Autopoietic spatial systems: the significance of actor network theory and system theory for the development of a system theoretical approach of space

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Abstract. This article presents a system theoretical approach to space. Basically, there have been two motivations that led to this approach. Firstly, within German-speaking social geography, a significant tendency can be recognised to understand space (spatiality) as solely determined by social factors. System theory, on the other hand, replaces this causal thinking with a reciprocal relationship of sociality and spatiality. Secondly, several attempts to integrate spatiality into the theory of systems remain unconvincing in certain parts. Even Luhmann, whose work formed the basis of my approach attributed only marginal significance to space in social systems.

Thus the paper deals with the difficulty of exclusively socially determined spatiality. In line with Flusser's "modes of translation" I suggest a way to overcome this difficulty. Flusser's ideas point directly and unsurprisingly to actor network theory (ANT), because here, too, the concept of translation is crucial. The concept of translation enables us to understand the results of relationships between social and spatial systems as hybrid phenomena. Moreover, ANT provides an interesting conceptual approach to space which will be interpreted from a system theoretical point of view.

One important outcome emerging from linking ANT and system theory is a symmetrical, mutually dependent relationship between the social construction of spatiality and spatial construction of sociality. However, the core implication is to focus on the results of these associative relations: the sociospatial hybrid settings. Discussing several characteristics of spatial systems and their connection with social systems, the paper offers some suggestions concerning the influence of information and communication technologies on generating new kinds of spaces.

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1 The missing symmetry of constructionism

In the context of German-speaking social geography, one can detect a common tendency in investigating the relationship of space and society. The discourse is dominated by one-sided references to the social construction of space. The complementary question of the spatial construction of society or the spatial effects of the social construction is hardly ever posed. So far, the nature of that relationship remains underconceptualized and is, therefore, criticised. "Indeed, privileging the social in modern geography, and especially in the reductionist sense that "everything is socially constructed", does as much disservice to geographical analysis as a whole as has privileging the natural in the days of environmental determinism [...]" (Sack, 1997:2).

In this light of emphasising the social construction of space several social geographers even stress the senselessness of semiotics of space. For instance Zierhofer (1999:177) proposes that the notion of space has been meaningless from the start and could be replaced appropriately by other notions like location, distance, area, or movement. From his point of view, those who do not share this opinion will be suspected of "space fetishism". Nevertheless, it remains remarkable that even "space exorcists" find themselves in a position to acknowledge to some degree that the notion of space is not meaningless. How can this contradiction be explained? I think the problem is given by a direct and exclusive equation of space and substance (e.g. Weichhart, 1999). A well-known representation is the "container space". The problem is that space exorcists impute a pure material imagination, i.e. they directly link the notion of space to "world", "reality", or "truth", instead of understanding it as a pictorial representation. However, according to Flusser (1998), it is possible to replace this direct link by a multi-stage process of translation (Fig. 1). This process of translation means that images (should) represent "world", texts (should) represent images which (should) represent "world" and technoimages (should) represent texts which (should) represent images which (should) represent "world".
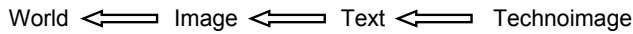
World $\Longleftarrow$ Image $\Longleftarrow$ Text $\Longleftarrow$ Technoimage

Fig. 1. Modes of translation (Flusser, 1998).

Each mode represents world in a specific manner and is, therefore, a reduction. The pictorial reduction is given by its visualisation of elements and the invisibility of relations among these elements (these relations can at best be deduced by the viewer and thus are implicitly included). To visualise these relations it is necessary to include notions or texts. In addition, the textual reduction is characterised by its linear structure when representing the image's content (the technoimage which is not crucial in this context is of different pictorial quality because it refers to the world via text and image and needs a machine-operator technology). The "world" remains unreachable in each case. Both images and texts remain independent (in the sense of being autonomous) and are mutually constitutive for a representation of "world". The notion of "world" is deliberately abstract in this context; it should include both the process of social construction of space and the process of spatial construction of society. For now, Flusser's modes of translation suggest that directly equating the signified and the sign is a less appropriate way to describe the social process of construction. Nevertheless, it provides the important hint that translations are necessary to reach a symmetrical relationship of spatial and social constructions.

In other words, all semiotics of space is embedded in a complementary circle of references to model the "world". So, "container space" is as real as "space as a dimension of order" or as "space in GIS" (Koch, 2003). The assumption made here is: if we represent "world" spatially – which is obviously not the only possibility – then the importance of space achieves a dynamic and independent quality because the rules that define spatiality are different from those that define sociality. If a hybrid world of communities and spatialities is able to emerge, it is then logically unavoidable to establish independent properties. An ontological monism, which only admits differences of perception (Zierhofer, 1999; Weichhart, 1999), is difficult to handle because with this assumption no hybrid communities or spatialities could be imagined. Either everything or nothing would be hybrid. And materiality must not be excluded as actor network theory is appropriately able to verify. The question is: How could this symmetry be brought into being? The proposal of this paper is to argue using the tools of system theory, and this means considering spatial systems as systems in the environment of social systems. To get there it is helpful to take into account some ideas of actor network theory that are concerned with the understanding of objects and spaces.

