Change in Networks – a Critical Realist Interpretation

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1. Introduction

Since introduced to the IMP forum by Easton (1995), critical realism has appeared in several contributions within the network approach - mainly to argue for and inform the use of case studies (eg Harrison & Easton, 1998) as well as the search for underlying mechanisms and their acting in networks (eg Harrison & Easton, 1999).

Closely tied to the latter argument change (or stability) in networks is an issue that obviously can get informed by critical realism. Emphasising causal analysis and the duality between action and structure, critical realism offers insights that might help explaining and interpreting network change.

Critical realism regards change and stability as ontologically similar, ie as ongoing processes transforming or reproducing structures. Consequently, critical realism might also offer insight on the issue raised on last year's IMP conference. *"Is it possible to conceptualise the interplay between structure and process in the industrial network approach?"* (Holmen, Pedersen & Torvatn, 1999).

The main issue of this work-in-progress paper is to address the explanation and understanding of change (and stability) in networks informed by a critical realist position. The aim is twofold. The next section presents a framework drawing heavily on a critical realist interpretation of logistics research (Aastrup & Nedergaard, 2000). Section three discusses a limited number of contributions from the IMP approach dealing with change in industrial networks in relation to the critical realist framework. The aim of this section is not to change the way to anticipate change in networks. Rather, it is a first attempt to see how existing contributions fit into the framework, and whether they are consistent (or rather not inconsistent) with the line of thinking in the framework. The discussion on the contributions is merely a question of how we can understand (parts of) these relations in the ontological framework in the more specific context of industrial networks.

2. A Critical Realist Framework
Critical realism's focus on generating forces and causality

The critical realist approach distances itself from the positivist ideal of deductive-nomothetic search for regularities. The central issue in critical realism is the existence of generative mechanisms or forces creating events – regular as well as non-regular. The critical realist

approach distinguishes between three domains of reality - the empirical domain, the actual domain and the real domain (Bhaskar cited in among others Lawson, 1994). The real domain contains the generative mechanisms existing independently from their activation and independently from the observer. These mechanisms in the real domain create events, thus constituting the actual domain. This domain likewise exists independently of the observer. The empirical domain is created when events are experienced by the observer. These domains are illustrated in the figure below (Easton, 1995):

	Domain of Real	Domain of Actual	Domain of Empirical
Mechanisms	✔		
Events	✔	✔	
Experiences	✔	✔	✔

Table 1: The Real, Actual and Empirical domains

Following this distinction in three domains, the critical realist argues that the understanding of reality as constituted by actual events and the empirical experiences of these is not sufficient. The link to the real domain (or the generative mechanisms) should be in focus. Thus, causal analysis exploring these generating forces is of crucial importance to the researcher in critical realism. *"To ask for the cause of something is to ask what 'makes it happen', what 'produces', 'generates', 'creates', or 'determines' it, or, more weakly what 'enables' or 'lead to' it….simple causal descriptions, that is, accounts of what produced change"* (Sayer, 1992).

Critical realism in social science
These generating mechanisms should be the crucial element in scientific explanation also in social sciences. Critical realism acknowledge the existence (or challenge) of ontological differences between the physical (natural) and the social world (Archer, 1998). These differences can be traced back to *"…society's intrinsic meaningfulness and activity-dependence"* (ibid). Bhaskar, similarly, argues for the activity, concept, and time-space dependence of social structures as distinct features of the social spheres (Bhaskar, 1998):

1. Social structures, unlike natural structures, do not exist independently of the activities they govern.
2. Social structures, unlike natural structures, do not exist independently of the agents' conceptions of what they are doing in their activity.
3. Social structures, unlike natural structures, may be only relatively enduring (so that the tendencies they ground may not be universal in the sense of space-time invariant).

Consequently, critical realism must incorporate in causal explanation the issues of:
• the duality of structure and agency;
• the choice and intentionality aspect in human practice as well as;
• the existence of material and non-material aspects of the social spheres.

The duality of structure and agency
The fact that social structures and thus mechanisms, unlike natural structures and mechanisms, depend on the events they cause as well as the conceptions of these leads to the highly complex issue of structure and agency. The complexity of this *"vexatious fact of society"* is expressed as a riddle (Archer, 1998):

"What is it that depends upon intentional human action but which never conforms to these intentions? What is it that is reliant upon people's conceptualisations but which they never fully know? What is it that is always activity-dependent but that never exactly corresponds to the activities of even the most powerful? What is it that has no organisational form without us, yet which also forms us its makers? And what is it whose constitution never satisfies the precise designs of anyone, but because of this always motivates its attempted reconstitution? This is the riddle of 'structure and agency'..."

