OBSERVATIONAL DECISIONS AND METAPHORS IN THE THEORY CONSTRUCTION PROCESS: THE BUSINESS ECOSYSTEM METAPHOR.

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ABSTRACT

Metaphors from ecology are common in business and the business research literature. Such metaphors are attractive because they potentially give access to new insights and they help to communicate complex issues. But there are dangers to using them erroneously. The role of metaphors in theory construction is to increase conceptual variety of theory to match the variety of the research problem. The process of theory construction incudes many opportunities for increasing conceptual variety. The researcher's role is to generate and filter candidate conceptual systems and the perspective of the researcher strongly affects the success of this role. Hierarchy theory is a theory of observation that helps us to define how the perspective of the researcher affects theory construction and the use of metaphors. We use this theory of observation to develop a model for avoiding error and bias whilst making best use of the researcher's preconceptions and metaphors. We illustrate our model using to assess the business ecosystem metaphor which is common in the business literature.

Keywords: theory construction process; hierarchy theory; observation; triangulation; business ecosystems.

INTRODUCTION

The term 'business ecosystem' has been frequently discussed in conjunction with supply chains and networks of businesses. The use of concepts from ecology to help make sense of business issues may be a powerful tool for business managers. But there has been little work done on justifying and explaining its use in the business domain. In the business literature there is little agreement even on which characteristics of natural ecosystems should be used to describe and analyse the outwardly similar characteristics of business systems. Certainly, there are many concepts and phenomena that seem to map between natural ecosystems and systems of firms. These include the concepts of General Systems Theory; a heterogeneous mixture of constituents that nonetheless can be categorised; a complexity of interrelations between constituents that is difficult to observe and understand; the processual characteristics of the flows between constituents; the self-organising processes at different levels; and of course the competition for resources between constituents. However, a natural ecosystem that has developed via natural selection over millions of years has very different characteristics to a human made organisation of businesses that may be just decades old. Some of the mechanisms of a natural ecosystem do appear to map with those of a business system and may provide insights for inhabiting or managing business ecosystems. But many do not. A certain precision of language is required because of a lack of widely agreed terms to discuss any congruent characteristics is an impediment to discussion and research. One way to logically build theoretical mappings between different domains is to use metaphors and narratives to suggest potential mappings.

This paper attempts to use an examination of the process of theory building to understand how ecological metaphors can be used to build good quality theory in the business domain. First we look at the appeal of using ecological terms in business and go on to assess the dangers. Then we examine the literature on the theory construction process from the perspective of using metaphors to increase the variety of ideas that can be incorporated into potential theory and how these ideas are assessed for quality at different stages in the process. Ashby (1958) introduced the idea of requisite variety that is there must be sufficient variety in the description of a system to map onto the phenomenon that is being described. Applying the concept of requisite variety at a meta-level, the objective is to enable the solution variety of the candidate theories to match the problem variety of the research question or research stimulus. We consider how the perspective of the research influences the incorporation of ideas and how they are assessed using Hierarchy Theory, a theory of observation. We then develop a 'cog-in-a-cog' model of how the researcher makes conceptual and empirical observation decisions, within the context of each stage of the theory construction process, and use it to consider some aspects of the business ecosystems metaphor. We assess the utility of these mappings and their theoretical quality. Finally we discuss our insights, their limitations and suggest areas for further research.

THE ATTRACTIONS AND DANGERS OF USING ECOLOGICAL TERMS IN THE BUSINESS DOMAIN

Using ecological concepts in the business domain can be very attractive. For example, accessing the conceptual tools that people have intuitively developed to understand the natural world, and reusing them, helps people to communicate and deal with each other in the business world. The World Wide Web, globalisation and outsourcing have moved the business world up scale in the last decade, opening new opportunities but also presenting unfamiliar settings. A readymade set of tools to help people deal with this elaboration, especially tools with which people feel comfortable, has great appeal. Ecology imports metaphors from other fields with terms such as invasion, stress and competition, coming respectively from military science, material science and economics. These metaphors are already reworked into a coherent vocabulary for dealing with complicated open structures and the language of ecology lends support to the use of ecological notions in both research and popular literatures. Researchers in Industrial Ecology use natural ecosystems to as a model for designing environmentally sustainable business systems (Frosch, 1992). Also, researchers in Organisational Ecology investigate communities of firms and the rates at which new organisations and organisational forms arise, change and die out (Barnett, 1990; Amburget and Rao, 1996).

One of the earliest uses of the term 'business ecosystem' was James Moore who highlighted the increasingly obvious co-evolution and co-dependence of certain business and their business partners, such as IBM, Apple and Wal-Mart (1993). Other business researchers have acknowledged the importance of studying the interrelationships of the local cluster of supporting firms and competing at the supply chain level rather than focusing on a single firm (Porter and Kramer, 2011; Rice and Hoppe, 2001); described how firms can cooperate to create value in new ways by playing a variety of roles in complex supply chains (Iansiti and Levien, 2004; Adner, 2006); drawn analogies with ecological food webs and the spread of infections in the context of the stability of the banking system (Haldane and May, 2001; May et al., 2008); investigated how information technology has helped company to work more closely together (Kim et al., 2010); and used the business ecosystem metaphor to examine emerging industrial structures (Rong et al., 2010).

