Chapter 6 Autopoiesis and its social application

6.1 Introduction

In the study of social systems theories in Chapter 5, social autopoiesis has been identified as a promising concept to include in a social systems framework for an ICT4D study. Before proceeding to apply it, the basic principles of autopoiesis need to be first understood, and its general social applicability needs to be confirmed. This chapter presents an overview of the theory and applications of autopoiesis, with a particular emphasis on its social application. In doing so, it addresses the following research question:

- What is the value of the theory of autopoiesis when applied socially?

The chapter commences by introducing the basic principles of autopoiesis, making use of Maturana and Varela's own writings, e.g. Varela et al. (1974), Maturana (1981), Varela (1981) and Maturana and Varela (1987), as well as Luisi (2003), a co-worker of Varela. Mingers' (1995; 2006) work on autopoiesis is also used, since his interpretation of Maturana and Varela's work appears to be careful and thorough. In introducing the basic concepts, a broad overview is provided, while a few concepts such as those related to biological reproduction are omitted, since they do not have direct bearing on the social framework that follows.

The chapter continues with a discussion of the social applicability and social application of autopoiesis. Although the corresponding literature is diverse and fragmented, an attempt is made to concisely present the major streams of thinking and schools of application in the social domain. The application section concludes with an argument for the social applicability of basic autopoiesis concepts, without necessarily having to prove that social systems are autopoietic in an ontological sense.

Presenting information on autopoiesis is not a straightforward task, since the theoretical principles are conceptually challenging, and as indicated in the quote below, the primary literature is not always accessible: "Despite the excitement generated by this approach, there are some hindrances which have kept it from spreading more rapidly. Perhaps chief among these is the complex writing style of Maturana and Varela" (Bailey, 1994: 287). The researcher has attempted to present the concepts accurately as well as in an accessible format.

6.2 Basic principles of autopoiesis

The theory of autopoiesis is developed by the Chilean biologists Humberto Maturana and Francisco Varela as a way to distinguish between living and non-living systems. Living systems are usually characterised by a set of features, such as movement, feeding and reproduction. However, Maturana and Varela are interested in the "mechanism" of life, or the arrangement that makes life possible.

"*Instead of asking what makes a living system reproduce, we ask what is the organisation reproduced when a living system gives origin to another living unity?*" (Varela et al., 1974: 187).

According to them, the distinguishing mechanism is that living beings are self-producing: they produce their own building blocks and keep reproducing the associated processes (Maturana and Varela, 1987: 43). As part of the process of self-production, a boundary is formed. The boundary not only limits the self-production network but also dynamically participates in the self-production process (Varela et al., 1974: 191; Maturana and Varela, 1987: 46). The key example provided by Maturana and Varela is that of a single living cell that produces its inner components as well as a cell membrane. Chemicals move through the membrane, such as nutrients and waste. However, the cell is autonomous and determines what it allows to move through the membrane. The self-producing process described above is termed ***autopoiesis***, which literally means self (auto) – production (poiesis).

Systems that produce not themselves but something different are called allopoietic. As opposed to autopoietic systems, they are not autonomous (Varela et al., 1974: 189). Examples of allopoietic systems are a ribosome (biological system) and a factory (mechanical system).

In the sections that follow, terminology will be introduced in bold face as necessary when presenting the theory.

6.2.1 Unity, organisation and structure

A ***unity*** is an entity distinguished by an observer, viewed within an environment but distinct from it. A composite unity is one in which we choose to distinguish the components (Maturana, 1981: 24). A unity always has an observer. The reasons for selecting a particular

unity and the manner in which it is observed are determined by the observer (Mingers, 2006: 37).

Organisation refers to "the relations between components that define a composite unity (system) as a composite unity of a particular class." All that matters of the properties of the components is what they contribute to realise the organisation of the unity (Maturana, 1981: 24).

"A complex system is defined as a unity by the relations between its components which realize the system as a whole, and its properties as a unity are determined by the way this unity is defined, and not by particular properties of its components. It is these relations which define a complex system as a unity and constitute its ***organisation***" (Varela et al., 1974: 188).

The notion of organisation implies an arrangement of components, each of which has properties that contribute to define the unity overall. The analogy in a designed system could be seen as its functional design. (It is acknowledged that Maturana and Varela's view is not functionalist, and that 'functionality' is a meaning attached by an observer.) Similar to a functional design, the notion of organisation is an abstract one.

A composite unity's ***structure*** refers to its physical embodiment in space and time. The structure refers to the unity's components and processes that are arranged in a particular manner so as to realise its organisation.

There may be many ways to realise a unity's organisation in a particular structure. For example, the concept of a car implies a certain organisation, including a powering mechanism, wheels, steering, brakes, seating and protection for passengers. These attributes and the relations between them are part of the *organisation* of a car. A Volkswagen Jetta 5 is an example of the embodiment of this organisation, and its particular seats, engine, steering column and brake technology represent its *structure*. Structure includes the particular elements of process of the Jetta 5, and not just the hardware. Further, there are properties of the components, such as their colour, that are immaterial to the organisation of the car.

According to Maturana and Varela (1987: 43), living beings are characterised by an organisation that is autopoietic or self-producing. It follows that living beings are ***autonomous***, meaning that they specify their own laws, or operation (1987: 48). They are not the only kinds of system that are autonomous, but what characterises living beings is that they

are autonomous because of autopoiesis. Another way to describe autonomy is to say that the relations that characterise an autonomous system "involve only the system itself, and not other systems" (Maturana, 1981: 22). This latter point will be revisited when the theory is applied in later chapters.

6.2.2 Organisational closure and the role of the boundary

An autopoietic system is open from a structural point of view, as can be seen with a living cell that allows certain chemicals through its membrane. However, it is operationally closed, meaning that it is autonomous and innately "produces its own rules of existence" (Luisi, 2003: 51). Mingers refers to ***organisational closure***. The system's organisation implies a certain range of activities, or structural states. One state always leads to another state within the range (Mingers, 2006: 42). Varela (1981: 37) defines organisational closure as the "indefinite recursion of component relations". Another way to look at it, according to Mingers, is that an organisationally closed system is not characterised by its transforming of inputs into outputs, but rather by the circular notion that it transforms itself into itself.

It has been noted that the boundary is an active participant in the self-production process. Luisi notes that a system's capability to make its own boundary is often the most significant indicator of whether a system is autopoietic or not (Luisi, 2003: 51). The boundary is not the only reason for the system's operational closure (the closure is not a physical one; indeed, the autopoietic system actively engages with its environment). The boundary also delineates the physical space in which the autopoietic production processes occur.

6.2.3 Multicellulars: introducing structural coupling

The ***ontogeny*** of a unity is the ongoing structural change that occurs in the unity during its lifetime, while its organisation remains the same. Structural change can be brought on by the unity itself or it might be triggered by its environment which could include other unities (Maturana and Varela, 1987:74).