2 Objects and spaces in actor network theory

In this chapter I would like to carry out a specific interpretation of actor network theory concerning the notions of object and space, as defined in particular by Law and Mol (2001, 1994), to arrive at a notion of hybridity which can be extended to system theory. First, the next paragraph introduces an example in a system theoretical terminology which, due to its similarity and transferability is of interest in an actor network context, too.

2.1 An example of social and spatial systems

To make the following train of thought easier to understand, I will use the family as an example of a social system and the home as an example of a spatial system. At this stage, only a few characteristics of systems theory will be considered; more explanations follow below.

According to Luhmann (1993a:196ff.) the family is a social system of the interaction system type. Since every social system is a communication system, the elements of each social system are communications (i.e. communication acts) and not individuals. The relations between system elements result from the capability to link communications. Communication itself is a synthesis of information, message, and understanding. As long as the transmitted information is understood, communication can be joined to communication. The assertion that the elements of the social system 'family' (like all other social systems) are not individuals does not mean they are superfluous. Rather, they are structurally linked to the social system as psychic and organic systems. From the perspective of the social system they are systems in their environment. They serve as addresses to execute communication (Luhmann, 1993a:202).

Like every social system the family is a closed system. The notion of closure is, thereby, related to the operational process, i.e. for a family to exist as a family it is necessary to draw a boundary. This is executed by the family itself – the social system family is a so-called autopoietic system (ibid. 197). If one communication is not joined to another communication the system ceases temporarily to exist. This is true even in the case if one member of the family is in the kitchen and the other is in the bedroom. Consequently, it is possible to describe family exclusively within the context of a social system. But this is somehow unsatisfactory, since a family remains a family beyond the systems' status, for example as a legal institution. A further important property is the shared home (it certainly could be split to two or more homes temporarily as shown below). It makes sense to regard the shared home as a spatial system which is structurally linked to the social system of the family. For the moment, we should keep in mind: For the social system "family" as an autopoietic system to emerge and exist, it is at least necessary for it to be linked to psychic systems – and what I would like to point out to spatial systems.

Applying this theory to the home, we then could understand it as a spatial system. The system elements should also
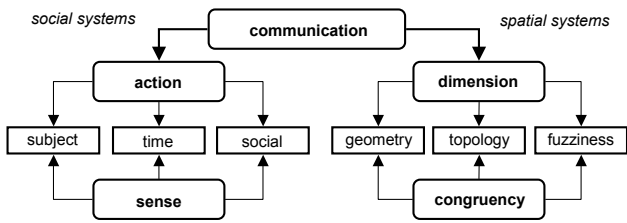
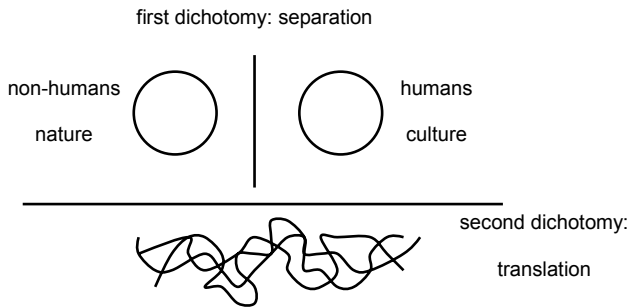**Fig. 2.** Communication in social and spatial systems (Koch, 2004b).

Fig. 3. The two dichotomies of thinking (according to Latour, 1995:20).

Fig. 4. The circle of references in actor network theory (Koch, 2004a).

2.2 The concept of objects and spaces

Actor network theory provides some important clues to obtain a theoretical view of hybrid systems. The essential starting point is grounded in the perspective of the objects of investigation (Fig. 3).

Beginning from the two dichotomies of modern thinking – in daily life as well as in science – Latour (1995:106f.) argues for considering translation (the hybrid phenomena) as the general principle, and separation as a specific case of it. For empirical investigations, however, this claim implies the need to look at both principles simultaneously. Subsequently, the principle of separation will be highlighted first, particularly in order to emphasise the independence (autonomy) of the social and the spatial, respectively, as a necessary precondition for the generation of hybrid phenomena. An oscillation between separation and translation is then unavoidable.