Metaphors are a powerful tool which can be used to provide "significant insights about mechanisms that product observable phenomena" (Tsoukas, 1991). Ecological metaphors help researchers to understand complex business issues and they help managers to communicate complex ideas more easily (ibid). But there are several dangers attached to using ecological terms in a business domain. The business researcher could just use the metaphors that are attractive, that fitted their preconceptions or that easily came to mind. The danger here is that the potential metaphors are chosen unsystematically. Also the chosen metaphors may only superficially map only the focal business phenomena, i.e. the ecological and business phenomena do not exhibit the sufficiently similar behaviours so the underlying mechanisms of the metaphor are not worth comparing, may be misleading or are just a small subset of the research study. The researcher may misunderstand the implications of the metaphorical system because it comes from another discipline. Finally the research might use the metaphor blindly, without checking for reasons not to use it or the boundaries of its valid use. So the danger is that the knowledge suggested by the metaphorical relationship could be used incorrectly.

Metaphors transfer information from a relatively well known domain to a less well know domain. Meanwhile similes assert the comparison of one thing with another. And yet again analogies focus on the relationships between an attribute of one thing and the attribute of another (Tsoukas, 1991). Metaphor is a description of one thing in terms of another, while analogy is a compression down to only what two or more systems have in common (Zellmer et al., 2006). Business ecosystem metaphors consist of a metaphorical relationship between some business phenomenon of interest and some ecological phenomena. The use of metaphor suggests that potentially there is something to be learned from knowledge of the ecological phenomena, or its underlying mechanisms, that could be applied to the focal business phenomenon. But there are dangers in using the metaphor because of potential inconsistencies and lack of fit in the *perceived* metaphorical relationship between the two different phenomena. Next we examine the process of theory construction in business literatures such as organisational research and information systems research in an attempt to assess where the different inconsistencies and lack of fit may occur.

THE PROCESS OF THEORY CONSTRUCTION

What constitutes theory?

There are multiple meanings of various words in the realm of research abstractions, such as theory, hypothesis, model and narrative. We lay out some of those alternatives for theory in the literature and finally say what we mean by the word. Theories consist of "what" – the variables, constructs and concepts that describe the subject of interest; "how" – the ways that they relate to each other; and "why" – the underlying reasons for the existence of the "what" and their relationships of "how" (Whetten, 1989). "What and How describe; only Why explains." (ibid, p. 491). Explanation invokes a change in level. The change in level of analysis may be a reduction to the parts, in which case there is some "How" in there: why does it happen. But if the change is to the level above, then there is only a "Why" that invokes the significance of the system in context. Theories do not consist of lists of variables or constructs because such lists are arbitrary. Such lists would pertain only to a model. Also, theories lack proofs of completeness and explanations of the relationships between the listed items (Sutton and Staw, 1995). For example, some of the model constructs in the business process modelling literature "merely list properties" (Lindland et al., 1994, p. 42), so there is no way first order way to judge the relative quality of different lists of model constructs. George Box said, "All models are wrong, i.e. they represent an arbitrary freezing of fluxes, but some models are useful. Quality in that setting is utilitarian, so a statement of purpose is crucial. Good quality theories include not just a list but also an internal logic that interrelates their conceptual elements that make up their conceptual systems. Good theory justifies the completeness of these elements. This internal logic comes from a mixture of sources such as the external literature, patterns of empirical data and the researcher's past experience. For example, Tsoukas's work on theory development uses Beer's methodology of scientific modelling in an approach to constructing organizational theory that uses external metaphors and analogies to increase the variety of concepts that are available (1991). In contrast to this Grounded Theory is a common theory building methodology that seeks to minimise the use of external theory to minimise preconceptions by focusing on emergent patterns of data and (Robson, 2002). Both extremes are part of a theory construction process and Weick illustrates this process with an examination of how organisational theory is constructed showing opportunities at each stage for improving theoretical quality (1989).

How metaphors can increase the requisite variety of the elements of conceptual systems

Tsoukas suggests that metaphors and analogies can be used to generate insights about potential mappings between known mechanisms that produce phenomena and unknown mechanisms that the researcher is investigating (1991). Rosen (1991) makes the distinction between insights that come from models used as metaphors, as opposed to analogies which are between two systems that map onto the model as metaphor. The two material systems suddenly become analog models of each other, as when the laws of aerodynamics (formal model of scaling equations) are applied to a DC 10 and a paper dart. The two flying objects are joined in a non-symbolic compression of what they have in common, i.e. all experimentation depends on that relation. Rosen's use of models and analogies is more open than Tsoukas'. Tsoukas' approach for using metaphors is developed from Beer's theorisations of the role of variety. First the researcher has the insight that there is a metaphorical similarity between two phenomena in different domains, e.g. natural ecosystems and business systems. Next the researcher defines a conceptual model of the precise analogies between the two phenomena and then abstracts each of the conceptual models into a homomorphic model. Homomorphisms are many-to-one transformations where there is some simplification in the homomorphic model relative to the phenomena that is modelled but the operations between elements are preserved. For example, in a national post code or zip code system all addresses can be mapped to the system and important information such as rough location is preserved but locational granularity is reduced. In contrast isomorphisms are one-to-one mappings, e.g. a map and the city it maps. Isomorphisms are "virtually interchangeable" (Tsoukas, p. 573) but a homomorphic model does not have all the properties of what it models. Of course, using two homomorphic models that abstract certain qualities from each conceptual model raises the question of which qualities to choose preserve when fashioning the homomorphic models.

Tsoukas' process of abstraction from one-to-one to many-to-one mappings excludes information, and that tightens the conceptual focus of each model. Two isomorphic models are most likely too heterogeneous to map usefully to each other but the two homomorphic models that abstract certain qualities from their respective conceptual models may be isomorphic to each other (ibid), i.e. it seeks to focus on commonalities. Beer advocates a 'yo-yo' movement to between metaphoric insight, analogous conceptual models, homomorphic models and a potential isomorphic mappings to test different systems of concepts by adding and subtracting possible structures of conceptual elements and their relations. But there is no guarantee of success in isolating two sub-systems of concepts that are isomorphic with each other as well as each being homomorphic with phenomena in the two domains.