Four conceptualisations of social structure are identified by Porpora (1998):

1. Patterns of aggregate behaviour that are stable over time
2. Lawlike regularities that govern the behavior of social facts
3. Systems of human relationships among social positions
4. Collective rules and resources that structure behaviour

The first position claims that there is no such thing as social structures as macrophenomena. There are only individual people acting in specific microsituations. Defining structure in behavioral terms makes it possible (in principle) to translate stable macrophenomena into microphenomena, ie repeated behaviour. This position is clearly based on individualism. The idea that society consist of only people is re-expressed by Bhaskar (1998) into *"the material presence of society = persons and the (material) results of their actions"*. According to the critical realist social structure is more than a material presence as they contain independent (and unobservable) causal forces that are presupposed for the individual to act. In ignoring this the individualist makes the error of voluntarism.

The second position is most often associated with Durkheim and methodological collectivism/holism. In this view macrophenomena are related to each other by patterns of lawlike regularities. According to the critical realist this position makes the error of reification. *"...it represents social structure as something entirely devoid of the influence of human agency........social structure operates mechanically and naturalistically over the heads of individual actors"* (Porpora, 1998).

Leaving aside for a moment the third conceptualisation, as it is the critical realist position, we have structure as collective rules and resources for behaviour. This position is associated with Giddens' theory of structuration. Structures in Giddens' conceptualisation refer to the intersubjective reality working as organising principles behind the actual situated practices. Three critical arguments are forwarded by the critical realist position[1]. First of all, Giddens' duality of structure and structuration mediate only among the subjective spheres of reality, and do not deal with material circumstances (Porpora, 1998). Secondly, actors in Giddens' theory do not seem to do much beyond following rules and, consequently, the role and motivation of the actors as well as the causal powers of relationships are given relatively low priority in causal explanation (ibid). Thirdly, Giddens' theory, to the critical realist, seems to assume simultaneity of agency and structure (Archer, 1998), instead of the pre-existence of structures which is the critical realist position.

The critical realist position on the issue states that structure and agency should be viewed as distinct strata of reality. The activity dependence of structures raises the question of whether

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[1] It is important to note that these arguments are merely taken as starting point for the discussion on structure and agency in critical realism. This criticism does not do justice to the work of Giddens as the original sources have not been confronted by the author. The same holds for the arguments against individualism and holism.

structures can become separable from agency, and thus constitute autonomous strata of reality. Realising the fact that social structure manifests itself only in and through human agency, easily leads one to argue that structures, simultaneously constituting actors and their practices, exist only in the generating moment without autonomous causal powers. One critical realist argument for upholding the distinction between structure and agency is that a given structure provides the agent certain powers to act, but these powers are not necessarily activated. Consequently, structures must be regarded as something distinct from human agency, as they must exist whether or not they manifest themselves in concrete actions.

"People and society are not, I shall argue, related 'dialectically'. they do not constitute two moments of the same process. Rather they refer to radically different kinds of thing.....For the properties possessed by social forms may be very different from those possessed by the individuals upon whose activity they depend. Thus one can allow, without paradox or strain, that purposefulness, intentionality and sometimes self-consciousness characterize human actions but not transformations in the social structure.....I want to distinguish sharply, then, between the genesis of human actions, lying in the reasons, intentions and plans of people, on the one hand, and the structures governing the reproduction and transformation of social activities, on the other " (Bhaskar, 1998).

Social structures, according to the critical realist position, are a necessary condition for any intentional action and, consequently, social structures must necessarily pre-exist social action. Following this, actors can never create social structures, but rather through their actions they reproduce or transform them. Thus, in critical realism there is logically a temporal relation between given structures and given actions. In this way structures pre-exist the actions which can transform them, and these actions must pre-exist the transformed (or reproduced) structures. Structures necessary for *future* activities will always be transformed or reproduced by *past* activities (Archer, 1998).

Bhaskar summarise the position in the following two paragraphs (Bhaskar, 1998): *"People do not create society. For it always pre-exists them and is a necessary condition for their activity. Rather, society must be regarded as an ensemble of structures, practices and conventions which individuals reproduce or transform, but which would not exist unless they did so. Society does not exist independently of human activity (the error of reification). But it is not the product of it (the error of voluntarism)...........Society, then, provides necessary conditions for intentional human action, and intentional human action is a necessary condition for it. Society is only present in human action, but human action always expresses and utilizes some or other social form. Neither can, however, be identified with, reduced to, explained in terms of, or reconstructed from the other"*.

Some point of contact between structure and agency has to be established. The mediating system in critical realism is positions and practices (Lawson, 1997; Archer, 1998; Bhaskar, 1998; Porpora, 1998). This mediating system consists of *positions* (places, functions, rules, tasks, duties, rights, etc.) occupied (filled, assumed, enacted, etc.) by individuals, and *practices* (activities, etc.) in which individuals engage, in virtue of their positions. In this mediating system *"the causal effects of the structure on individuals are manifested in certain structured interests, resources, powers, constraints and predicaments that are built into each position by the web of relationships"* (Archer, 1998). By including positions we add to a concept of exchange (actions, practice) a concept of distribution (Bhaskar, 1998), thus allowing actors to have different interests, different abilities to act etc.