The theory design of ANT is in one sense quite similar to the modes of translation of Flusser's, i.e. in this case, too, we have a complementary circle of references (Fig. 4). One reference is given by the semiotics of materiality. ANT,, [...] is a semiotics. That is, it is a method [...] that has to do with and explores relations, relationality. [...] ANT (and other poststructuralist semiotics of materiality such as that developed by M. Foucault) extends this beyond language to all entities" (Law, 2000b:3). This general statement has several far reaching implications. If one applies the notion of space/spatiality to entities as well, then a crucial consequence might be that the importance of space is both relative and necessarily material. Relative in the sense that the former emphasis on the chorological dimension is now extended to the relational dimension. And material in the sense that all entities, all objects and, consequently, all aspects of space and spatiality, respectively, cannot be reduced to a purely mental state as criticised above. As Law and Hetherington (1999:2) argue "[...] if we want to understand phenomena such as global capital flows, the transmission of information, cultural hybridity, or economic inequality, it is also important to ask how the relations that produce these are materially brought into being and sustained in particular locations". Moreover, a semiotics of materiality is not restricted to spatial phenomena; it is a core principle related to bodies, information, and objects in general.

be designated as communications, even though the notion of communication has a different meaning in this context. Related to spatial systems' communication is a synthesis of geometry, topology, and (in a geocomputational sense) fuzziness (Koch, 2004b:240). While "sense" is the reference of social systems, the reference of spatial systems is "congruency" (Fig. 2). As explained by this concept, the elements of the spatial system "home" are not the rooms, the floor, the garage, or the garden, but the congruent interplay of its geometrical, topological, and fuzzy components (the analogy of social and spatial systems seems to be stronger than it actually is. It is particularly the formal structure of system theory which is being considered as appropriate for drawing an analogy, and less the implications of content).

Similarly, without structural linkages a spatial system is not able to emerge and exist. I would like to term the type of system which is structurally linked to the spatial system of "home" an architectural system. It includes the rooms, floors, garage, etc.

As in the case of the social system of the family it is undoubtedly possible to investigate the home as a spatial system as such – but this too is an unsatisfactory undertaking. Determining the congruency requires the integration of the concrete constellation of the rooms, floors, etc. Moreover, the structural linkage with the family leads to a knowledge which could not be gained without it. This example illustrates that it is certainly possible to describe and analyse the two types of systems separately. This is the sectoral view. If both types of systems would be brought together new perspectives of investigation could be reached. This is the hybrid view.
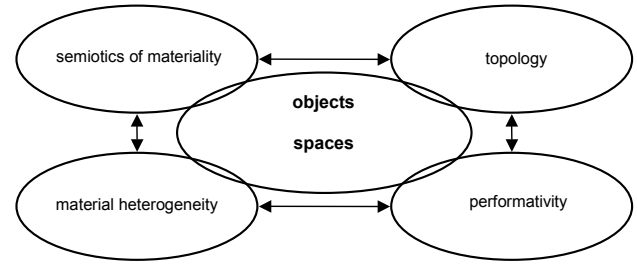
Obviously, this idea implies a coherent understanding of objects. If relationality is a key condition, then an object "[...] is an effect of an array of relations, the effect, in short, of a network" (Law, 2000a:1). Objects emerge through their relations to other objects and create in this way manifold networks of different hierarchies and/or heterarchies. This is the common property shared by all objects. However, objects differ from each other. There are multiple forms of objects, of spatialities and communities; in other words, all entities of observation are materially heterogeneous. According again to Law (1997:6): "For it turns out that we live in, perform in, and recursively form part of, a world that is materially heterogeneous. [...] For it turns out [...] that relations are not simply social. Simply social? What a peculiar idea! No doubt the idea that this might be possible was one born of the purificatory rituals of nineteenth century social thought". The clear conclusion to this is that relations are also spatial. The remarkable point here is that there is an explicit decision to avoid reductionism. Neither objects nor spaces nor communities can be reduced to something which is one-dimensional or total. The phenomenon of hybridity presupposes that the components which constitute hybridity remain distinguishable. Consequently, three main statements can be formulated:

1. „[...] the making of objects indeed has spatial implications; [...] spaces are not self-evident and singular, but that there are multiple forms of spatiality"

    (a) "[...] objects perform spatial conditions of im/possibility"

    (b) "[...] these spatialities and the objects which inhabit and perform them are unconformable, that they are Other to one another" (Law, 2000a:2).

Again, a complementary circle of references can be recognised: Because objects are able to perform spatial conditions (2), objects and spaces remain mutually independent (3); and this is expressed in multiple forms (1).

The third aspect is related to topology. Beyond the above-mentioned relational worldview of actor network theory which suggests a topological focus, the notion of topology specifies the fact that relations among and between objects are not universal. Not everything is connected to everything. Different objects, spaces, and communities are related to one another to different degrees and through different qualities, they are "partially connected" (Law, 1997:9). In this sense hybridity will be concrete. Moreover, the topological dimension stresses the intermediate, instead of the extremes. Both the "universal" and the "contingent" are just epistemological poles, the "in between" is the crucial point. This is outlined as "more than one and less than many": "[...] the world is not singular. The world is not even multiple, a set of parallel universes. The world is more than a singularity, but it is less than a multiplicity. It is a fractionality of complex and partially connected space/times. Which is, I guess, extraordinarily difficult to think. And not so easy to study either" (Law, 1997:10).