One example Tsoukas uses is how biological metaphors in organisational science suggest explanations for organisational variety and the relations between organisations and their environments. The insight in his illustration is that organisations can be seen as organisms and that "consequently, organisational populations can be described as similar to as biological populations" (p. 580, 1991). In other words, conceptual systems can be developed that show analogies between organisms and organisations such as the processes of growth and decay and the arising of a dominant form in both types of population. He constructs a homomorphic model for this conceptual system that includes the principle of variation, the principle of natural selection, the principle of retention and diffusion and the principle of struggle for existence. Insights from this homomorphic model, he suggests, can be applied to organisational populations to develop a potentially corresponding homomorphic model of organisational evolution. The inference being that such a research programme could potentially highlight two corresponding homomorphic models that could be used to suggest mechanisms for how different organisations come into existence in different environments which is based on the more developed theory of how biological populations do so.

Tsoukas uses metaphoric similarities to suggest candidate theories for explaining phenomena in new domains. The candidate theories are presented in the form of conceptual systems, then abstractions of different aspects of them are made. Then these abstractions are tested for fit with abstractions of the conceptual system of the target phenomena. This process of suggestion and testing is analogous to pharmaceutical companies testing vast numbers of natural chemicals against specific diseases. Both the metaphors and the natural chemicals increase the requisite variety of the solution systems that could potential explain the target phenomena, or cure the disease. They are devices to promote *heterogeneity* among early stage candidate solutions (Weick, 1989). Tsoukas' process tests for logical fit between candidate conceptual system and target phenomena. This illustrates the danger of using concepts from a source domain in a different target domain and the difficulties that it causes for researchers who wish to develop a potentially corresponding homomorphic models. The danger is that the researcher may take unneeded, unwanted or misleading conceptual (or pharmaceutical) resources from the source domain. Systematically testing for fit is particularly relevant for defining the boundary of application of the target homomorphic model. This boundary is the extent to which the model can be generalised within the target domain, i.e. the target homomorphic model is an *abstraction* of the target domain so there are limits to what it can map to in the target domain. Unless great care is taken firstly in choosing which properties to abstract into the homomorphic models, and secondly in testing their fit with the target phenomena, then any resulting theoretical development is likely to be misleading or incomplete. Alternatively, if the limitations are too great then the model may be of little use.

How Grounded Theory can increase the requisite variety of the structure of conceptual systems

Tsoukas' approach rests on how metaphors can be used to highlight potentially corresponding conceptual systems, to increase the requisite variety of candidate solutions and how increasing the requisite variety of potential component concepts in theory construction can increase theory quality. A contrasting approach is Grounded Theory which tries to limit the external sources of constraints on the imagination of the theorist. Again the objective is to increase the requisite variety of possible solutions. Grounded Theory is an inductive coding technique that builds emergent codes, i.e. classifications, from relationships that are perceived within the data. These relationships emerge during the researcher's examination and re-examination of field data rather than from any prior theory (Miles and Huberman, 1994). Although researchers always commence fieldwork with incumbent ideas, experiences, associations and conceptual frameworks rather than as 'blank sheets of paper' (Silverman, 2000).

The Grounded Theory approach builds data concepts into conceptual patterns and then assembles conceptual patterns into theory (Silverman, 2000). Silverman's approach parallels Glaser and Strauss' original description of Grounded Theory (2000) with several stages: an initial attempt to categorise the data; an attempt to 'saturate' these categories with examples from the data that demonstrate relevance; and the development of these categories into a more general analytic framework "with relevance outside the setting" (ibid, p. 144). The grounded theory approach seeks to develop an emergent conceptual system of codes from field data. Field data are coded in three stages: 'open', 'axial' and 'selective' coding (Robson, 2002; Silverman, 2000). Miles and Huberman call it coding data for description, then for interpretation and then for patterns (1994). First, the researcher codes the raw data, using a minimum of abstraction to manage its volume, and then it is coded for the links *between these first level codes* to organise concepts and phenomena in the data into categories. Open coding is done by reading through transcripts, field notes and other data sources and by adding coded level 1 tags. Second, the researcher axially codes for *patterns in the links between the first level codes* to understand the inter-relations between the different categories, case phenomena, conditions of occurrence, contexts, actors' actions and their consequences. Axial coding is done by adding higher level 2 tags that form a model of the relationships between the open coding tags. Third, the researcher uses selective coding to differentiate between possible patterns of inter-category relations and to build coding structures into conceptual structures and then theoretical models. Selective coding is done by adding a level 3 tags which selects patterns of axial coding (level 2) tags. For example, in a study of a soccer club's commercial activities the level 1 tags could be the different aspects of the products and services that fans consume; the level 2 tags could be the overall activities of the partner firms that integrate the level 1 tags; and the level 3 tag could be the insight that the club's role is to connect the fans' needs for products and services with the partner firms' needs for knowing the fans' needs. The result of the selective coding stage is a core conceptual category (Miles and Huberman, 1994; Robson, 2002), a 'level 3 tag' which connects the other categories at some abstract level and can be linked to external theoretical concepts and the research question. Similar to Tsoukas' approach (1991), the grounded theory approach is a cyclic and multi-level process that composes and decomposes elements on the data level and on the coded levels that emerge. The objective is to build a conceptual system that reflects the detailed phenomena that is described by the data and that can also be articulated in several broad high level codes.