A few points about positions can be added by turning to Lawson (1997). First of all any position of the individual refers to given relations (or webs of such). Consequently, individuals can occupy any number of positions in different systems or webs of relations. This allows for conflict of interest at the level of individuals (ibid). Secondly, a position of an individual is not just affected by the actions of the immediate occupants. The positions depend also on the actions of those related to the position (both contingent and necessary). *"Social rules associated with specific positions are not merely reproduced and transformed by the immediate occupants of the positions in question but by the actions, inter-actions and inactions of a far wider grouping"* (ibid).

At last Lawson reminds us that structures cannot be regarded as something fixed (even though often with stable characteristics). Structures must be regarded as continuous processes of reproduction (or transformation). Thus, both transformation and reproduction should be addressed, and should be addressed as being ontologically similar. *"...change cannot be reduced merely to contrasting states of affairs such as structures of market prices on different days, or voting patterns in succeeding general elections. Rather, social items such as markets, political systems and households must be understood as processes, as reproduced structures of interaction, with change recognised not as (or not only as) an external happening, the result of an external or exogenous shock, but as an integral part of what the system or object in question is....It follows from this transformational conception of social activity that if change, or at least the potential for change, is always present, the analysis of change per se is of no greater (or less) significance to social explanation than the understanding of continuity and reproduction. Both (relative) change and (relative) continuity need to be addressed and accounted for in science......Put differently, there is no ontological asymmetry between relative continuity and relative change"* (Lawson, 1997).

The centrality of choice and practice
In social science a crucial element in causal analysis circles around the concept of social practice. Social practice refers to the understanding of actual practices and changes in these as a result of human choice and intentionality, contrary to practice as something defined by optimality, excellence or systems logic[2]. Lawson, especially, emphasises the centrality of practice in social explanation.

"Human practices or doings are the key to it all.......the social world depends upon human activities and practices. Human beings are the motivating forces in history, and it is through human doings that society and economy are reproduced. It follows that any social phenomena that we may wish to explain will either be the result of, or, perhaps, just consist in, some forms of human activity. If the latter is the case, that is, if our direct concern is with forms of human practice in themselves, the explanatory exercise straightforwardly turns upon identifying their facilitating conditions. If the former is the case, that is, if we are first of all interested in some consequences of human action, then part of the explanation will involve locating those practices most responsible for the phenomena in question............Generally speaking, then, the explananda of the social realm, the phenomena to be explained, are the practices in which people engage, and the explanans are the physical, social and psychological conditions of the relevant actions" (Lawson, 1997).

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[2] This has to a large degree been the case in logistics research (Aastrup & Nedergaard, 2000).

Consequently, whether or not social practice is the direct object of attention, any explanation of social phenomena (structures, positions, choices etc) will include an identification of the practices involved.

Behind human practice lie the capacities of choice and intentionality. By ascribing intentionality to actions/practice attention is directed towards the reasons causing action, and choice refers to the power of actors, in any situation, to act in another way than was actually done (Lawson, 1997). The power to make different choices to act is an outcome of the structural embeddedness of the actor, ie the positions occupied.

The researcher should be able to provide explanation of specific practises by accounting for the particular choices made by individuals, their structural conditioning and their motivations[3] as well as the consequences of these practices.

Material and non-material aspects of social practice
A distinctive ontological feature of the critical realist approach is the emphasis on both material and non-material aspects of reality. *"Social phenomena have a crucial material dimension and are closely associated everywhere to relationships with nature, both in its virgin and its artificially transformed states. Knowledge of society, whether scientific or lay, should therefore always include reference to this material side, although it tends to be overlooked in some 'interpretive' approaches to sociology and anthropology"* (Sayer, 1992). Sayer distinguishes between intrinsically meaningful (or concept-dependent) from intrinsically meaningless objects. The nature of material objects do not depend on their meanings in society, although their possible use and functioning in society is concept-dependent. Non-material social objects on the other hand are intrinsically dependent of the meanings ascribed to them, in the sense that what these are depend on what they mean. Consequently, social practices (ie the object of our experience) often possess two types of properties actively conditioning what they are and how they operate/function: a social determination and a material determination (ie by virtue of their natures). These are only loosely coupled, but anyway coupled so that a dynamic mutual relationship exists which may alter these determinations. It is important to note that no practice *is* only by virtue of its nature, nor solely by its social predication, but by both in a not straightforward manner as they come into play through the intentional activity of the actor.