The above mentioned statement that objects perform spatial conditions of (im-)possibility leads to the fourth important facet of actor network theory, the notion of performativity. Since objects are able to perform spatial conditions of (im-)possibility there need to be nodes of connection to space – a minimum degree of compatibility and congruency must be present, so that "[...] entities achieve their form as a consequence of the relations in which they are located" (Law, 1999:4). If one bears in mind the above mentioned aspects, then we can draw the conclusion that conversely, also spaces perform an object's conditions of (im-)pos-sibility. Thus the notion of condition has a different meaning. More precisely, four differences are to be taken into account by applying the performing-performed complementary:

1. objects perform spatial conditions of (im-)possibility

2. objects perform objects' conditions of (im-)possibility

3. spaces perform objects' conditions of (im-)possibility

4. spaces perform spatial conditions of (im-)possibility

An example for each case might illustrate this:

At (1) the geometry of the rooms of a home and their topological relations will be crucially influenced by the objects which inhabit them. Usually the living room is bigger than the bathroom and the bedroom has – at least – to include a bed and a wardrobe.

At (2) It is impossible to erect a house at a place where a house already exists.

At (3) the geometry of a plot of land and its relative location to adjacent plots influences the size, shape, function, etc. of a house.

At (4) The general relationship of the home's rooms influences its spatial function. Usually, the bedroom is not on the ground floor, while the kitchen is not on the first floor.

These simple examples might help to understand the fourfold differentiation. However, as they are mutually dependent, overlap commonly takes place. Basing my argument on Kaufmann (1999), I would like to illustrate this by two examples. The first example is related to the relationship of objects and bodies. Here, objects are understood as ordinary tangible elements which are available in every household, like furniture. The daily use of these objects (cleaning them, putting things into them, etc.) leads – in each case to a different degree – to a continuous shift between objectivation and incorporation. In the first case the object (furniture) is outside of the body, in the latter case the object will be "incorporated" by the body – the objects are overlapping each other so intensely as if they were one object. Due to this observation Kaufmann (1999:52; according to Bessy and Chateauraynaud, 1993) talks of a variable geometry of the body's space. The following part of an interview might illustrate this (translation by A.K.): "Christelle has such strange emotions, like when she hits the cabinet's feet with her broom a little bit too strong. "If this happens I say ouch! as though I were suffering pain. I shout instead of the cabinet."" (Kaufmann 1999:53; see also Jöns, 2003:121).

The second example is related to the intertwined paths and manifold places laundry is moved or placed during its cycle of cleaning, ironing, and putting in the wardrobe. Dirty laundry could be discarded in the bedroom, the bathroom, or the children's room. From there it is moved to the basket and then to the washing machine. The washing machine could be in the bathroom, the kitchen, or the cellar (or in a laundry outside the home). For drying, the clothes will be carried to the dryer, or in the garden, or in the living room, or in the cellar. There are also multiple places where laundry is commonly ironed: mostly in the living room (facing the TV) but also, possibly, in a separate room. Finally the clean clothes are distributed to the various rooms. "The circle is closed; all or almost all rooms were paid a visit" (Kaufmann, 1999:57f.).

In summary: performativity, as defined here, covers the mutual relationship of process and state, of temporality and stability. It is about "performing" and "being performed", or as Crang and Thrift (2003:3) point out, "spacing" and "timing", or "space in process" and "space as process", respectively. These four notions define the frame for an appropriate understanding of hybrid spatialities and hybrid communities which will be now described in more detail.

3 Hybrid spatialities

A social geographical conceptualisation of space which is based on the approach of actor network theory leads to an understanding of space that is rather different from some other current proposals, such as a perspectivistic (Glückler, 1999) or a language-pragmatic imagination (Zierhofer, 1999). What remains, however, is the recognition that "space is made". Space is a creation. At least two differences are to be added. The first concerns the material component – space is also a material outcome (Law and Hetherington, 1999:8) – and the second is related to the process of mutuality – once spatiality is created, spatiality causes effects to objects or the social. In the context of actor network theory, Mol and Law (1994) discuss four spaces which could be used for achieving a better understanding of the emergence, (temporarily) consolidation, and disappearance of hybrid spatialities: "First, there are regions in which objects are clustered together and boundaries are drawn around each cluster. Second, there are networks in which distance is a function of the relations between the elements and difference a matter of relational variety. These are the two topologies with which social theory is familiar. [...] Sometimes, we suggest, neither boundaries nor relations mark the difference between one place and another. [...] Sometimes, then, social space behaves like a fluid" (Mol and Law, 1994:643). Recently, Law and Mol (2001) introduced fire space as a fourth component which they describe as follows: "As with fluid constancy, movement rather than stasis is crucial. Without movement there is no consistency. The difference is that, whereas in fluidity constancy depends on gradual change, in a topology of fire constancy is produced in abrupt and discontinuous movements" (Law and Mol, 2001:615).
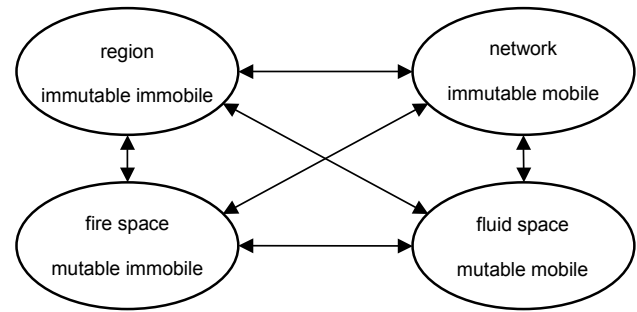