Structural coupling refers to the recurrent interactions between two or more unities, or between a unity and its environment, such that a perturbation initiated by one triggers a structural change in the other, and vice versa (Maturana and Varela, 1987: 75). Through a series of non-destructive mutual triggers, they manage to co-exist in a compatible way.

In the view of evolution presented by Maturana and Varela, multicellular organisms originated as a result of the close structural coupling between unicellulars, the latter which were the first living entities. In multicellulars, there is a history of component cells that coupled so closely that they have come to depend on each other for their own autopoiesis (Maturana and Varela, 1987: 77).

A single living cell is autopoietic, and multicellular organisms are made up of multiple such cells. Are multicellulars then also autopoietic? Maturana and Varela refer to single cells as ***first-order autopoietic systems***, and multicellulars as being ***second-order autopoietic***. They claim that multicellulars are operationally closed. Further, multicellulars reproduce and form lineages by means of individual cells. In the process, the autopoiesis of the component cells are preserved, and the organisation of the multicellular unities are conserved. Maturana and Varela note that their statements on autopoiesis apply to first-order as well as second-order autopoietic systems, but leave open the question whether multicellulars are first-order autopoietic (Maturana and Varela, 1987: 88).

6.2.4 Structural determinism

A trigger from outside (or within) a unity can result in a structural change in the unity. At any given moment, the unity has a set of possible structural states it can change to, while maintaining its organisation. It can also change into being destroyed. A trigger that leads to a change where organisation is conserved is called a perturbation, otherwise it is referred to as a destructive interaction. Maturana and Varela stress that the *change in structure is always determined by the unity and not the environment*. This is called ***structural determinism***. In simpler systems of which the structure and its environment are understood, it may be possible to predict the response of a system to a trigger. However, predictability is not always possible and structural determinism does not imply predictability (Maturana and Varela, 1987: 123).

6.2.5 Structural change: ontogeny, phylogeny and structural drift

Maturana and Varela claim that the concepts of structural determinism and structural coupling hold for all systems, not just living systems. What is different with living systems is that their organisation (or autopoiesis) is maintained in the process. The ontogeny, or ongoing structural change that happens while the living system's organisation is maintained, is also called ***structural drift*** (Maturana and Varela, 1987: 103).

Maturana and Varela continue to describe the process of evolution as a natural structural drift. They introduce the term ***phylogeny***, which refers to a succession of life forms over time, generated through reproduction. (Reproduction is necessary for a life form to continue its process of evolution, but a particular unity can be alive without reproducing, such as a mule. Hence, reproduction is not part of the definition of autopoiesis (Varela et al., 1974: 189)). Species that have enough structural variety to successfully respond to changes in their environment, survive such changes, and others do not. Those that survive, continue with the process of structural coupling, their ontogeny at any time being a result of the state of the environment as well as their own structural state, which, with triggers from the immediate environment determines their next structural state. Organisms vary slightly from one generation to the next, while abrupt changes in the environment forces them to change their structure more drastically to adapt. The environment itself has its own dynamics, and is influenced by all the systems interacting with it. The sum of all these structural changes over time, for all life forms, provides us with the collection of living beings and their environment as it is today.

Evolution is described here as a natural drift, rather than a natural "selection" (the latter would imply that the environment does the selection, which with structural determinism is not the case). It is simply the product of ontogeny with successful structural coupling, implying successful adaptation, and that organisation is conserved (Maturana and Varela, 1987: 103-117). There is no higher goal or aim that directs the process of evolution. It occurs spontaneously, although it is not totally random but "in harmony with the inner structure of the autopoietic unity" (Luisi, 2003: 54).

Maturana and Varela contest the notion that some living organisms are better adapted than others to their environment. An organism is either successfully structurally coupled, or it dies. As long as a living being is alive, it is adapted (Maturana and Varela, 1987: 114).

6.2.6 Different views on a system, and the assessment of behaviour

Apart from their training as biologists, Varela and Maturana shared a philosophical interest. Varela developed his interest in philosophy during a period at Harvard, and "European authors such as Husserl, Heidegger and Merleau-Ponty were particularly important for his work" (Luisi, 2003: 50). Mingers (1995) shows the similarities in thinking between Husserl and Maturana, as well as Heidegger and Maturana. According to Mingers, Maturana's use of the terms autopoiesis and allopoiesis are foreshadowed by Heidegger, and "many of the ideas of

autopoiesis bear strong resemblances to the phenomenology of both Heidegger and Merleau-Ponty" (Mingers, 2006: 36). The statements above indicate that Varela as well as Maturana was influenced by the school of phenomenology, and its interpretive world view. One of the places where this is evident is in the importance they place on the role of the observer when assessing the behaviour of a system.

Before getting to the role of the observer, a particular distinction that Maturana and Varela make between views on a system needs to be mentioned. The one kind of view considers the internal dynamics of a system, where structural changes are visible at component level, almost like that of a state machine. The other kind of view is the one from outside, where the system is observed as a unity within a particular environment, regarding it as a black box and focusing on its interactions with the environment. Maturana and Varela (1987: 136) provide the example of a person who has grown up in a submarine, whose world consists of operating instrumentation and who is guided by the feedback provided by the instruments. Such a person will not understand if someone from the outside tells them how successful their manoeuvres are in the underwater conditions. It is only the observer, who can see both the submarine and the environment, who can assess the ***behaviour*** of the submarine within a particular environment. However, two different outside observers, with two different frames of reference, will assess the behaviour differently. In other words, whether behaviour is regarded as adequate or not, always depend on the expectations of the observer. The destruction of the submarine may be acceptable to someone assessing destruction testing, but not to someone assessing the skills of the operator in stormy seas.

To summarise: not only are there different ways to regard a system, depending on whether one looks at the internal dynamics of a system or observes it from the outside; there are also multiple possible ways of observing. Interestingly, while Maturana and Varela recognise their own subjectivity, they take on a more positivist view when describing the inner mechanics of a living system, namely the view of biologists. They assume only one correct way of describing the chemistry of the nervous system, for example, while at the same time looking through the lens of autopoiesis theory. When it comes to observing a system as a unity within the context of its environment, they have a strong interpretive view, resembling the thinking of the above mentioned philosophers. However, this interpretive view has biological roots, as will be shown in the section below describing the nervous system, as well as the section on language.

6.2.7 The nervous system and cognition

One of the most basic functions of the nervous system is to assist in mobility, by connecting the sensory surfaces and motor areas in an organism, and providing a feedback mechanism that allows for constant correlation between these areas. In a more advanced organism with a central nervous system, the nerves attached to sensory surfaces have intermediate multiple links to an inter-neuronal network before connecting to the motor areas. The signal from sensory cells form only part of what determines the organism's response to sensory input: many other interconnections to other parts of the body as well as other parts of the nervous system are involved in determining the response. The nervous system, *connecting itself onto itself*, greatly expands the possible structural states and variety of responses to triggers from the environment as well as from within. The nervous system is an operationally closed system, a closed network of interactions that interprets triggers according to its own structure, and correlates and adapts that same structure in the process. What appears to an observer as effective behaviour and continuous learning, is simply a process of ongoing structural coupling with the organism's environment. ***Cognition*** is the ability to effectively act in an environment. Knowledge is displayed when a living system shows behaviour in accordance to what an observer expects to see. Knowledge is expressed in doing, and doing presupposes knowing, all as part of effective structural coupling (Maturana and Varela, 1987: 174).