How Theory construction is a process for building conceptual systems

Weick describes theory construction as a process that is made up of stating the problem, formulating thought trials and applying selection criteria (Weick, 1989). *Problem statements* include an anomaly that the theorist is seeking to explain and a set of assumptions that needs to be confirmed or disconfirmed. The trigger is some puzzle, anomaly, inconsistency or problem that motivates the researcher. *Thought trials* are what Weick calls the process of building the candidate conceptual systems that make up potential theories. In line with Tsoukas he also supports approaches that amplify requisite variety by minimising the dependences between the methods of generating candidate conceptual systems and the sources of their components. For example, he advocates heterogeneous research teams and researchers with more general experience, eclectic methods, randomisation and highly specific categorisation schemes. All these support a greater variety of conceptual inputs, the highlighting of diverse relationships and a greater ability to recognise important relationships. Finally, *applying selection critera* is Weick's label for testing the significance of a candidate conceptual system. He suggests that theoretical quality can be checked if the theorists compare their early stage theoretical ideas to their past experience, in the form of assumptions, and assess their own reactions. These reactions then come in four different types: that's interesting (a moderately strong assumption is disconfirmed); that's absurd (a strong assumption is disconfirmed); that's irrelevant (no assumption is disconfirmed); or that's obvious (a strong assumption is confirmed).

Theoretical quality can also be checked by looking for the theoretical fit with external literatures to look for consistency, inconsistency and alternative theorisations. Eisenhardt advocates linking a candidate theory to the 'enfolding literature' to look for contrasts and similarities (1989). Discussing contrasting theory presents an opportunity to develop both the candidate theory and the enfolding literature in order to reach theoretical coherence. Also, if there is contrasting theory that is apparent but that is not addressed by the researcher, then the theory is open to accusations of internal validity or generalisation problems because it might be assumed that the study's results may be incorrect or idiosyncratic. Discussing similar theory presents an opportunity to increase the theory's internal validity, widen its generalisability and raise its conceptual level (ibid). Internal validity is increased and generalisability is widened by showing that the research theoretically models phenomenon in different contexts. Different contexts cover a more general span of phenomena and the validity of the theoretical model is strengthened if it is maintained under additional empirical contexts. The conceptual level of the research can be raised by adding a conceptual level to either the candidate theory or to the 'enfolding literature' or both. The new level becomes a theoretical bridge between them. This bridge is similar to Yin's point that linking the research to external theory enhances *analytical* generalisability (2003). Lee and Baskerville suggest a framework of four types of generalisability that are based upon the four different permutations of generalising *from* empirical statements or *from* theoretical statements versus generalising *to* empirical statements or *to* theoretical statements (2003): generalising from data to a description; generalising from data to a theory; generalising a theory, confirmed in one setting, to descriptions of other settings; and generalising a variable, construct or concept to a theory. So Generalisability can be thought of as a form of empirical or theoretical *triangulation* that can be used to assess consistency and logical robustness.

How the researcher's role generates and filters candidate conceptual systems

If we think of theories as conceptual systems that map onto aspects of phenomena that the researcher wishes to investigate then we can represent their construction as a trial and error process that assembles candidate conceptual systems, then selects between them for more extensive validation and finally validates the resulting short list (Weick, 1989). The higher the variety of possible concepts that the candidate conceptual systems can draw on then the more likely they will be able to match the requisite variety of the external phenomena that they need to model. Similarly, the higher the variety of possible structural relations that can be used then the more likely they will be able to match the requisite variety of the relations within the external phenomena. This access to greater variety will generate more heterogeneous candidate theories for internal selection and these candidate theories will cover a greater theoretical scope. The theoretical quality of the remaining candidate theories can then be checked by linking them to external theory and then they can be validated by checking their fit with the empirical or theoretical phenomena of interest (see Figure 1).

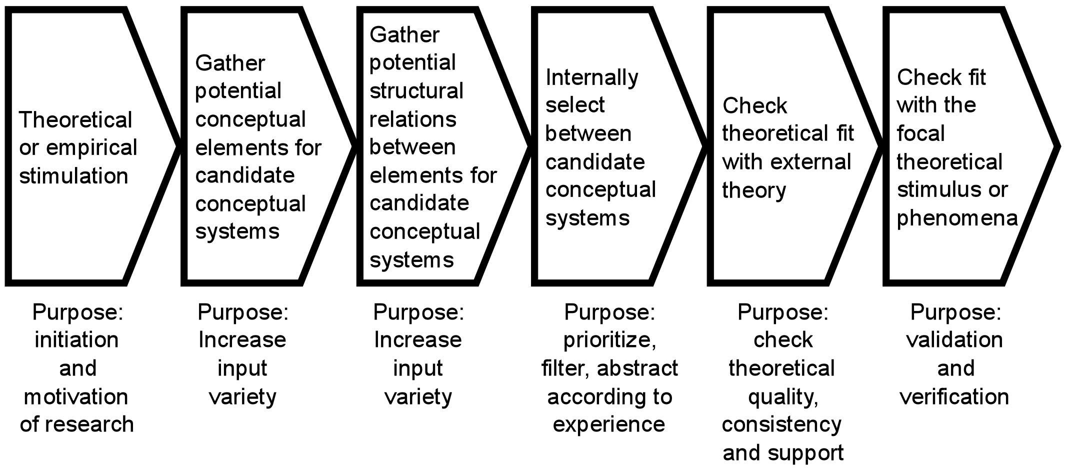

Figure 1: The six stages of the theory construction process which uses high variety input and high variety testing strategies to make candidate conceptual systems more likely to fit the variety of the focal phenomena (based on Weick (1989).