Fig. 5. The spaces of actor network theory and their characteristics (Koch, 2004b).

Each of the four ANT spaces has its specific characteristics which result from the specific relation to each other (Fig. 5). Originally related to the object-space relationship by a twofold space connotation (namely region and network) the notion of "immutable mobile" expands in meaning from there. "Instead of saying that messages or information or action speed up within a single space and time frame, we are saying that several intersecting spatialities and temporalities get created. The fidelity of the immutable mobile – its immutability – is a network phenomenon, while its speed – its mobility – is an effect of network immobility within geographical space and chronological time" (Law and Hetherington, 1999:9). Regions and networks are mutually necessary conditions and this is also true for the more or less continuously shaped fluid spaces – "fluid possibility is network impossibility" (Law, 2000a:9) – as well as for the more or less discontinuously shaped fire spaces.

The attractiveness of this approach can be explained by its renunciation of one-sided settings. Space is neither defined as exclusively substantial nor exclusively as a notion; space is also not exclusively seen from a perspective of social efforts of construction. There is an acceptance that spatiality influences the construction of objects and communities, respectively. Despite the dominance of the relational (the topology), the geometrical (Euclidean) dimension will not be excluded. Quite the opposite ought to be true: "[...] the old unspoken ANT view, a hierarchical view – that somehow network-objects and network-spatiality underpin Euclidean-objects and Euclidean-spatiality – is misleading, because the interference between the two objects and their spatialities is one that is reciprocal" (Law, 2000a:6). The description and explanation of constituting hybrid spatialities follows exactly this pattern of mutuality of (im-)mutable and (im-)mobile.

Once again, the example of the family and the home provides some empirical evidence. Let us assume the parents have separated and both are now living together with new partners. The children now have two children's rooms, one in their mother's home (the familiar one) and one in their father's home. Each children's room on its own is an immutable immobile. As soon as and as long as the children commute between the two, a topological relationship emerges and exists. This network describes an immutable
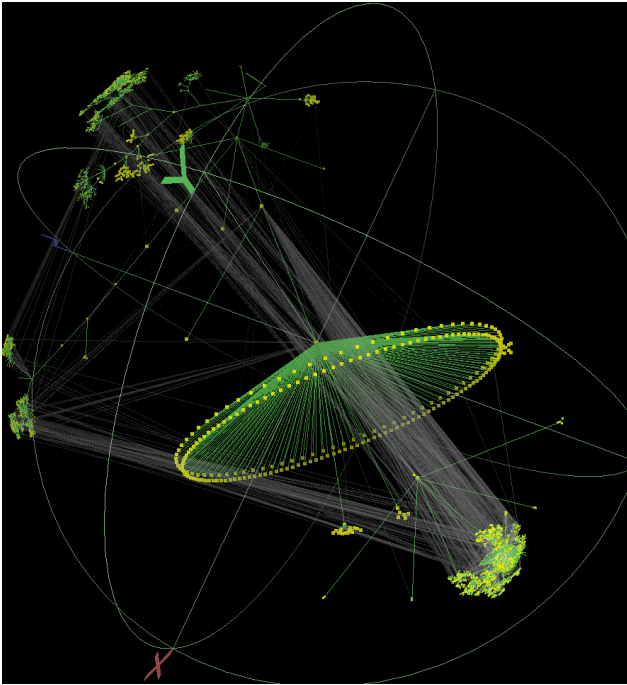
Fig. 6. An example of Internet topology (Young Hyun). source: http://www.cybergeography.org/atlas/walrus2_large.gif (26 March 2004).

mobile. Now the new partner of the father has a baby. The child from the earlier relationship has to share its room with the baby. In this case, the topological relationship is affected – the intervention causes mutability. New arrangements are made. So, at least these three types of spatialities could be asserted (I doubt that a fluid space exists in this example, but generally, it is not to be excluded).