6.2.8 Social systems

The material in the section that follows will be discussed in more detail, since social systems is the focus of this thesis.

The section on multicellulars indicated how single autopoietic cells can, through long-term structural coupling, form multicellulars, as second-order autopoietic unities. In the same manner, multicellulars, or organisms, can form long-term structural coupling bonds with other organisms to form social systems. These co-ontogenies, where individual organisms become dependent on each other and have a mutual recurrent influence, are termed ***third-order structural couplings*** (Maturana and Varela, 1987: 181). Although Maturana and Varela's views are not teleological, they do mention in a descriptive manner some important functions that are fulfilled by social structural coupling. These include sexual reproduction and the rearing of the offspring. In mammals, the task of breastfeeding results in the mother being more closely involved with the rearing of the offspring. In other animal types, there is no such general rule. For example, in some bird species, the father is more involved with the

offspring, in some bird species the mother, in some they each have a role, while yet in others they have a kindergarten arrangement where one parent takes care of all the offspring in the group. The same holds for bonds formed around sexual reproduction: some male-female bonds in animals are life-long and others just for the duration of sexual intercourse – there is no general pattern.

Maturana and Varela continue to discuss other kinds of third-order coupling, related to the behaviour of individuals belonging to a group. Such structural coupling usually lasts a lifetime. In the example of ants, chemical substances are continually exchanged to help reinforce and produce the variety of individual ant structures required by the colony. Ant larvae are the same when born, but the chemicals they are fed result in most developing into barren workers, with one fertile female or queen, and a few males – all with different social roles that are continually reinforced. An ant has to belong to a colony and will not survive for long on its own. In general, the social structural coupling of insects is very visible but also rigid, as determined by the shapes and limitations of their exoskeletons (Maturana and Varela, 1987: 188).

The social differentiation in vertebrates is less visible but more subtle and flexible than with insects, allowing for differences in personality as well as roles in the group. This advanced differentiation is enabled by the advanced nature and flexibility of their nervous systems, allowing for infinitely more structural "states" and variety than in the case of an insect. In general, the sophistication in social differentiation and coordination increases as the nervous systems of animals become more sophisticated.

Maturana and Varela refer to social phenomena as phenomena that arise spontaneously into third-order couplings, to constitute ***social systems*** (Maturana and Varela, 1987: 193). Individuals that participate all adapt structurally as part of the social system, and individuals are only part of the system as long as they remain part of the structural coupling process.

Communication is the coordination mechanism in social systems. Maturana and Varela's unusual notion of communication is about structural coupling rather than the transfer of information. The outcome of communication depends on the structural effect it has on the participating agents, rather than on the content of the message. Some communication is for the sake of coordination between particular individuals, in an immediate context. Maturana and Varela (1987: 194) provide the example of an African bird couple that sing a duet. The two birds sing complementary phrases that form a melody unique to the couple. The song

helps them locate each other in a thick forest. The unique melody only exists for the lifespan of the bird couple. More enduring coordinating mechanisms can be found in larger social groups. Such social habits are communicated by means of imitation, over generations. The collection of such habits that remain stable over the span of generations is termed ***cultural behaviour*** (Maturana and Varela, 1987: 201).

Another issue discussed by Maturana and Varela is that of "give and take" in a social system. Does an individual have to sacrifice its own interests for the sake of the social system? This is particularly relevant in life forms with a more sophisticated nervous system that allows for individual expression. According to Maturana and Varela, the one is not at the cost of the other. The adaptation/ structural coupling/ survival of the group occur at the same time as the adaptation/ structural coupling of the individual to its immediate environment (i.e. the group) for the sake of its own continuation. This is regarded as a balance rather than a contradiction. Maturana and Varela discuss different kinds of such "balances", which can be placed on a spectrum, from composite systems where members have no individual autonomy to where they have high autonomy. At the bottom of the spectrum is an organism, of which the organ-components exist purely for the sake of the organism and have no autonomy. This is followed by social insects, vertebrates, primates, restricted human social systems (with rigid rules governing behaviour) and lastly, human society in general. In human society, the members' freedom and autonomy is so high that it could be said that the society exists for the sake of its members rather than the other way round (Maturana and Varela, 1987: 199).

6.2.9 Language and self-reflection

Language is a result of humans' ability to reflect upon their coordinating social behaviour; humans have made abstract their means to communicate. Language provides a means to describe behaviour, including one's own behaviour. Anything that someone says, will be influenced by their own structure in observing, as well as their own structure in reflection – their own structure being the unique product of their own path of structural coupling. Here, we can see the biological roots of interpretivism.

According to Maturana and Varela (1987: 233), our human mental activity and self-consciousness are a result of our ability to express ourselves in language, and these again are closely related to people's structures and social structural coupling, enabling them to speak and to coordinate their conversations. The consensual domains formed by humans who coordinate their communication form an important foundation for human social systems.

While this is acknowledged, the social systems framework presented in Chapter 7 will not dwell in more detail on Maturana and Varela's work on language.

6.2.10 Autopoiesis, autonomy and sustainability

According to Maturana and Varela (1987: 48), living beings are autonomous, meaning that they specify their own laws. Maturana (1981) states that an autopoietic system is autonomous, but that autonomy does not imply autopoiesis. Luisi (2003: 51) notes that an autopoietic system is self-sustaining.

Zeleny (1997) has an extreme view, namely that a self-sustainable system should be autopoietic. This follows from his definition of sustainability, namely that "a system is sustainable if, through its operations, it expands or maintains the set of options and choices it has itself started with" (Zeleny, 1997: 251). Zeleny's view, which is argued from his strong definition of sustainability, is contestable: autopoiesis, as defined by Maturana and Varela, is a stricter notion than that of sustainability. An autopoietic system "arises spontaneously from the interaction of otherwise independent elements" (Varela at al., 1974: 192). However, as is the case in ICT for development, a system might arise and become sustainable through external intervention.

The researcher will stay with the view of Maturana, Varela and Luisi, namely that autopoiesis implies autonomy as well as sustainability, but not the other way round. It logically follows that if a system is not autonomous or not sustainable, it is not autopoietic.