The theoretical quality of the outputs of the process can be increased by acknowledging the importance of the researcher's role in creating *bias* which in turn reduces both input variety and testing variety. This role is consistent with the literature on theory building that we have discussed but it also highlights the role of the researcher in theory construction. In the process of theory generation and testing all stages are strongly subject to the researcher's interests, focus, experience, values, chosen methodologies and priorities. These both limit and enable the conceptual scope and content of any conceptual systems that the research may generate or consider testing. Which is why theorists advocate the use of devices to improve the variety of input concepts and structural relations (Tsoukas, 1991; Weick, 1989; Robson, 2002). This effect on possible conceptual systems is also why attention is paid to the phenomena of researcher bias and other limitations in the availability of possible concepts for candidate conceptual systems, and how they interrelate, which may shape such systems according to the limitations of the researcher rather than the phenomena being researched. These shaping forces must be acknowledged in order to enhance theoretical quality.

The conceptual system that constitutes a theory can only map on to an abstraction of the complex phenomena being investigated. Thus the potential for researcher bias is inherent in theory building because the researcher must choose which aspect of the phenomena to abstract from an infinite number of possible aspects. The problem with bias is not just when it limits the abstractions that can be made. It is also a problem when the researcher does not realise that biased research decisions are being made. If certain candidate conceptual systems cannot be proposed, e.g. due to limitations in the researcher's knowledge, and this is acknowledged then the boundaries of the current research project are defined for future research. If there is no acknowledgement or awareness that certain candidate conceptual systems are unavailable then they will never be proposed. This preclusion of possibilities reduces the potential fit between theory and the domain of interest by reducing the conceptual tools available and by producing conceptual artefacts. Examples of this sort of blind omission are listed by Miles and Huberman and include researcher effects on the research participants or the case site, and their effects on the researcher; sampling bias and method bias (1994). They also suggest strategies to minimise bias such as checking other data sources; using other methods; checking the implication of outliers and surprises; searching for negative evidence; replication; checking for rival explanations; checking implications; and getting participants to feedback on your findings. These are all methods of widening the focus of investigation to compare and take in more of each logical type of entity that makes up the whole research project and research strategy, e.g. multi-stakeholder assessment of significance and validity, theoretical and methodological heterogeneity and robust sampling strategies.

We call this 'triangulation' because of its metaphorical link to moving ones view point to compare different perspectives on the same target after Patton's four types of triangulation: data triangulation, investigator triangulation, theoretical triangulation and methodological triangulation (in Yin, 2003). All these strategies are methods of examining the internal relations of the candidate conceptual system, and its relations to the phenomena that it hopefully models as well as the users of any resulting theory. For example, data triangulation checks for relationships between the candidate conceptual system and new data that may disprove or support it. Method triangulation checks for artefacts produced by any one particular method. In this way triangulation uses multiple perspectives to check for the existence of new relationships. This more rigorous assessment is also true for data that surprises and at first sight look like outliers, but that then may point to some new relationships. Negative evidence or rival explanations may disprove the existence of other relationships. Replication is a type of triangulation on the research project level. Checking implications and participants feedback is a form of processual triangulation where the outcomes of the theory being valid are checked.

How the perspective of the researcher affects the generation and filtering of candidate conceptual systems

The goal for the researcher is to construct a conceptual system that maps onto the chosen abstraction of the phenomena under investigation. But the researcher can think of many more different conceptual systems than can be tested or even communicated to others. So researchers generate many candidate conceptual systems and select among them for the ones that are most attractive. Most candidates are part systems rather than full conceptualisations of the focal phenomena and most ideas never even get noted down. As Tsoukas (1991) and Weick (1989) have noted, the attractiveness of candidate conceptual systems and the quality of the resulting theories can be enhanced by increasing the variety of the elements and relations of these candidate conceptual systems, and there are different ways to do this that include the use of metaphors. Variety can also be increased by acknowledging where variety is restricted by bias. Bias can be minimised and checked for by examining the relationships between the entities in the research project in the same way that internal logic is checked within the candidate conceptual system (see Figure 2). This *internal triangulation* checks for consistency between the research question, the objectives and interests of the researchers, the theory and approach that they use and the focal empirical or theoretical phenomena. But *external triangulation* can be used to check for consistency between the elements of the system of the research project and other stakeholders, e.g. users of any research contributions; other theory and research domains; other empirical domains, e.g. other case sites or applications of any research contributions; and other research projects. Any inconsistencies can lead to insignificant research contributions, lack of novelty, theoretical weakness and lack of generalisability. Also, the act of *external triangulation* can increase the variety of perspectives that are available to the researchers which increases the variety of the conceptual systems that they have available for theory generation. But this requires a specific definition the researcher's perspective, i.e. a description of the researcher's relations to the theories and the phenomena under study. If the researcher's perspective is not defined then the research project may lose its way or the findings of the research will be open to misinterpretation.

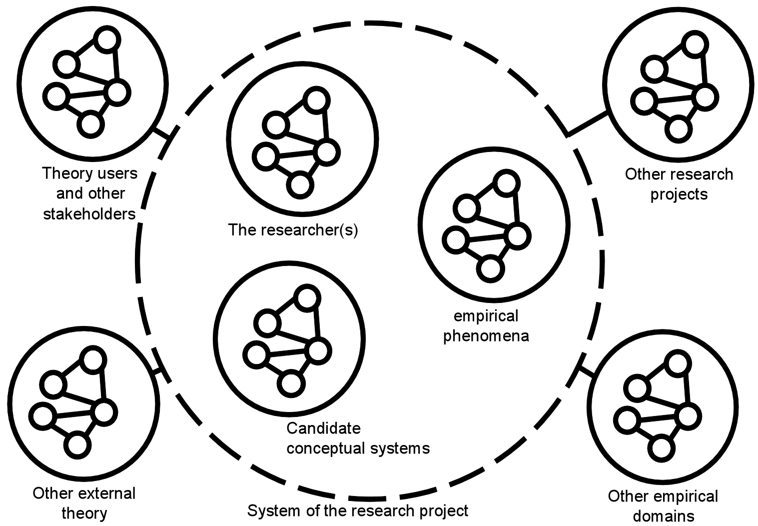

Figure 2: The research project is a system of the researcher or researchers, the conceptual systems that they are aware of and any empirical phenomena of interest. External to this system are other stakeholders and users of the internal theory, other external theory, other research projects and other empirical domains. The circles and lines within the large circles signify the elements and relations within each external entity.