Another example refers to the relationship of "real" and "digital" spaces (geographical space and cyberspace). These also should not be thought of as opposing poles but as different in the relevance of the characteristics by which they are defined (this will be explained below). The Euclidean dimension might be less important than the topological one in digital spaces. This assessment might be different for geographical spaces, so the crucial point is that there is no absolute distinction between the two dimensions. Scaling is significant for both, one can find local digital spaces as well as global physical spaces and vice versa. An impressive visualisation is shown in Fig. 6 which makes the Internet topology visible using 3-D hyperbolic graphs. The nodes represent web pages and the relations indicate the relative importance of these pages related to the frequency of visits.

4 Hybrid communities

While hybrid spaces are characterised by the context of (im-)mutability and (im-)mobility of regions, networks, fluids, and fire spaces, the main approach to describe hybrid communities is the notion of "framed interaction". By stating

that every social interaction of human beings is a framed interaction, the dichotomy of materiality and sociality is surmounted. In his essay on "sociology without object?", Latour (2001:242) remarks: "The framed interaction is not, seen by itself, local – as though the individual actor, this necessary element of social existence upon which the totality is supposed to be built – existed at all times. [...] In the case of humans [as opposed to apes; A.K.] one localises interaction, one localises it via an ensemble of subdivisions, frames, screens, aisles which allow us to move from a complex situation on to a complicated situation" (translation by A.K.). Obviously, Latour uses the terms of local/localising and global/globalising, respectively, in a different sense than it is usually used in geography. Likewise, this is true for other notions like as complex and complicated. A complex situation, hereby, is characterised by the fact that a multitude of variables are present simultaneously, while in a complicated situation the multitude of variables is present successively. For this, Latour gives a simple example: If one buys stamps at a post office then, one will usually not be confronted with the private concerns of the employee of the post office. Instead, a framing of the interaction takes place: since the possibilities of social interaction are reduced to those that are evident in this specific context, the aim (buying stamps) can be achieved.

Complementary to the localised level of framed interaction the framed interaction is not global, "[...] as though this Being existed by itself at any given point in time, this Being off whose body the actor's individual actions detached themselves over time. [...] Instead, when analysing human beings one globalises the successive interactions via an ensemble of instruments, tools, accounts, calculations, combinations; they allow us to move from a complicated relationship one still could isolate to other, equally complicated relationships which are connected to each other" (Latour, 2001:242).

This permanent shift of localising and globalising puts the process element – the performing – into the foreground. Just as spatialities have to be created, the social is not simply present. Rather, sociality is also something that is created; it continuously emerges, temporarily exists and disappears again. This process takes place repeatedly at different places. In order for social communities to be able to exist, processes of localisation are necessary. For this, the spatial context provides the frame, it is a condition of possibility to generate interactions. Processes of globalisation are necessary so that social communities are able to persist. Again, there are material components that are necessary to make it possible, at least potentially, to link interactions. Framed interactions are, therefore, not static and not persistent, they will be created recursively through interactions and within interactions. Herewith, they provide a spatio-temporal structuring which allows for contexts within and between interactions.

The changes to the social system "family" described above is once again an appropriate reference point. The original family is now twofold. This statement, however, is only true at first glance. Strictly speaking, a superimposition has replaced the originally clearly identifiable systems (Fig. 7).

The children of the original family now have a 'new' father and a 'new' mother. There are definitely two families between which they commute. But quite possibly, they only regard the new partnership of their mother as their family, and not their father's new relationship – the relationship on the father's side is only to the father himself. Or vice versa. Or they regard none of them as their family. Or both of them. Obviously, the relationships of the fathers and mothers would be complicated in a similar way but this should be of less interest. This fluid constellation of belonging represents an appropriate description of a hybrid community – or rather, hybrid communities. To make social interactions (communications from a systems theoretical point of view) possible in an ordered context, framing conditions are necessary. One of these frames is generated by the spatial system of homes. The localising frame is, thereby, created by the rooms in both homes. This frame enables social interactions between the involved individuals by embedding them in a context. The globalising frame becomes evident by the arrangement of the when and where the children are. Herewith, the successive contexts will be integrated in a greater interrelation.

Even the difference of "real" and "virtual" communities loses its relevance by observing the hybrid intersection of the two. Every social interaction is a framed interaction, be it within a real or a virtual community. Or rather: in a real-virtual community. Indeed, even in a face-to-face community we have these localising and globalising processes. For instance a managers' meeting is framed by the conference room, which is part of a building. The managers are equipped with business reports, PDAs', notebooks, etc. A real-virtual online chat-community has other framing conditions like computers, bulletin boards, avatars as virtual representations and others. All this leads to the awareness that we should not attempt to discriminate between both the social and spatial conditions and properties. They become blurred.

Finally, I would like explore the idea of applying system theory to spatiality in more depth. In doing this, the simultaneity of independence (unconformable to one another) and hybridity (partially connected to one another) could be conceptualised.