6.2.11 Conclusion

Maturana and Varela in their autopoiesis theory present a notion of a system that is drastically different from conventional system notions. The autopoietic system does not transform anything except itself. It does not have "inputs", it can be called "information-closed" (Dell, 1985: 6; Morgan, 1986: 238). Its changes over time are a result of continuous adaptation to its environment. While it responds and adapts as a result of each trigger from the outside (as well as triggers from the inside), these responses are determined by its own structure. Human cognition, mental activity, self-reflection and language all result from our individual internal structures and their social structural coupling. Behaviour is always assessed from the point of view of an observer, who is himself uniquely structurally determined. Hence, all observations are subjective.

In addition to the autopoietic organisation of a single living cell, with its first-order structural coupling, Maturana and Varela discuss composite unities, namely multicellulars and social systems, together with the respective concepts of second- and third-order structural coupling. Although they do not state that composite unities, and in particular social systems, are autopoietic, they proceed to apply autopoiesis theory to investigate these composite systems.

Apart from the notion of autopoiesis, the concepts of autonomy and sustainability are available to investigate the success of a system's ability to maintain itself and to interface with its environment. In the application area of ICT4D, where sustainability is an important issue, the theory and principles presented above could make a contribution when attempting to understand the underlying systemic issues related to sustainability.

6.3 Application in the social domain

The potential value of using autopoiesis in a social context[5] is discussed by Mingers (2002: 281; 2006: 168-170). Firstly, the notion of an autopoietic system is more suited to a social system than the traditional systems definition. A traditional systems view will focus on inputs, functions and outputs. However, a social system does not necessarily produce or transform something, and may not be concerned with its own functions or even its inter-relations with other systems. An autopoietic system's organisational closure means that these traditional systems aspects become less relevant, and, as Mingers puts it, its goal is purely its own self-production. Secondly, the autopoiesis theory's distinction between organisation and structure means that a system can change dramatically over time (in terms of its structure and membership) without losing its identity (which is in its organisation). Further, structural determinism implies that the origin of change is the system itself, and not its environment. According to Mingers, this is preferable to views that regard systems at the mercy of their environment, as if it were the environment that determined the system. The autopoietic notion of structural coupling provides an alternative, more equitable way of studying the mutual influence between system, environment and other systems. Mingers also mention a few other benefits, such as with regard to legal theory, which are not perceived to be directly relevant to this study.

Varela (1981: 38) does not believe autopoiesis can be directly applied to social systems. According to Luisi (2003), Maturana is more receptive to the idea. Kay (2001) gathers from

[5] A limited portion of this discussion has appeared in Turpin (2009).

Maturana and Varela's writings that neither believes autopoiesis can be directly applied to social systems, and they do not provide consistent suggestions as to the way forward. Kay also states that a lot of debate has taken place around the topic in the systems community with few useful outcomes to show.

Despite the scepticism, debate and lack of consensus about its wider applicability, autopoiesis has been applied in chemistry (Luisi, 2003) as well as a range of social domains. These include law (Teubner, cited in Luisi, 2003), literature (Paulson, cited in Luisi, 2003), family therapy (Efran and Lukens, 1985), social work (Bilson, 2007), the economy (Zeleny, 1997), information systems (Córdoba and Midgley, 2006; Winograd and Flores, 1987) the business organisation (Kay, 2001; Limone and Bastias, 2006; Radosavljevic, 2008) and society at large (Luhmann, 1990; 2006; Gregory, 2006; Vanderstraeten, 2005). Luisi (2003) believes the social application of autopoiesis has been a surprise and remains exciting.

6.3.1 Attempts to develop a social autopoiesis theory

Several suggestions have been made for ways to apply autopoiesis theory to social systems. Some authors are satisfied with a metaphoric application (Morgan, 1986), while others concern themselves with the question of whether social systems are, in the ontological sense, autopoietic (e.g. Kay, 2001; Mingers, 2002; 2004; Radosavljevic, 2008). Kay (2001) distinguishes the following streams of thinking: a "scientistic" stream, characterised by the work of Zeleny and Hufford (1992), a sociological stream, characterised by the work of Luhmann (1990), and a metaphoric stream, to which Morgan (1986) contributed. In addition to the streams mentioned in Kay (ibid.), Kay has made an own contribution, based on the work of Hejl. Subsequent to the publication of Kay's review paper, Mingers (2002; 2004; 2006) has also made a theoretically significant contribution, suggesting a conceptualisation that incorporates the social theory of Bhaskar and Giddens. The different lines of thinking of the above mentioned authors will be discussed.

6.3.2 The "scientistic" stream: Zeleny and Hufford

Zeleny and Hufford (1992) make strong claims about the social applicability of autopoiesis, but these claims have been equally strongly criticised. It appears that much of the early resistance against the social application of autopoiesis (e.g. Mingers, 1992) stems from Zeleny and Hufford's claims.

Varela et al. (1974) present six criteria for a system to be classified as autopoietic. These criteria assess whether one can, for a particular system, clearly determine a boundary, constitutive components, self-producing internal relations, whether the boundary is constituted by these relations and so forth. Zeleny and Hufford (ibid.) apply these criteria to a eukaryotic cell, an osmotic membrane and similarly to a human family. They argue that the family constitutes a "spontaneous social order" and is an example of an autopoietic system, "produced and maintained through organisational rules… of a given society" (Zeleny and Hufford, 1992: 155). They proceed through each of Varela et al.'s criteria, arguing that a family has a well defined boundary, clearly identifiable components, produced by means of family interactions, and so continues to respond to each of Varela et al.'s criteria. Mingers (1995: 126) works through Zeleny and Hufford's argument and refutes every single one of their claims. He questions the notion of a neatly defined nuclear family with clear boundaries, and finds it easy to provide counter-examples. He questions the existence of boundary components and their participation in autopoiesis. He also shows that there is confusion between what occurs in the biological/physical and what in the social domain, and notes this confusion as the central problem of the paper. Zeleny and Hufford (1992: 156) conclude that "all autopoietic systems are social systems". This Mingers (1995) takes to be a distortion of the notion of "social".

Following from Mingers' identification of a central problem in Zeleny and Hufford's work, Kay (2001) also notes that whether a social system exists in the physical or non-physical space is a central issue in social autopoiesis. Mingers infers from Maturana's thinking that "an attempt to describe social autopoiesis must locate it entirely in the social domain" (Mingers, 1995: 128).

Another possible view on Zeleny and Hufford's claims is that they are pragmatists rather than being unscientific. Zeleny is an operational researcher who might be interested in the practical value of the application of a theory rather than in keeping all his critics happy. Robb (1985) and Beer (1979, cited in Mingers, 1995) are other proponents of social autopoiesis who could be placed in this category, recognising practical value from a direct application of autopoiesis in the social context. They also happen to be active in the operational research field. Mingers (1995: 120) calls this kind of approach "naïve", since the authors did not concern themselves with the underlying conceptual problems of social autopoiesis.

