pp. 365–399
7. G. Hard, Landschaft und Raum [landscape and space]. Aufsätze zur Theorie der Geographie, Band 1. Universitätsverlag Rasch, Osnabrück (2002)
8. A. Heppenstall, A. Crooks, L. See, M. Batty (eds.), *Agent-Based Models of Geographical Systems* (Springer, Heidelberg New York Dordrecht London, 2012)
9. T. Knuutila, From Representation to Production: Parsers and Parsing in Language Technology. In: Lenhard J., Küppers G., Shinn T.: *Simulation. Pragmatic Construction of Reality*, pp. 41–55. Springer Dordrecht (2006)
10. T. Kohler, G. Gumerman, *Dynamics in Human and Primate Societies*, (Agent-Based Modelling of Social and Spatial Processes. Oxford University Press, Oxford New York, 2000)
11. R. Krzanowski, J. Raper, *Spatial Evolutionary Modeling*, (Oxford University Press, Oxford, 2001)
12. C. Lantuéjoul, *Geostatistical Simulation*, (Springer, Heidelberg, 2002)
13. B. Latour, *Reassembling the Social*, (An Introduction to Actor-Network-Theory. Oxford University Press, Oxford, 2005)
14. J. Lenhard, G. Küppers, T. Shinn, *Simulation*, (Pragmatic Construction of Reality. Springer, Dordrecht, 2006)
15. N. Luhmann, *Soziale Systeme [Social Systems]*, (Suhrkamp Verlag, Frankfurt a.M, 1993)
16. D. Mader, Critical Realism. Arbeit. Zur Verselbständigung des Sozialen am Beispiel der Industrie 4.0. In: Henkel A. (ed.) *10 Minuten Materialität [Ten Minutes on Materiality]*, pp. 67–81. Transcript Verlag, Bielefeld (2018)

17. M. Neumann, Social Constraint, in *Simulating Social Complexity*. ed. by B. Edmonds, R. Meyer (Springer, Heidelberg New York Dordrecht London, 2013), pp. 335–364
18. R. Sack, *Homo geographicus: a framework for action, awareness, and moral concern*, (The John Hopkins University Press, Baltimore and London, 1997)
19. R. Stimson, *Handbook of Research Methods and Applications in Spatially Integrated Social Science* (Edward Elgar, Cheltenham Northampton, 2014)
20. P. Torrens, Geographical Agents in Three Dimensions, in *Geocomputation*. ed. by C. Brunsdon, A. Singleton (Sage Publications Ltd., Los Angeles London New Delhi Singapore Washington, 2015), pp. 21–39