The researcher must explicitly define the focus and interest of their research question, i.e., their level of analysis; the specific phenomena of interest; and the boundary between what is relevant to them and what they are not concerned with. For example, Markus and Robey's classification of dimensions of causal structure in theories enables the positioning of the *logical structure* of a theory, i.e. a variance or a process theory; the *causal agency* of the theory, i.e. a technological imperative, an organisational imperative or an emergent perspective; and the *level of analysis* that the theory is concerned with (1988). This classification is normative rather than subjective though because it does not include the position of the researcher relative to the model and the phenomenon that is modelled. Semiotic theory, the theory of signs, is subjective in the sense that it conceptualises the relations between the sign (the theory or model), the sign maker (the researcher or theorist) and the focal phenomena. The three semiotic sub-dimensions are the syntactic relations of the sign, i.e. its internal conceptual system; the semantic relations between the sign and the phenomenon that they point to, i.e. their meaning; and pragmatic relations between the sign and the user of the sign; i.e. the use of the theory (Liu, 2000). Semiotics does not normally deal with the relations that directly link the researcher and the phenomena under study, i.e. the researcher's observations.

But hierarchy theory is a theory of observation. It is an approach for modelling complex systems "through a self reflective process of observation and description" (Wilby, 1994, p. 659). It gives us some tools to explicitly describe the perspective of the researcher and the researcher's role. These tools enable us to externally triangulate between the research project system and components like the candidate conceptual systems and the research objectives and external stakeholders, theory, empirical domains and other research projects. These tools enable us to internally triangulate between the theoretical elements and empirical elements of the research process. "Hierarchy theory's method is to expand the problem space to include the observer as well as the observed" (p.28, Ahl and Allen). It enables the preconceptions, metaphors, values, interests, external theories and experience of the researcher to be examined as part of the research strategy. This method is not the exact reverse of Grounded Theory since it acknowledges the researcher's perspective on conceptual systems that emerge during the internal theory construction process as well as those that are imported from external sources. Hierarchy theory addresses how "observation is the interface between perception and learning" (p.13, Ahl and Allen). Observation, and research, require not just seeing but *looking*. Knowledge does not come from the observer and it does not come from the external world. Knowledge comes but from an interaction of the two. This assertion is consistent with Weick's segmentation of experience (1989) and Tsoukas' Homomorphic mappings (1991). Research involves important design decisions by the researcher and these are dependent upon the researcher's values and experience. We can take several ideas from hierarchy theory to develop our thoughts of the researcher's role in theory construction and most specifically about how the interests and perspective of the researcher affect the theory construction process. Here we include the theory construction process as well as validation and empirical research by considering the theorist's *observation of the conceptual system that makes up a possible theory* as well as the observation of any empirical phenomena.

Hierarchy theory is concerned with issues of definition, measurement, scale and purpose in theory construction. The definitions that the researcher knowingly or unknowingly brings to a research study, such as the theoretical frameworks, greatly affect the objectives of data capture. The choice of measuring instruments and methodological frameworks greatly affect what phenomena can be captured and what aspect of those phenomena is described by the data that is recorded. The analytical scale of the research study defines the focal phenomena as well as the maximum detail of the phenomena that can be observed. Finally, the purpose and values of the researcher drives the choice of all other research design decisions. The danger for the researcher is that if these elements of the research strategy are not considered then they may not be consistent or exhaustive and they may lead to perspective errors in the research and theory construction process. Ahl and Allen explain that observation involves five crucial decisions. Next we will consider how each of these decisions involves potential perspective errors that the researcher must avoid.

(i) *posing a question*: observation is an active process, i.e. a process of looking rather than the passive absorption of sensory input. The researcher starts by being stimulated by a problem, an inconsistency or an unexpected occurrence. In research the initial stage for formulating the research question must be 'triangulated' just in the repetition of research investigations in the same and different contexts but in the use of the knowledge that theory supports. Evaluation is a process that involves the perspectives of all stakeholders, eventually. The potential error here is that the researcher may not evaluate a theory against 'enough' external theory, other empirical domains or theory users to systematically assess where its theoretical and empirical boundaries are.

A SYSTEMATIC CONSIDERATION OF OBSERVATIONAL DESIGN DECISIONS IN THE THEORY CONSTRUCTION PROCESS

In this section we illustrate how a systematic consideration of observational design decisions in the different stages of the theory construction process can guard against the dangers of using metaphors. We illustrate this using the 'cog-inside-a-cog' metaphor in Figure 3. The inner cog represents the cycle of suggestion and triangulation that can be used to repeatedly generate candidate concepts, relations and conceptual systems from the researcher's empirical or theoretical experience and then check their consistency with the rest of the research project system. The inner cog cycles within the inner teeth of the outer cog, which represents the stages of exploration and validation in the theory construction process (see Figure 1). We check the quality of our cog metaphor by emphasising that the sole metaphoric link that we use is that the inner cog turns one full cycle for each stage of the theory construction process that is set along the outer cog's inner teeth. The individual perspective of the researcher informs all observation decisions at each stage and the action of generating candidate conceptual systems is affected by the researcher's perspective just as much as empirical observation is. There are similarities between the two cycles because they are both observation processes, i.e. proposal and testing processes. But the cycle of suggestion and triangulation is a lower level process in that it is a higher frequency and an internal process of a single researcher. The theory construction process is a lower frequency process of the whole research project system, which may include more than one researcher. The teeth of the outer cog are not fully shown and they represent a link to a higher level of suggestion and checking such as using the theory. Next we check the usefulness of the business ecosystem metaphor using our cog-in-cog model in Figure 3. Since we are in the theorisation phase of our investigation into Business Ecosystems and this check includes no empirical research yet.