6.3.3 Luhmann's social theory

Niklas Luhmann, a major German sociologist, developed in the 1980s an entire social theory based on autopoiesis (Mingers, 1995). Of all the contributions on social autopoiesis, Luhmann's theories appear to be the most extensively developed, discussed, criticised and applied. Influences on Luhmann's work include general systems theory and the functionalist work of Parsons, with whom he studied. Luhmann is also known for his published debates with Habermas (Mingers 1995). Luhmann's work on social autopoiesis, that appeared later in his career, is particularly influenced by Spencer Brown's theory of distinction, in addition to Maturana and Varela's autopoiesis theory (Seidl and Becker, 2006). Of Luhmann's vast body of work, only elements of his work on social autopoiesis will be discussed below, together with some of the surrounding critique.

Luhmann (1990) departs with the statement that autopoiesis theory is not a general systems theory. As conceived by Maturana and Varela, it only applies to particular kinds of systems, notably living systems. Luhmann attempts to take autopoietic principles to a higher level of abstraction where they could also apply to non-living systems. He holds that most generally, autopoiesis refers to any system of which the elements are (re)produced by its own elements (Seidl and Becker, 2006). According to this broad definition, he specifies three types of autopoietic system: living, psychic and social. The latter two are non-living systems (Luhmann, ibid.).

In Luhmann's conceptualisation of social systems, the mode of reproduction is *communication*. The social system contains only the network of communications and nothing else: not humans, nor actions or thoughts. This definition of a social system enables Luhmann to place the social system as well as its components and production process in the same non-physical space (Mingers, 1995). Communication, as used by Luhmann (ibid.), is an abstract notion defined different from its conventional use. A communicative event has three aspects, namely information (content), utterance (the way and motive of conveying the information) and understanding (including misunderstanding). Such an event is instantaneous and only exists while the utterance is conveyed. It only has importance insofar as it leads to a new communicative event. If the next communicative event is concerned with the information aspect of the previous communication, it is called hetero-referential. If the next event is concerned with the utterance aspect (such as who said it, or why was it said), it is auto-referential (Luhmann, ibid.). Luhmann emphasises that the three communicative aspects do not exist independently (although they can be analysed as such); they can only be regarded as

part of an ongoing process of communication. Communication requires at least two humans in order to take place. However, Luhmann separates the notion of communication from the participating people and focuses his theory on the event and its influence on further communication (Seidl and Becker, 2006).

According to Luhmann, modern-day society's network of communication includes the following subsystems: political, economic, scientific, education (Luhmann, 1990: 177), religion (1990: 144), law (p 225) and art (p 191). The functional differentiation of society into increasingly autonomous subsystems is a way to increase its internal variety, in response to the increased complexity of its environment (Mingers, 1995: 140). Each subsystem has its own code and rules that determine what qualifies as acceptable communication. For example, the legal system specifies legal vs. illegal, and what would count as acceptable information, utterances and understanding, e.g. respectively, legal contracts, a judge's way of ruling and the way previous rulings are interpreted. For each subsystem, all that exists is its own network of valid communications over time (Seidl and Becker, 2006: 16). Here, one can see Spencer Brown's theory of distinction applied: what is distinguished as "valid" by the system (as observers of themselves) is recognised as elements of the system. One can see that such a system has no boundary elements; only a membership of distinction vs. "everything else" (Seidl and Becker, 2006: 18). What counts as valid elements of a system may change over time (Mingers, 1995: 147).

Subsystems, although independent in their language of communication, are functionally co-dependent. They can trigger changes in each other, for example a scientific discovery can trigger economic and legal communication. In this way, they are structurally coupled. Mingers (1995: 146) provides an overall social systems picture, with society consisting of the interconnected subsystems, plus an enveloping "lifeworld" that contains everyday communications not belonging to particular subsystems. Around this social system of lifeworld and subsystems, Mingers draws a boundary. The system's environment, according to Mingers, contains "everything else", including humans, actions and thoughts. King and Thornhill (2003: 281) contest Mingers' representation on at least two grounds. They do not find evidence of the existence of a lifeworld as part of the social system in Luhmann's theory. They interpret Luhmann to mean that everyday conversations can only be recognised as communications once they are valid contributors to a particular subsystem. Further, the environment of the subsystems is not a common one: every subsystem only recognises itself as distinguished from "everything else"; that "everything else" is different for each subsystem

(King and Thornhill, 2003: 283). One can see that it is difficult to draw a neat systems picture of Luhmann's social theory, as Mingers attempts.

How do humans relate to Luhmann's system of communication? One of the three kinds of autopoietic system Luhmann defines, is the psychic system or human mind. Psychic systems have thoughts as elements of their autopoietic production process: thoughts producing thoughts (Seidl and Becker, 2006: 17). Psychic systems (representing individuals) and social systems are operationally separate but structurally coupled. Luhmann refers to a special relation between the two, namely interpenetration: they have a strong mutual influence, as if they were part of the same system (Seidel and Becker, ibid.). The mind "has the privileged position of being able to disturb, stimulate and irritate communication. The mind cannot instruct communication, because communication constructs itself" (Luhmann, cited in Seidl and Becker, 2006: 22). The social system depends on the psychic system, among other, to interpret information and trigger new rounds of communications. Social systems cannot exist without psychic systems, and communication cannot occur without humans.

Apart from society as the all-encompassing social system, Luhmann distinguishes between two other kinds of social system, namely (face-to-face) interaction and Organisation[6]. These two are also based on communication, but a particular type of communication each. In the case of interaction, it is "communication based on the participants' mutual perception of their presence" (Seidl and Becker, 2006: 24). The autopoietic production elements of Organisations are decision communications. Luhmann proceeds to reframe Organisational decision-making by means of his autopoiesis-related theory base. In this way, he paves the way for a different way of thinking to be applied to the study of Organisations.

6.3.3.1 Critique on Luhmann's work

Mingers (2002) has two main concerns with Luhmann's theory, of which the key notions are italicised below. Mingers' first concern is with communication as the autopoietic production process. Communication cannot happen without people - and people have been removed from Luhmann's social system in order to frame it entirely in the non-physical domain. Communication can lead to more communication but cannot produce it. Mingers recognises that Luhmann's notion of interpenetration goes some way towards describing the role of

[6] Organisation is written here with a capital letter, with reference to a firm, and to distinguish it from Maturana and Varela's notion of organisation.

humans in producing communication, but it does not explain it. Mingers' second overall concern is with the system boundaries. Luhmann successfully demarcates what counts as communication and what not, also for the subsystems of law, science and so forth. Theoretically, this is satisfactory but in practice not: can real-life communication be so neatly classified into the subsystems? People's behaviour, that gives rise to communication, is multi-faceted and does not respect subsystem boundaries. Similarly, the real-life Organisation is much more varied than only being a decision-making mechanism. An earlier version of Mingers' critique lists additional concerns, such as the absence of boundary elements active in the self-producing process (Mingers, 1995). However, Mingers (2002) appears to capture his main concerns, which remains the same in Mingers (2006).