5   Social and spatial systems

The following explanations only serve as a brief overview of the idea of spatial systems (for more detail see, Koch, 2004b). Furthermore, there are several alternative approaches to thinking about space from the point of view of system theory (among others Fliedner, 2001, 1999; Klüter, 2003, 1986; Löw, 2001; Stichweh, 1998; Wirth, 1979). It is necessary to keep in mind that this approach adopts the theoretical fundamentals of Luhmann's work in the context of a social geographical elaboration of space. In turn, it also influences the theory of social systems to some degree. Luhmann himself did not pay much attention to the spatial dimension of his theory.
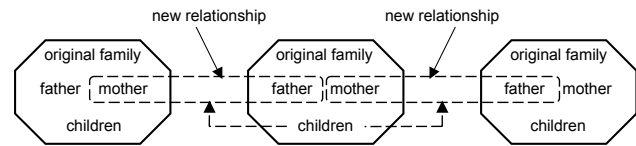

Fig. 7. Changes of family relations.

In Sect. 2.1 two simple examples of a social system (the family) and a spatial system (the home) with its common and specific characteristics were introduced. The guideline of this system approach can be now summed up in the following definition:

A spatial system is an autopoietic, self-referential system that constitutes itself by being different from an environment. The constitution is based on congruency. Its elements are communications.

From this particular point of view, other possible alternatives (from the above mentioned representatives) of a system theory approach to space can be excluded. Thus, in my view, a spatial system is not :

- identical with a social system

- identical with the environment of a social system

- a further dimension of reason, beyond the subject, time, and social dimensions

- solely a theme in the communication within social systems

- the limits of a social system

The definition given above indicates that spatial systems have an environment, too. The notion of an environment in system theory is quite abstract. It emerges along with the system itself – thus, environment is just a "negative correlative" (Luhmann, 1993b:249). "The" environment has a higher degree of complexity than the system has. This is certainly true for every social system. It is, therefore, rather inappropriate to equate space with the environment of social systems. In this case, space would remain ambiguous, it would be difficult or even impossible to designate something as a spatial fact. As a result, it seems to be reasonable to construct spaces as systems which are systems in the environment of social systems. And vice versa. This comes along with a second advantage: The theory of social systems claims that social systems are non-spatial systems, i.e. space is not a constitutive condition for social systems to emerge.

As illustrated (Fig. 2) and defined above, spatial systems are communication systems. This implies a twofold meaning of communication – it is based on sense in social systems and based on congruency in spatial systems. Likewise, the underlying logic of this statement is twofold as well. On the one hand, social systems are unlike spatial systems, they differ ontologically. On the other hand, there must be a possibility of linking them structurally. In order to be able to link
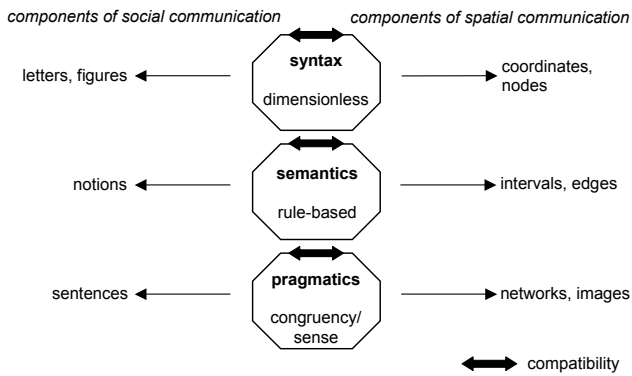
Fig. 8. The components of social and spatial communication (Koch, 2004b).

Fig. 9. Social and spatial systems linked structurally (Koch and Huber, 2004).

the two systems, an appropriate mechanism of translation, a shared basis must be found.

This point about ontological difference refers to the autopoietic status of spatial systems. Autopoietic means that the system elements will be generated solely by the system itself, and, secondly, that the process of joining the elements together depends entirely on the status of the system. Autopoiesis is strongly related to the operational level of systems, representing as it does the modus operandi within the systems. At this operational level, systems are necessarily closed systems. Simultaneously, at the structural level, they are necessarily open systems. Both conditions apply at the same time. Compared to social systems with their threefold structure of communication (information, message, understanding), communication in spatial systems is compound of (1) networks, (2) places, and (3) locations. When concrete entities emerge from the total stock of networks, places, and locations, spatial systems are brought into being (they create themselves). The notion of the network, in this case, is not reduced to the physical infrastructure (like, for example, roads, power lines, railroad tracks). Here the notion of the network embraces the full relationship that exists during the communication process. In reference to our example: Several places of the network of rooms can be identified as being linked to different types of social interaction. If these places are actually selected for interaction, they achieve the status of locations. And the connection of location – via networks and the pool of places – generates the spatial system of home.

The point made above in regards to mechanisms of translation refers to the structural linkage between social and spatial systems. That is to say that what one system produces must be 'understood' by the other – at least to a minimum degree. Figure 8 proposes one possible mode of translation.