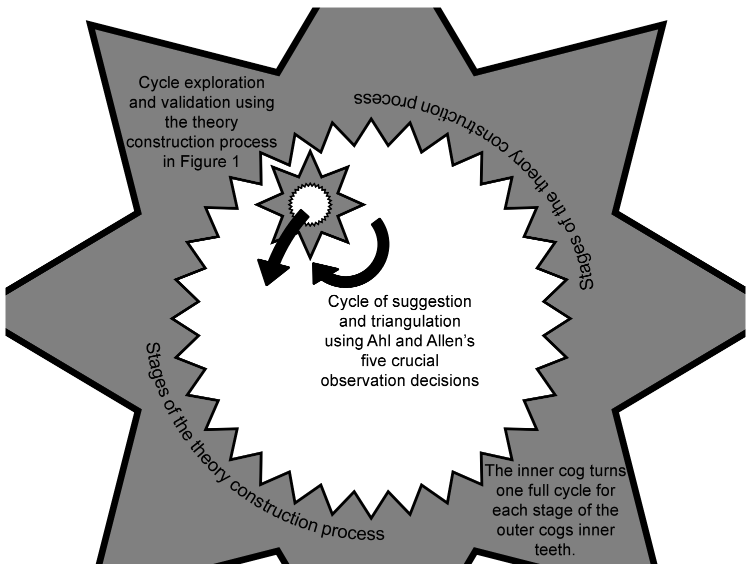

Figure 3: The researcher makes conceptual and empirical observation decisions within the context of each stage of the theory construction process.

The metaphor of a business ecosystem

Stage 1: Theoretical or empirical stimulation

Moore's metaphor of a business ecosystem suggests that business supply chains have some homomorphic commonality with natural ecosystems and that this can be used to inform business strategy (1993). The stimulation to use such a metaphor is access to new theoretical insights and practical advice about business strategies for supply chains and networks of firms. Considering Ahl and Allen's observation decisions we can see that this research objective is commonly valued in the literature and in industry and the entities to observe are business communities rather than supply chains, which have limited exchanges in terms of content and time. Single firms and customers are on a level of analysis that is irrelevant to the focal phenomena because they change too often; Appropriate behaviours to measure are resource flows and one noticeable aspect of the focal phenomena that the metaphor suggests is a business ecosystem's potential ability to use its complex interrelationships to access more of the value in a given market than a simple supply chain can. Also this research objective, the level and scope of analysis, the focal entities and behavioural measures, the possible relationship between system complexity and accessing value are all consistent with the initial stimulation to use the metaphor.

Stage 2: Gather potential conceptual elements for candidate conceptual systems
The business ecosystem metaphor suggests many different conceptual elements that could be used because ecology is a highly detailed research domain. One concept that is suggested by the initial stimulus to use this metaphor is the concept of *resource*. Considering Ahl and Allen's observation decisions we can see that this concept is present and significant in the business literature and well researched from a business perspective, i.e. the concept fits but it is not novel. In terms of the concept of *resource*, the entities to observe are the flows and stocks of resource and the different types of resource, such as materials, energy, cash and information, each with their different behavioural measures. There are similar considerations for the concept of *competition* and both sets of considerations are consistent with the initial stimulation to use the metaphor, the research objectives and other theory construction stages.

Stage 3: Gather potential structural relations between elements for candidate systems
One link between the concept of *resource flows* and the concept of *competition* is the concept of competition between different ways of organising resources. These concepts are consistent with concept of *business model* in the business literature. The business model concept generates great debate although we notice that the debate is usually applied only at the firm level of analysis (Shaw, 2008). Again, the concept of *competition between different ways of organising resources at the community level* is consistent with the initial stimulation to use the metaphor, the research objectives and other theory construction stages. We will call this the 'ecosystem business model'.

Stage 4: Internally select between candidate conceptual systems
In addition to the concept of the ecosystem business model the metaphor suggests many more potential conceptual elements and relations to build into candidate conceptual systems. We discounted these due to space constraints and because they were trivial, only superficial mappings, in well researched areas, not novel or they were not strongly associated with the theoretical domains or analytical level of the business literature that interest us, i.e. value creation in business networks. We applied these filters at all parts of Ahl and Allen's cycle of observation decisions and to the all aspects of candidate conceptual system.

Stage 5: Check theoretical fit with external theory
When we checked the concept the ecosystem business model against external theory we found that the concept was consistent with the related concepts of value creation systems, e.g. Lepak, et al. (2007), significant and under-researched at the level of analysis that we have chosen (Shaw, 2008). The limitations of our perspective were that we were mostly aware of information system theory, business process theory, value creations theory and ecological theory rather than for example economic theory.

Stage 6: Check fit with the focal theoretical stimulus or phenomena
Finally we confirmed that this conceptual system of ecosystem business model, the competing organisations of resource flows and the potential relationship between complexity of flows and value creation remained true to our initial stimulus in using the business ecosystems metaphor.