The critical realist, thus, agrees with the social constructivist that the discursive dimension of social phenomena is a fundamental aspect to be understood. Lawson sees it necessary to remind us that economic activity, as well as the social process of coming to grips with reality, in a fundamental way is embedded in material circumstances which affect the scope and direction of action, and which cannot be reduced to hermeneutics alone. *"Indeed, the explananda of economics and other social sciences depend upon or consist in intentional human agency so that reference to beliefs, opinions, interpretations, attitudes, and other conceptual matter is, in general, clearly necessary for any adequate social explanation"* (Lawson, 1994). However the material aspect *"...cannot be reduced to its conceptual one...The social is inescapably embedded in, and internally related to, the material/physical*

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[3] The critical realist states that human intentional activity, and thus our concept of choice, cannot be pursued to be a result of neither sequences of decision events based on individual conscious reflection and evaluation only, nor exclusively on largely tacit, structurally guided evaluation and motivation processes. Instead human action can be understood as deriving from both processes - as a mixture of both. Non-trivial decision events occur which encourage a conscious reflection and evaluation, as well as one must anticipate that the daily decision making to a large degree is tacit, routinised and procedural in character (Lawson, 1997).

basis of reality...The social realm is not a dislocated re-description (or mis-specification) of Nature. Rather, it is nested within and in continuous dynamic causal interaction with the rest of nature" (Lawson, 1994).

Framework and questions to change in networks
A modest attempt to summarise and visualise the structure-agency duality in our interpretation of critical realism is illustrated below (slightly modified from Aastrup & Nedergaard, 2000):
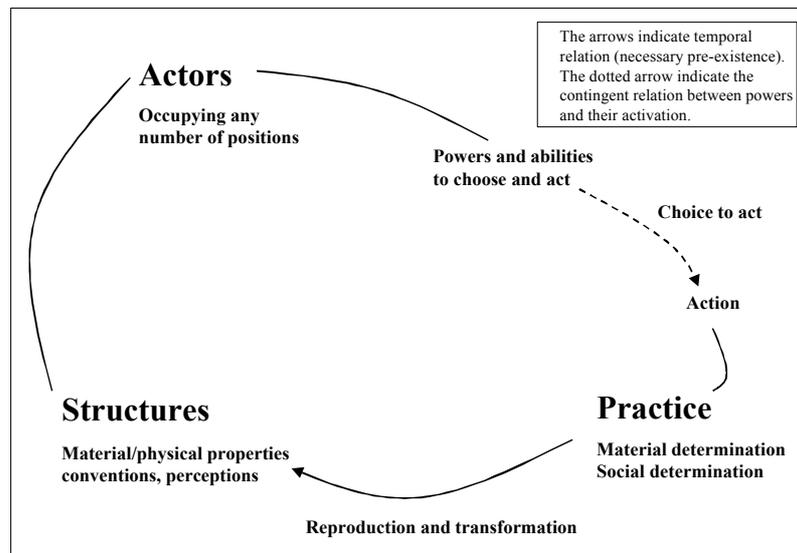

Figure 1: A critical realist framework

From the description of critical realism and the figure above several questions about analysis and conceptualisations of change in networks emerge. These questions will be used to guide the description/analysis of change conceptualisations in the IMP tradition of industrial networks.

- How can we conceptualise change (or stability) in network structures as being originated from choices, actions and practices?
- How can we understand and explain choices, actions and practices embedded in pre-existing network structures?
- How can we understand and explain processes of transformation (or reproduction) of network structures from pre-existing practices?
- How can we conceptualise the network structures (with material and non-material properties) in which actors are embedded?
- How can we understand and explain the actors' causal powers and abilities to choose and act stemming from positions in these structures?

The first question (and the two subordinates) represents what Sayer (1992) terms concrete research, ie how concrete events, practices are created as well as the effect of these on the structures. The last two questions on the other hand represent Sayer's abstract research, ie the understanding of why certain actors through their positions possess certain powers and abilities to act (this is termed abstract as it does not depend on the actual choices and practices).

3. Issues on Change in Networks

In this section some of the contributions dealing with change in networks will be presented and discussed in light of the critical realist framework above. It is the author's belief that the IMP tradition of industrial networks puts the absolute emphasis on conceptualising structures and positions, as well as the embeddedness of actors within these. Thus, dealing with abstract issues (in a critical realist term) the IMP tradition offers a very rich and manyfold conceptual frame. Consequently, understanding and explaining actors' ability to act as properties of their embeddedness in positions and network structures is definitely possible from the different IMP contributions. The concrete issues has also been conceptualised in the IMP tradition but to a much lesser degree (at least to the author's knowledge). The presentation and discussion below will be limited to these concrete issues, ie the first cluster of questions dealing with the concrete analysis of change (or stability).

First, I will make a reference to the discussion on stability and change in networks as well as different types of change in networks. Then two lines of thinking in the conceptualisation of change in networks will be presented. The first one deals with change as originating from single actions and reactions. The second one deals with conceptualising aggregate change patterns in networks. This second part is limited to contributions of the vectors of change.