The remaining question is: How can one conceptualise the linkage between the two types of systems which leads to a hybrid composition of spatial and social elements? I would like to introduce one possible proposal (Fig. 9).

Each of the two types of systems is characterised by a particular type of address. Examples for social addresses are name, age, gender, attitude – or address. This address could
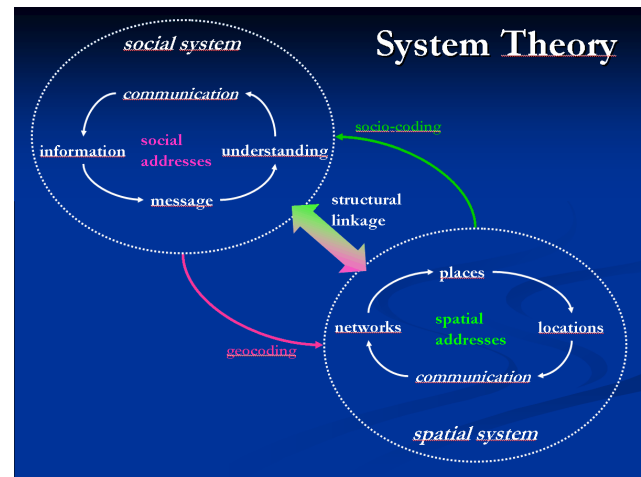
be the address of a house or the IP-address of the Internet connection. The spatial address can be composed of X- and Y-co-ordinates but it also can be a node in the global network of telecommunication. The structural coupling of both systems works if the social address can be translated into the spatial address and vice versa. For a successful translation this means: social addresses have to have been geocoded and spatial addresses have to have been sociocoded. In this sense communities and spatialities are linked as hybrid complexes. Framed interactions are executed in different spatial contexts and perform in this way the spatial conditions of (im-)possibility by specifying the mutual relationships of (im-)mutable and (im-)mobile as I would like to summarise in my conclusion.

6 Conclusion

About five years ago a remarkable experiment took place (Kaul, 1999:A27): Two specific rooms – one located in Germany and the other in the USA – were networked via a fibre optics cable. Both rooms were equipped with stereo screens on all walls, and the floor with screens which could be viewed with appropriate stereo glasses. The two persons who stood in the rooms saw the same surrounding, and were able to mutually recognise one another. Meanwhile, technology allows us to extend this experiment to several persons at several locations, video conferencing being one example among others. This may be less remarkable from a technological point of view, but it still remains remarkable from a social geographical point of view. There are two "real" rooms and, simultaneously, there is one commonly shared "virtual" room. A "virtual" community is created which is, however, perceived as "real". Since the labels "real" and "virtual" are losing their significance, the emerging phenomenon can be conceptualised as a continuum, i.e. a hybrid.

This is the conclusion one can draw from the descriptions and the argument presented above.

Entirely socially constructed space vs. spatial determinism? "Virtual" or "real"? "Physical" or "digital"? Previously familiar dichotomies are increasingly being replaced by hybrid phenomena characterised by a simultaneous overlying of different characteristics (Koch, 2004a). This experiment, called Distributed Video Production (DVP) represents a huge variety of opportunities we are confronted with in our daily life. Supported by robots we are able to colonise Internet-worlds while the "real" human being maintains her/his status of actor and generates a duplicate within the Cyberworld (the so called Multi-User-Dungeons MUDs). Meanwhile, these robots or avatars are able to interact independently. After being programmed by real human beings and equipped with the individuals' information like attitudes, hobbies, preferences and so on, these avatars are independent in the sense that they can communicate with other avatars without any programmer's help (e.g. Hattori et al., 1998). Within this context, recognising, imagining, and conceptualising hybrid communities and hybrid spatialities becomes a challenging task for social geographers.

Meanwhile, the virtual world of cyberspace – with its rather different communities – is for many of us a familiar space. From the very beginning it is constructed differently from our "natural" environment. Despite this difference, this space achieves a "reality" which, it seems, is scarcely different from physical reality. On the other hand, physical reality sometimes takes on forms which are rather artificial and strange. Even the apparently simple systems of family/families and home/homes, respectively, illustrate the potential to create complex linkages that can be observed in a process of recursive translations.

Whether talking about the virtual, digital, physical, or real, two aspects should be addressed once again, which I would like to draw attention to in this paper. Firstly, distinguishing clearly between the two spheres is by no means impossible because sociality and spatiality are ontologically different. For a description and explanation of socio-spatial phenomena, however, this discrimination is inappropriate. More attention should be paid to the hybrid nature of sociality and spatiality.

Secondly, the argument presented proves – based on actor network theory – that spaces/ spatialities have independent (autonomous) characteristics. Pre-supposing that space is exclusively a social construction is a misleading reduction. Hybrid complexity does not imply assuming a symmetrical balance between social and spatial aspects in every case. There are multiple forms of space and the material dimension of space is one of them.

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