DISCUSSION

The perspective of the research is relevant to the qualitative theory construction phase *and* the quantitative theory validation phase of research. The theory construction process involves frequent switching between examinations of candidate potential systems, their conceptual elements and their interrelationships as well as the examination of empirical data. Hierarchy theory makes a distinction between *definitional frameworks* and *empirical frameworks*. Definitional frameworks are systems of categorisation that are set by the observer and empirical frameworks are systems of categorisation that patterned on what is observed. Definitional frameworks are based on what is important to the observer and empirical frameworks reflect the phenomena that are observed. Problems arise when definitional frameworks are confused with empirical frameworks and this confusion can happen in theorisation as much as in empirical study. We can best use metaphors, the researcher's preconceptions and the researcher's observation frameworks by articulating them and by forcing their assessment as part of systematic internal and external triangulation process. This includes specifying the research question and all other parts of the research process so that they are all consistent. A process of theory construction that includes the perceptions and role of the researcher is also useful when metaphors and preconceptions are kept to a minimum, e.g. when using Grounded Theory. These perceptions govern how the researcher relates to the conceptual system that emerges to make sense of the observed phenomena. This is true whether or not the conceptual system has external components from sources other than the observed phenomena or not.

The values and experience of the researcher inform all stages of the theory construction process. Tsoukas uses the guiding principle of 'systemacity' and advocates the preservation of higher order relations, i.e. abstraction. But Tsoukas does not explicitly explain what he means by 'higher order' and what he means by 'lower' order except to suggest that high order relations would be important and are very often associated with the cause and sustenance of the mechanisms of the phenomenon of interest. The researcher's values and experience define what higher and lower order relations are. This definition is a product of the researcher rather than the researched. These values and experiences are 'parallel', i.e. each idea that they suggest does not necessarily exclude other ideas. This means that the cog-in-a-cog model can be used in reverse, as well as cyclically, not to solely use metaphor inputs as building blocks for candidate conceptual systems in one direction but also in reverse to use problems to suggest metaphorical bridges to candidate conceptual systems that could theorise them.

Selection between possible candidate conceptual systems is prioritisation and filtering by the researcher's bias in the form of setting the problem statement, choosing the research methodology and validation strategy. A research team itself introduces bias based on how positions in the team are advertised and the experience, interests, personalities and attitudes of the researchers. Biases are based on the inherent bounded rationality of the research team and express themselves in the forms of limitation in the variety of conceptual systems that given researchers are able to think up. External triangulation is a label we have given to ways of *trying to* avoid bias and maintain consistency in and between the different stages of the theory construction process. The problem with exhorting researchers to systematically use external triangulation to check fit and reduce bias is that there is a limit to how many triangulation checks the research is able to do. This also produces a need to prioritise which in turn generates a potential bias and thus potential opportunities for wrongly ordering alternatives as well as missing others. Practically speaking all that a researcher can do is to be aware of how the boundary of their experience affects their observation decisions and their research. They can only try to be *reasonably* systematic and use triangulation techniques such as 'theoretical saturation' (Miles and Huberman, 1994), which systematically utilises all the points of view available to a single researcher, and the perspectives of other stakeholders, which systematically utilises all the stakeholders *and* their points of view. Generalisability is linked to empirical and theoretical triangulation in that triangulation checks for consistency and accesses new perspectives where as generalisation makes use of them.

CONCLUSIONS

The researcher's conceptual and empirical observation decisions within the context of each stage of the theory construction process are related to the researcher's personal experience and interests. The individual perspective of the researcher informs all observation decisions at each stage and the generation of candidate conceptual systems is affected by the researcher's perspective as much as empirical observation is affected. We use the concept of observation decisions from hierarchy theory to examine the role of the researcher as an observer in the different stages of the theory construction process. From this examination we develop a 'cog-in-a-cog' model which we apply to theorisations as well as to physical observations. The 'cog-in-a-cog' model enables the systematic consideration and challenge of assumptions that cause missing or ill fitting conceptualisations, as well as assessments for physical phenomena that are missed by a flawed sampling protocol. We develop the concept of internal and external triangulation to describe how the systematic consideration and challenge of assumptions can be applied to the internal elements of the research project system as well as to relationships with entities in its external environment. The concept of internal and external triangulation is consistent with Tsoukas' use of variety (1991) and Weick's use of heterogeneity and dependency (1989).

The contribution of the 'cog-in-a-cog' model and the concept of internal and external triangulation is that together they are a processual and structural framework for assessing the coherence of a research project from its initial stimulus to the eventual external use of any theory that is produced. This contribution develops the business literature in the area of theory construction which does not currently use such formal theorisations of processes, systems and observation. We apply our ideas to the use of metaphors in theory construction and illustrate their use with the business ecosystems metaphor, a metaphor which is common in the business literature. Our analysis of the business ecosystems metaphor is brief but it does show how the consideration of observation decisions at each stage of the theory construction process can systematically increase variety and guard against bias. Our analysis helps us to increase the variety of perspectives that we hold and it shows that there is no single embodiment of the business ecosystem metaphor but instead there are potentially as many aspects of a business ecosystem as there aspects to the ecosystems that comes from. Our ideas are limited, as always, by the perspectives of the authors which in this case means our foci on ecology, business information systems and complex system; the early stage of our research on business ecosystems; the limited perspectives of two authors; and by a focus on a single 'live' research project. With this in mind, our model could be tested further by assessing the correspondence of metaphors that link different pairs of disciplines; using research projects that are in later validation phases; and by examining the external triangulation relations between different 'live' research projects' rather than solely by their publication outputs.

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