King and Thornhill (2003) react strongly against Mingers' critique, arguing that Mingers misinterpreted Luhmann. They remind the reader that Luhmann reconceived the notion of autopoiesis to be more general and abstract, so that it is not the same as Maturana and Varela's notion of autopoiesis. Seidl and Becker (2006) also note that Luhmann has been widely criticised, often as a result of not understanding the nuances of his theory.

Despite the controversy around Luhmann's social theory, it remains a topical area of study and discussion, as can be seen in the work of Elder-Vass (2007), Gregory (2006), Vanderstraeten (2005), Seidl and Becker (2006), Hertig and Stein (2007), Morner and von Krogh (2009) and Mavrofides et al. (2011).

6.3.4 The use of autopoiesis as a metaphor

Morgan's work is representative of a metaphoric use of autopoiesis, applied to Organisations (Mingers, 1995; Kay, 2001). According to Kay, this is the least problematic of the views on social autopoiesis. Morgan (1986) presents three arguments related to autopoiesis in an Organisational context. The first is that when Organisations do planning, they actually do self-reflection or self-assessment. They create an image of themselves and project it onto the business environment in order to inform their actions. The way they describe the business environment is determined by their own interests. When they intervene in the environment, it is in order to (re)create or produce themselves. Mingers (1995: 151) notes that such behaviour reflects the structurally determined way of observation performed by Organisations. Morgan's second point is that Organisations, in this process of producing self, should not be overly egocentric but also notice the changing environment with which they interact. Their survival depends on successful relations with the environment and not just on self-production against a

given backdrop (Morgan, 1986: 243). In autopoietic terms, their structure needs to be one that can maintain structural coupling with the environment. Organisations need to realise that their structure can be adapted without having to sacrifice their identity (Mingers, 1995: 151). Morgan's third point is that Organisations are often over-protective of their identity, or define it too narrowly, which is costly to themselves and their environment in the longer term. Organisations are fellow custodians of a bigger system that even includes their competitors. Their identity should remain open enough to allow the successful co-evolution of the larger system (Morgan, 1986: 246).

Morgan manages to capture something of the underlying spirit of autopoiesis and show its implications for Organisations. Mingers comments that Morgan's metaphoric use of autopoiesis saves him from the agony of ontological concerns. However, Mingers concludes that the results of this metaphoric application are equally metaphoric and do not carry much weight (Mingers, 1995: 152). Luhmann and Varela are of similar opinion (Kay, 2001: 467). However, Kay points out that theorists should be careful in their criticism of the use of a metaphor, which is a way of seeing, since a social system itself is only a "way of seeing things" that is construed by an observer, using Checkland's definition. If a social system is not a literal entity, how can it be literally autopoietic? Kay argues that Mingers' criticism is "over-dismissive", and that the value of a metaphoric (or any other) approach should rather be measured against a person's reason for using it in the first place. Kay believes the concepts of autopoiesis are useful to apply regardless of whether one believes a social system is autopoietic.

6.3.5 The work of Hejl and Kay

According to Hejl, society is "the process in which individuals interact with one another and with their natural environment under the primacy of self-preservation" (Hejl, cited in Kay, 2001: 470). From this, Kay (ibid.) notes that central to Hejl's notion of society are humans, their natural environment and self-preservation. Together with the latter term, Hejl draws in concepts from evolution, consistent with Maturana and Varela's thinking. As such, Hejl's notion of socialisation refers to ontogenic structural drift. However, since humans can create external realities for themselves, environmental triggers sometimes originate from within their own created realities. On the one hand, this may be dangerous, such as with a paranoid person, but it also helps humans to increase their structural variety, such as with a marathon athlete who applies mental conditioning to improve her performance. Kay (ibid.) continues in this manner to elaborate on Hejl's work and adds some conceptualisations of his own.

The importance of Hejl and Kay to this thesis lies not so much in their conceptualisations but in their view and use of autopoiesis. According to them, social systems are not autopoietic. The membership of human components to a social system are too non-committal and people could be members of multiple social systems at once. Another interesting point is the way Hejl chooses to define boundaries: boundaries of a social system are construed through the interactions of the people (as components) within the system. To determine the boundary, one has to observe the system and hear from the involved people how they would define the system (Kay, 2001: 471).

Hejl and Kay represent examples of theorists who recognise value in applying concepts from autopoiesis to society, on the one hand trying to remain true to Maturana and Varela's original thinking while on the other hand not finding it necessary to claim that social systems are autopoietic.

6.3.6 The contribution of Mingers

Mingers (1995; 2002; 2004; 2006) is very careful about the social application of autopoiesis. He scrutinises and critiques the attempts of Zeleny and Hufford, Morgan as well as Luhmann, before exploring some notions of his own. Mingers (2004) investigates the use of the social theories of respectively Bhaskar and Giddens, for describing self-producing social systems. Both these theorists are concerned with the "continual self-production of society" (Mingers, 2004: 403).

Giddens' structuration theory is introduced and discussed in Chapter 5. Mingers quotes Giddens as follows: "human social activities, like some self-producing items in nature, are recursive", and "by its recursive nature I mean that the structured properties of social activity – via the duality of structure – are constantly recreated out of the very resources which constitute them" (Giddens, 1984, cited in Mingers, 2004: 406). Further similarities between autopoiesis and structuration theory include the following (Mingers, 2004):

- They are both based on non-functionalist and non-teleological views;
- Both have a way of recognising physical as well as intangible constructs, Maturana with structure and organisation, and Giddens with system/social practices and structure; and
- Both have a relational view of systems, specifying three sets of relations or differences, namely the *when* (spatial), *where* (temporal) and the *what*.

Whereas Giddens is a sociologist who attempts to reconcile objectivist and subjectivist views of society (Mendelsohn and Gelderblom, 2004), Bhaskar is a philosopher and a critical realist. Bhaskar has developed a model based on critical realism, called the Transformational Model of Social Activity (TMSA) (Bhaskar, 1979, cited in Mingers, 2004). Bhaskar proposes that there are structures or mechanisms underlying our entire existence, which are ontologically *real*. These structures cause events to occur (in the natural as well as social world), in a domain he terms the *actual*. People are able to observe a subset of the actual, called the *empirical*. Society is a real structure, but not unchanging, and observable empirically through social activity. There is a reciprocal influence over time between society and social activity. Society consists of social "structures, practices and conventions, where structures are relatively enduring mechanisms that govern social activities" (Mingers, 2004: 409).

Bhaskar's structure and agency appear in a dualism (they are separate entities), as opposed to Giddens' agency and structure which are a duality, or two sides of the same coin. Further, in comparison to Bhaskar's realist position, Giddens' theory includes some subjectivism when it comes to his view on structure. Overall, Bhaskar's conception of structure is a stronger one than that of Giddens: it has an ontologically real, separate existence and is a generating mechanism for social action. However, in both theorists' views, there is a mutual influence between structure and social activity.