Stability and different types of change in networks

In the network approach it is often recognised that change and stability co-exist or even presuppose each other. This might seem paradoxical, but according to Lundgren (1995) this paradox is semantic in character. The co-existence and interdependency between change and stability occur in different dimensions of the network. In the actor, activity and resource conceptualisation change in the activity structure might presuppose a stable actor structure or vice versa.

According to critical realism, explicated by Lawson, there is no ontological asymmetry between change and stability. Both should be viewed as ongoing processes of reproduction or transformation. This is also recognised in some IMP contributions challenging the dominant view in which instability is to be regarded as the same as change and vice versa (Gadde, Håkansson & Öberg, 1989 and Gadde & Håkansson, 1992). Two important points come from these contributions. First, it is argued that actors in the network should be seen as important initiators of change, not only as passive adapters to the environment. Basically all change in a network must has to it some active participation from one or more actors. *"...no change is created without activities undertaken by an actor, regardless of the occurrence of new conditions in the environment"* (Gadde & Håkansson, 1992).

Secondly, it is argued that stability is something that has to be created. Stability is not something that exists as a normal condition if no change is created. In fact the contributors agree with Weick in saying that stability is a rather surprising condition (Gadde & Håkansson, 1992). The environment is more or less always considered to be continuously in change. Why then should we view stability and the absence of change in networks and organisations as the normal condition? We should not, because stability is created by actors' practices and consequently *"...mechanisms supporting stability are, therefore, as important to understand as are the mechanisms creating change"* (Gadde & Håkansson, 1992).

The critical realist would never say that stability and change is to be *created*, but rather reproduced or transformed. But beside this difference in terminology, these two points

exactly match what Lawson emphasise, ie that both reproduction and transformation should be seen as processes integral to what the system or object in question is.

Most IMP contributions dealing with change in networks distinguish between different types of change, or different degrees of radicality. These distinctions vary in content depending on the contribution. Hertz's (1996) gradual and radical changes and Havila & Salmi's (1999) incremental and radical changes are based on whether change happens within existing relationships or in the development of new ones. Lundgren's (1992) continuous and discontinuous changes are based on a distinction between change taking place in existing activities and established structures or only loosely coupled to these. Håkansson & Snehota (1995) and Håkansson & Henders (1995) base their distinctions on the idea that network change often follow a certain pattern, path or logic. Gradual or evolutionary change follows a certain direction or pattern while radical or revolutionary change is a basic reorientation or path-breaking change.

Following the reasoning above, my point here is that both radical change, continuous change (or whatever terminology is used to distinguish different types of change) as well as stability should be accounted for by making reference to the mechanisms that must exist for these processes to occur.

Actions, reactions and domino effects

According to our critical realist interpretation change in networks must basically be understood as being processes of practice that transform or reproduce network structures. Networks (understood as structures) are not a result of optimality, efficient and effective designs, some exogeniously infused teleology or natural selection mechanism. Network structures in our critical realist must be understood as modified by practices performed by actors through intentional choice (implicit as well as explicit). That change basically must be understood based on actual practices, is also recognised by network contributions. For instance it is stated that *"...it is the change episodes initiated by individual companies in industrial systems that constitute the building blocks of network dynamics"* (Håkansson & Henders, 1995). A similar logic is inherent in the next quote on technological development in networks. *"It is not a single forward movement, but rather involves many actions and reactions, many changes of gear.....The outcome of the process is never optimal nor conclusive, it plainly is, and whatever is, is right"* (Håkansson & Lundgren, 1995). Both the quoted contributions have a 'but' tied to the further argumentation as it is the idea that network dynamics can never be adequately understood in light of initiatives of individual actors. I will return to this later. For the moment I will address contributions conceptualising network change as actions and reactions.

Categorising actions and reactions in networks are addressed in few contributions. As a method for handling complex and messy data from network studies Smith & Laage-Hellman (1992) discuss options for actors to transform or change the network structure at the level of the triad. Five patterns of transformation are identified (ibid):

- *By-pass* which refers to the situation in which an actor wants to either avoid an intermediary actor (*avoidance*) by interacting directly with the third party or influence an intermediary actor through this third party (*flanking*).
- *Combination* which refers to the strategy in which the focal actor chooses to pool resources and co-ordinate activities with a second organisation in the context of their common relation to a third party.

- *Bridging* which refers to the strategy in which the focal actor uses an intermediary actor as facilitator or access to a third actor.
- *Displacement* which basically is a focal actor replacing a former partner with another.
- *Separation* which occurs when a focal actor establishes an indirect relation as a replacement of a direct one. Two degrees of separation can be distinguished – *elaboration* and *blocking*.

These 'patterns of transformation' is basically categories of options possible for the single actor to initiate change. In this case the context is a triad, but this logic or understanding is applicable also for network levels beyond the triad (at least in principle).

Where the options described by Smith & Laage-Hellman are the initiating actions, Easton & Lundgren (1992) in a similar way describe reactions to initiated change. *"A network actor has a number of options available when faced with a change initiated by another network actor"* (ibid). This is described by five sequences (reflection, adaption, absorption, transmission and transmutation), a question of the extent of the modifications (amplitude modification) and the number of involved actors (dissemination).