Mingers concludes that Bhaskar and Giddens' thinking is compatible enough to allow for a synthesis of their key concepts, phrased as follows: "Social structures, consisting of position-practices, rules and resources, are generating mechanisms that, through their complex interactions, enable and constrain observable and social activity which in turn reproduces and transforms these structures" (Mingers 2004: 416). According to Mingers, it follows that society is a combination of activity and structure that is temporally situated.

Mingers subsequently tries to assess whether the synthesised Bhaskar/Giddens thinking lends itself to an application of autopoiesis to the social domain. He suggests that the best candidate to describe the components of the social system would be the social structure. Since social structure is (re)produced by social activity, such human activity needs to be included in the processes of production. However, action and structure form a duality. The processes of production, or organisation of a social system, are best described by Giddens' process of structuration.

After having specified the autopoietic production processes and components, Mingers (2004: 417) investigates the requirement of organisational closure. One would need to show circular feedback loops in the processes of production, creating implicit boundaries. Since social activity as well as social structure is present in the production process, both aspects need to be part of the feedback loop: activity needs to reproduce the structure that influences it. Mingers state that such causal loops abound in society, for example families, religions, sports clubs or even Western capitalism. However, these social systems can seldom (if at all) be isolated from the intricate network of processes and loops that underlie the wider society. It will be difficult to find current-day social systems which are truly self-contained. To Mingers, this is the only factor keeping his formulation of a social system from being autopoietic.

6.3.6.1 Discussion of Mingers' social system

Using the social theories of Giddens and Bhaskar, Mingers produces a fairly straightforward and elegant way of applying autopoiesis to social systems. The theories of Giddens and Bhaskar manage to capture something of the essence of a social system, as opposed to a biological, mechanical or other kind of system. Mingers finds a conceptually sound way to apply the principles of autopoiesis to a systems notion that is essentially social. However, Mingers' application raises a few theoretical concerns that have been noted during previous criticisms of social autopoiesis. Since these are central concerns of social autopoiesis, they will be discussed in more detail below.

The first concern is that of the space (or domain) in which social autopoiesis should occur. Maturana and Varela's notion of autopoiesis is characterised fully in the physical space. Zeleny and Hufford (1992) describe a family as being autopoietic, referring to biological as well as social characteristics. The authors are criticised for confusing the physical and non-physical component space. A requirement is subsequently stated that autopoietic production should be consistently in the same space (Kay, 2001). Mingers responds to Zeleny and Hufford as follows: "any attempt to describe social autopoiesis must locate it entirely within the social domain" (Mingers, 1995: 128). Luhmann removes human activity from his autopoietic system of communication, so that his system is entirely in the non-physical domain. He is criticised by Mingers for doing this, since how can communication occur without humans? The dilemma is clear: one cannot do right by including or excluding human activity. However, it appears that the issue is whether the nature of human activity is biological or social. Mingers includes human activity as well as tacit social structure in the autopoietic production process. While human activity plays out in the physical space, its

nature is social, and therefore in the "social domain". Hence, Mingers' conceptualisation all fits in the social domain.

The second concern refers to the nature of the boundary of a social system. Varela (1981) states that autonomy and organisational closure can possibly be shown in social systems where the relations that define them do not involve the production of (physical) components. However, they cannot be termed autopoietic. An autopoietic system requires boundary components that actively participate in the production process. Mingers (1995) criticises Luhmann for only defining a boundary of distinction (specifying what is inside and outside), since it does not have boundary components. He also criticises Zeleny and Hufford for defining a "membership-type boundary" that does not play a role in autopoiesis. However, the boundary created in Mingers' conceptualisation is *also a boundary of distinction*. Mingers (2004) now appears to justify a boundary of distinction for the social domain with his interpretation of Varela. It is possible that he became more realistic as to what is feasible in the case of a social system.

The third concern is the requirement of organisational closure. Mingers (1995) criticises the boundary distinction provided by Luhmann for societal subsystems by stating that in reality, a social system cannot have a clearly drawn identity. Mingers admits that this remains a problem with his own conceptualisation as well. Social systems are not and cannot be organisationally isolated. According to the researcher, this is a reflection of the nature of social systems and any theory that makes such an assumption will only be able to formulate its social system as an "ideal type".

6.3.7 Fuchs' use of Giddens

Prompted by Mingers' (1995) discussion of the similarities between structuration theory and autopoiesis theory, Fuchs (2003) develops a seemingly independent argument for the combination of the two in the social domain. Fuchs' departure point is that of complexity theory, where the term "self-organisation" is used to describe emergent behaviour in thermodynamical systems. Fuchs uses "self-organising" also in reference to autopoiesis, which he classifies with complexity theory. Such an association is problematic, as discussed in Section 4.7, which deals with complexity thinking. Fuchs' substitute phrase of "self-organising systems" for "autopoietic systems" is in particular problematic. In the way which Maturana and Varela use the term "organise", autopoietic systems are not self-organising. "The organisation of a system… specifies the class identity of the system… if the

organisation of a system changes, then its identity changes and it becomes a unity of another kind" (Maturana, 1981: 24). An autopoietic system does not have the ability to change its own defining characteristics from within. Over time, structural drift (through structural coupling) and phylogeny leads to evolutionary change, but this is still not the same as Fuchs' notion of "self-organising" from complexity theory. Fuchs directly transfers the notion of self-organising, meaning autopoietic, to social systems. Here, he recognises the contribution of Luhmann. He criticises Luhmann's theory for its dualistic distinction between human activity and society, and for his neo-functionalist approach. He prefers Giddens' duality of structure, where human activity and social structure are inseparable. Fuchs provides a detailed discussion of Giddens' social theory to show its compatibility with the underlying thinking of complexity and emergence, as opposed to the thinking of the competing paradigm of "functionalism", "dualism", "reductionism" and "determinism" (Fuchs, 2003: 161). Fuchs' argument is possibly simplistic, for example by not recognising the structural determinism in autopoiesis. However, it reveals the overall compatibility between the way Giddens portrays social systems and the recent understanding of physical, chemical and biological systems.

6.3.8 A spectrum of social applications

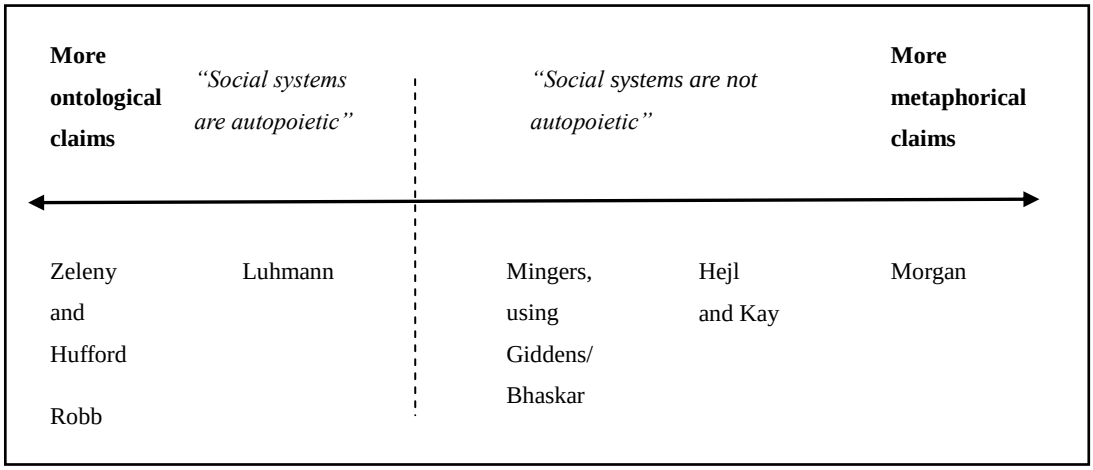

Figure 6.1: A spectrum of positions on social autopoiesis

Figure 6.1 shows a selection of authors on social autopoiesis, and their relative positions on the applicability of autopoiesis to social systems. Towards the left are Zeleny and Hufford, who claim that social systems are autopoietic in an ontological sense, without any qualifiers or re-conceptualisations. Towards the other extreme is the purely metaphorical application of Morgan. The authors in between can be broadly classified in two camps: those who claim that

social systems can in some way be regarded as autopoietic, and those who claim that this is not possible. Despite their reservations, the second group recognise the value in autopoietic concepts and play around with ways to possibly (or actually) apply them in a social context. This is where the similarities end: the grouping of theorists together in a camp does not imply that their respective theories are at all similar.

6.3.9 Reflection

The literature on the social application of autopoiesis presents a variety of arguments about whether and how autopoiesis should, or should not, be applied in the social domain. The voices against the view that social systems are autopoietic in an ontological sense, include concerns over the physical vs. non-physical space of components, the production process, the definition of boundaries and active boundary components, and the dilemma of an operationally closed human system. However, as shown during the discussion on Mingers' theory, the critique on attempts towards social autopoiesis has become somewhat more moderate. It appears that too strict requirements on a social autopoiesis theory are generally not helpful, and one needs to make some allowances for the differences in nature between a social and biological system.

While the theoretical debates continue, there is evidence of authors who boldly (but not carelessly) apply the principles of autopoiesis in their respective fields and find value from it. Autopoiesis enables them to generate new insight in their fields of study and add value to the existing body of theory in their respective subject fields. Examples are Maula (1999), Lambropoulou (1999), Córdoba and Midgley (2006) and Bilson (2007).

To illustrate this point, and to simultaneously provide an example of how autopoiesis has been applied previously in the IS domain, Córdoba and Midgley's (2006) work is discussed. Córdoba and Midgley (ibid.) combine concepts from autopoiesis and critical systems thinking (CST) when conducting a participative IS planning exercise in Columbia. They portray humans as autopoietic systems whose knowledge bases, values and beliefs are uniquely structurally determined, and are based on the individual's physical attributes and path of development. Second, through structural coupling by means of language, humans form consensual domains for interaction. In a CST context, the implications are as follows. The notion of structurally determined uniqueness should lead to an ethical awareness of the limitations of our own knowledge, and acknowledging as equally valid the views of others. Further, through structural coupling by means of conversation we can create new mutual

understandings, allowing for new consensual domains to develop. Córdoba and Midgley introduce a critical methodology for IS planning, that interchangeably moves between 'distinction' (identifying different unique views), 'dialogue for improvement' (conversation towards mutual understanding) and 'boundary critique' (a CST notion looking to acknowledge marginalised parties and issues). They discuss the implementation of this methodology in the context of carrying out IS planning at a university in Columbia, and show how the critical approach manages to include concerns and views far beyond those of a traditional IS planning approach. In terms of their application of autopoiesis concepts, Córdoba and Midgley take the view that humans are autopoietic, proceed to identify particular autopoiesis concepts that add value to their CST methodology, and in their application indicate how it adds value.

In addition to the above mentioned social applications, it is inferred from the writings of a number of authors that the principles of autopoiesis can indeed be applied to a social system *without having to claim upfront that the system is autopoietic or even organisationally closed* (e.g. Maturana and Varela, 1987; Mingers, 2006; Kay, 2001; Morgan, 1986). "Regardless of whether social systems are autopoietic or not, the ideas underpinning autopoietic theory could provide useful tools to conceptualise, model and help make decisions" (Kay, 2001: 468). Mingers, after much consideration, comes to the conclusion that the acceptance of social autopoiesis will depend not so much on its absolute truth but "on its effectiveness, its usefulness, as part of an ongoing conversation among observers" (Mingers, 1995: 205).

When deciding whether to apply autopoiesis socially, it appears that the potential benefit needs to be weighed against the theoretical challenges that might be faced in the process. Also, a pragmatic approach that focuses on the sound application of the basic underlying principles of autopoiesis, taking note of but not trying to satisfy each previously voiced requirement, might be more achievable.

6.3.10 Way forward for a systems framework

Not all of the theoretical suggestions towards social autopoiesis have been applied in practice. One of these is Mingers' suggestion of using a structuration-based social theory to describe the social system to which autopoiesis is applied. As shown by Mingers (2004) and discussed above, structuration theory and autopoiesis resonate well. The same point is argued by Fuchs (2003). The use of a structuration-based theory to model the social system is satisfactory from a sociological point of view: it well reflects the social nature of the system. At the same time,

it provides the opportunity to gain insights into the systemic nature of the social system by applying autopoiesis principles.

When social autopoiesis is included as part of the systems framework in a following chapter, the ontological claim will not be made that social systems "are" autopoietic. As argued above, the concepts related to autopoiesis can be applied to the social domain without making such a claim. Nevertheless, it is proposed that the use of a structuration-based theory to describe the organisation of a social system, provides a stronger theoretical foundation than when autopoiesis is applied in the purely metaphorical sense.

6.4 Conclusion

Maturana and Varela's work presents a revolutionary way of thinking about the definition of life, as well as autonomy, sustainability, cognition, communication and knowledge. This way of thinking includes the notion of a system. Autopoiesis' social application is controversial and contested, but at the same time has given rise to new insights in a number of fields. While addressing the research question:

- What is the value of the theory of autopoiesis when applied socially?

It has been found that despite the theoretical controversy around social autopoiesis, a number of authors have found value from applying its basic principles in the social domain. It has been argued that that the principles of autopoiesis can indeed be applied to a social system without having to claim upfront that the system is autopoietic or even organisationally closed. After having conducted a study on the value of social autopoiesis, the researcher believes that the questions around its theoretical applicability have been resolved, and she can proceed to apply it empirically to a social system. However, before proceeding to apply it, a framework still needs to be developed for its practical application. This framework is presented in Chapter 7 that follows.