- *Reflection* is when the involved actors reject or nullify changes initiated by another actor in the network.
- *Adaption* is when the change is managed by negotiations in the dyad, thus not influencing the rest of the network.
- *Absorption* happens when the actor accepts the initiated changes and handles these within own firm boundaries. Ie, the change does not affect outside the receiving actors.
- *Transmission* is the process in which the receiving actor transmits the effects of the initiated change further on to other members of the network.
- *Transmutation* then is when absorption and transmission is combined. The actor receiving the changes adapts its own organisation but also transmits change requirements to the rest of the network.
- *Amplitude modification* is a question of the receiving actor using the change initiative to either amplify or reduce the requirements to own organisation and/or the rest of the network. Thus, it is a question on the extent of the modifications required more than the nature of these.
- *Dissemination* then is the question of whether the required changes involve many or few actors.

Basically, what we have in these two contributions is categories of actions and reactions in network structures (level of dyad/triad). In focussing on the actions and reactions, these two contributions nicely fits Lawson's assertion that *"human practices or doings are the key to it all"*. Thus, these contributions offer, at a descriptive level, a tool for analysing the actions and practices (the change origins) that are central in social science. Even though possible reasons or motivations for the different actions and reactions are discussed, the contributions do not attempt to analyse the positions, abilities and choices behind the actions and reactions in depth. What is the actor's position to do what he does? What is the actor empowered to do? Why does the actor choose the particular action? In a given research situation answers to these questions (going backwards from action in the framework) would add to the depth of the causal explanation, ie analysing the question of 'why action?' as well as 'which action?'. Thus, combining research on concrete actions with abstract research adds to the depth of explanation.

Going forward in the temporal relations of the framework, the next issue is: How do these actions and reactions (practices) reproduce or transform the network structures? Easton & Lundgren address this issue by the extent of modification and the number of actors involved. These aspects (together with the nature of the actions and reactions) affect the nature and amount of change in/to the larger network. This leads to the idea of domino effects dealt with by Hertz (eg 1992 and 1998). Dealing mainly with integration processes[4], Hertz develops a way of understanding change in networks based on different levels – the relational, systems and network levels. The idea is that change is initiated in concrete relationships, but because of these relationships' interconnectedness to other relationships the initiated change has effects also on non-involved (but connected) actors. This leads to reactions by these actors, and consequently effects of the initial change on the relational level spread throughout the larger network. Thus, the argument is a way of anticipating change on network levels (ie structures) as being actions and reactions following each other through interconnected relationships. *"...increased integration at a relational level in an industrial system could lead to changes of both evolutionary and radical type not only at the relational level but also on the system and network levels. Which type of change will occur will depend on the origins of the process and the speed and number of the reactions of the non-involved actors"* (Hertz, 1992).

Based on this way of thinking domino effects are defined and explored. *"...connectedness, speed and sequence of changes are seen as basic elements of domino effects. Sequences of changes are the process, connectedness is a prerequisite and speed a contributing factor to the development. These three are triggered by the initial change"* (Hertz, 1998).

Similar thoughts are presented in Havila & Salmi (1999). The origin of change is situated in the interaction in dyads, ie practices (actions and reactions) in the dyads. Based on the idea of the dyad as both the receiver and transmitter of change, Havila & Salmi then distinguish between confined and connected change. In the former the change remains within the dyad (eg based on the reactions of reflection, adaption or absorption), and in the latter change influence actors outside of (but connected to) the dyad. Connected change could be the result of such reactions as transmission or transmutation, and seems to be quite similar to Hertz' concept of domino effects.

The amplitude modification and dissemination (Easton & Lundgren, 1992), the domino effects (Hertz, 1998), and the confined and connected change (Havila & Salmi, 1999) explains the spread or diffusion of change in the network. How far in the network will the change initiated have an effect? How many actors will have to react to changes? These questions depend on the level of interconnectedness, the speed of change, the number of actors involved, the wish to absorb or transmit change etc.

Another question is the nature of the change in the network structures, ie what kind of reproduction or transformation happens from the actions and reactions? This is addressed in both Hertz and Havila & Salmi, and also in the contributions addressed in the next section. Hertz (1996) presents change in networks based on the integration (decreasing-increasing) and degree of change (gradual-radical) dimensions. Four patterns of change on what she terms the net level is, drifting away, drifting closer, splitting of nets and joining of nets. These changes on the net (or macro) level originate from change in dyads (micro level). *"Changes*

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[4] The implications, though, hold for other change processes than integration.

of single, dyadic relationships are seen as changes on the micro level, while changes of nets take place at the macro level. Change at the relationship level is a prerequisite for change in nets" (ibid). Whether the changes are of gradual or radical nature depends on whether they are based on the development of existing relationships or new ones (or breaking old ones). Thus, the kind of change happening can be traced back to actions and reactions in the dyad.

Havila & Salmi (1999) also have some points on the nature of change. They distinguish between incremental and radical change depending on the same criteria as Hertz', ie whether change deal with existing relationships or new ones. Incremental change circles occur when incremental dyadic change spread through connected change and result in incremental network change. This happens according to Havila & Salmi through the mechanism of inertia. This mechanism of inertia must in a critical realist interpretation consist of some structural and positional features of the network that makes certain actions and reactions the most likely, ie actions and reactions that do not break up the existing actor structures. Radical change circles occur, on the other hand, when radical dyadic change result in radical network change. This happens through the mechanism of critical events. These critical events have the potential to break up existing actor structures, ie must have the potential to trigger actions and reactions to do so[5]. An interesting aspect of the Havila & Salmi contribution is that they emphasise the non-material determination of certain practices or events. *"The perceptions and intentional behaviour of business actors are thus decisive for change. What can be considered a critical event is ultimately an empirical question. It is business actors and their interpretations that determine what is critical and what is not"* (Havila & Salmi, 1999).

Summing up, the basic idea in these contributions is that change emerges from micro-level, ie from initial actions that, depending on the reactions, might have effects in the larger network. Thus, changes in networks can, in principle, be traced back to actions and reactions in relationships. And conceptualisations aiming for this micro to macro kind of explanation is developed. *"...if we understand the workings of small components of a network there is, at least in theory, a chance that we can begin to predict network processes as a whole"* (Easton & Lundgren, 1992). These contributions add to the understanding of change in networks by analysing actions, reactions and dyadic change and the way these affect the transformation (or reproduction) of larger network structures.

Change patterns and network evolution
Studying change at network levels as being modified by individual change episodes (actions and reactions) is analytically a very complex task (or perhaps impossible). Also, the existence of multiple centres of origin (Håkansson & Lundgren, 1995) makes this kind of analysis extremely complex. Several contributions present different patterns of evolution or processes at the network level – most often assumed to be result of single interaction episodes, but nevertheless conceptualised as overall network patterns. Havila & Salmi's radical and incremental change is a conceptualisation of such overall network patterns. Likewise are Hertz' joining of nets, splitting up of nets, drifting closer and drifting away.

I will in this section deal with the line of contributions leading to the network evolution patterns understood as vectors of change. Several articles, with Håkansson as a common contributor, lead to this much cited conceptualisation (Håkansson, 1992; Håkansson & Snehota, 1995; Håkansson & Henders, 1995; Håkansson & Lundgren, 1995).

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[5] It could be noted that the idea of critical events (though labelled significant events) is explicitly dealt with by Bhaskar (1998).

Three vectors of change are identified based on connections between activity links, actor bonds and resource ties. The first vector of change describes the way activity links and resource ties connect. *Structuring* is the refinement of existing ways to utilise and combine resources in activities. *Heterogenising*, on the other hand, is new ways of combining activities and resources. This structuring-heterogenising vector is about technology and economy. The second vector of change regards the connection between actor bonds and activity links. *Specialisation* is the tendency towards each actor performing a narrow range of activities, whereas *generalisation* describes the tendency towards each actor performing a broader range of activities. The generalisation-specialisation vector is about the organisation of activities. The third vector connects actor bonds and resource ties in the hierarchisation and extrication tendencies. *Hierarchisation* is a change process towards the necessary resources controlled by fewer actors, whereas *extrication* is a change direction in which the resources used are controlled by a larger number of actors. This vector describes resource control or availability. These vectors of change are usable for identifying the general dimension in the development of a network structure.

The vectors of change are combined with Lundgren's (1995) processes of coalescence and dissemination[6] in Håkansson & Lundgren (1995). The direction and weight of these vectors together form the total network evolution, ie the coalescence and dissemination processes. Dissemination occurs when heterogenising, generalisation and extrication is the dominant tendencies. Coalescence, on the other hand, describes the changes where structuring, specialisation and hierarchisation are the dominant tendencies.

The question is what these vectors of change represent. The obvious answer is that these represent actual evolution patterns as being reproduced by single change episodes, ie actions and reactions. The contributions, though, argue otherwise. *"The network is shaped through interactions but these in turn take place in accordance with the perceptions of the network held by individual companies. Therefore it is impossible simply to add together the individual interactions in order to understand the network as a whole. Instead individual interactions must be seen in the light of the total development of the network"* (Håkansson, 1992). This states that actual change still is viewed as consisting of single interactions, but these must be understood in relation to the 'total' development. There is a connection between separate interactions and the total network. Changes in networks result from actions and reactions, but these are closely linked to stable evolutionary processes of the total network. In a later contribution it is stated similarly that *"...single instances of change in a network can be attributed to the initiatives of individual actors, but the dynamics of a network cannot. Rather, network dynamics are more fundamentally a neverending process that defines the core of the industrial game and that is an integrated aspect of the network itself"* (Håkansson & Henders, 1995).

But then what is this total development of the network, if it is something more than reproduced patterns of actions and reactions? What is this network dynamic that is integrated in the network itself? And what gives weight to certain directions of change? This leads to the existence of a logic at the network level. The network logic is historically explained by Håkansson & Henders (1995). *"Each change must be put into a context consisting of what has happened before, what is happening at the same time and what is expected to happen. This means that the historical process is important because it has created a specific, although temporary, industrial logic within which the change appears...........change, at least partly,*

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[6] This is a descriptive model for understanding the emergence of industrial networks in the digital image industry based on the processes of genesis, coalescence and dissemination.

creates its own context for the direction and speed of further change". Furthermore, the network logic is described as *"the rationale in how connections between resource ties, activity links and actor bonds develop and become manifest in the pattern in which actors, activities and resources are bonded, linked and tied"* (Håkansson & Snehota, 1995).

This kind of rationale or logic inherent in the network must in our critical realist interpretation be a social construction. It must exist as some perceived (perhaps collectively perceived) logic. The actors have some perceptions of the past and future development of the network as a whole upon which they act, and through this action they reproduce or transform the network structure and the network logic. Therefore, the concept of network logic could be (and is by the author) viewed as a non-material determination of practice and structures.

Whether the actual development follows such a logic must depend on the interests and perceptions of actors. First of all, the network logic can exist as commonly agreed upon by all actors. But if some of these actors are interested in transforming the existing logic (ie conflicts on which logic should drive the actual development), the actual development will depend on whether these actors occupy the positions empowering them to trigger some radical change. Secondly, different perceptions on the existing network logic might exist. In this way actors act on different beliefs on the future development. This will most likely lead to actions hard to interpret and pointing in different directions, ie a pattern is hard to identify. Thus, what give weight to a certain direction of change are the interests in and the (agreed upon) perceptions of the network logic.

Summing up, the vectors of change can in the critical realist framework serve two purposes:
- Describing the actual pattern in the reproduction and transformation processes basically brought about by practices.
- Describing the perceptions or conventions (network logic) tied to actual structures and practices which guide future choices and actions.

4. Conclusion

This work-in-progress paper has presented a critical realist framework of the duality of structure and agency. The framework emphasise:
- The temporal relation between structure, actor and practice.
- The centrality of practice in social explanation.
- The existence of material and non-material aspects of practice.

The second aim of the paper was to discuss existing contributions on change in networks in light of this ontological framework. The contributions from IMP offer conceptual insight in the specific context of industrial networks. The issue to discuss was how and where different contributions fit within the critical realist framework, as well as discussing whether the contributions are consistent (or not inconsistent) with the critical realist line of thinking inherent in the framework.

Change in networks according to the critical realist position should be viewed as processes transforming or reproducing the network structures. This is the case dealing with radical change, continuous change as well as stability. All kinds of change (or stability) should be accounted for, and should be viewed as ontologically similar. The different types of change can be viewed as nothing but empirical categorisations (Havila & Salmi, 1999).

Addressing the question of whether the interplay between process and structure can be conceptualised in the industrial network approach (Holmen, Pedersen & Torvatn, 1999), the critical realist position provides a possible conceptualisation. In this practice is seen as constituting the processes going on, as well as being the transforming or reproducing force on the structures.

In the discussion on existing contributions two lines of thought were dealt with. In the first one change emerges from initial actions in the relationships that through reactions create domino effects or connected change throughout the network. These contributions offer a way to describe the initial actions and reactions, ie the triggering events and practices, as well as the spread from these throughout the network.

These contributions do not take much into account what underlies the specific actions and reactions described. Here the link to the actual choices made as well as the abstract analysis (how actors through their positions in network structures posses powers to choose) can add to the explanatory depth. This is also emphasised by Easton & Harrison (1999) in what they term low level explanation, ie how relationships change and how new networks form rather than why.

Furthermore the nature of change is not dealt with - at least not at the network level. But this is in focus in the second line of thought which account for change patterns for the network as a whole. The discussion in this paper is limited to the vectors of change and the existence of a network logic. The vectors of change describe tendencies or directions of change. These vectors of change can serve two purposes. First of all, they can describe the actual patterns in the reproduction and transformation processes basically brought about by practices. Secondly, they can describe the perceptions or conventions (the network logic) tied to actual structures and practices which guide future choices and actions, thus making a link to the abstract analysis.

As I see these two lines of thought, there is no ontological inconsistency between them. Discussed in the light of the critical realist framework, they seem to offer conceptualisations dealing with different parts of the structure agency duality, thus possessing a great deal of complementarity.

As a final point of this paper, it might be stated that in any given ideographic research task, explanatory depth can be added by combining abstract and concrete research. Thus, structure and process must go hand in hand when understanding change in networks.

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