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Literary Praxiphorical Analysis: Using Science Fiction and Fantasy to Shape Organizational Futures

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Abstract

In the last two decades, organization theorists have sought to apply complexity theories developed in the natural sciences to the study of organizations. This article develops a fictional approach for critically interrogating two important complexity concepts – order-through-fluctuations and autopoiesis. Using these concepts in a metaphorical sense, this paper explores how science fiction and fantasy (SFF) can be used to prepare for and shape organizational analysis. Exploring the consequences of scientific innovation is a key purpose of SFF. The speculative nature of the genre makes it a fertile metaphorical ground for testing new management concepts. This article, therefore, uses two classic SFF novels to explore the metaphorical use of complexity concepts for organizational analysis: i. William Golding's Lord of the Flies is used to explore the dissipative structures model, a theory devised by Ilya Prigogine; and ii. Arthur C. Clarke's The City and the Stars is used to explore autopoiesis, a theory devised by Humberto Maturana and Francisco Varela. The article outlines the theoretical modelling possibilities from embedding fictional constructs into critical organizational analysis. It concludes by summarizing the methodological guidelines and business contexts for implementing literary praxiphorical analysis.

Literary Praxiphorical Analysis: Using Science Fiction and Fantasy to Shape Dynamic Organizational Futures

1. Introduction

Broekstra (1996) claims that systemic theories derived from the natural sciences can illuminate organizational research. However, Burnes (2005) warns that it is necessary to be clear as to whether such theories are being used as metaphorical devices to provide a means of gaining new insights into organizations or as a way of mathematically discovering how and why organizations operate as they do. In this article, we are using complexity theories developed in the natural sciences in a metaphorical manner. The use of metaphors to explore organisations is not new (Alvesson, 1993; Clark and Salaman, 1996; Morgan, 1997; Oswick and Marshak, 2011). However, the approach adopted in this article, instead of applying a given metaphor to an existing organization to 'test' its validity, seeks to apply metaphors to fictional literary settings. In essence, we adopt a 'literary praxiphorical' analysis in order to 'test' a metaphor's explanatory value in a fictional context. Of course, applying metaphors to real-world organizations is also praxiphorical analysis in the strictest sense, in that it involves the 'testing' of metaphor in a practical context, but we aim to interrogate organizational theory through creative fictional analysis. The advantage of this approach is that it embeds fictional creativity into model construction.

The term 'complexity theories' serves as an umbrella label for a number of theories, ideas and research programmes that are derived from scientific disciplines such as meteorology,

biology, physics, chemistry and mathematics (Rescher 1996; Stacey 2003). As Burnes (2005) argues, there is not one theory, but a number of theories developed by different scientific disciplines, which gather under the general heading of complexity research. Consequently, it has to be recognized that any particular definition of complexity is coloured by the perspective of the original discipline. To emphasize the diversity of viewpoints among complexity researchers, this paper follows Black's (2000) lead and uses the term complexity theories rather than theory.

Complexity theories are increasingly being seen by academics and practitioners as a way of understanding organizations and promoting organizational change (Black 2000; Boje and Wakefield, 2011; Burnes, 2014; Choi et al, 2001; Macbeth 2002; Seel, 2006). In the natural sciences, their proponents use complexity theories to argue that disequilibrium (chaos) is a necessary condition for the growth of dynamic systems, but that such systems are prevented from tearing themselves apart by the presence of simple order-generating rules (Gell-Mann 1994; Prigogine and Stengers 1984). Those seeking to apply complexity theories to organizations argue that organizations, like complex systems in nature, are dynamic non-linear systems, and that the outcomes of their actions are unpredictable but, like turbulence in gases and liquids, are governed by a set of simple order-generating rules (Brown and Eisenhardt 1997; Stacey et al. 2002; Wheatley 1992). If organizations are too stable, nothing changes and the system dies; if too chaotic, the system will be overwhelmed by change. In both situations, an organization can only survive and prosper if a new, more appropriate, set of order-generating rules is established MacIntosh and MacLean 2001). We will look at two prominent complexity theories – the dissipative structures model and autopoiesis. These will be applied praxiphorically to William Golding's Lord of the Flies and Arthur C. Clarke's The City and the Stars.

For the most part, applying metaphors to real-world organizations should provide better strategic insights and outcomes than applying metaphors to organizations in fictional settings. However, applying them to the works of SFF, which are designed to speculate about future imaginings of products, organizations and even societies can open up fruitful avenues for speculating on the future states of organisations and how these might be achieved. The fact that SFF need to maintain internal consistency, or 'the willing suspension of disbelief', reinforces this claim their ability to create a cogent 'environment' where new perspectives and concepts emerge. Golding and Clarke's novels were selected were selected for praxiphorical analysis because the social organizations presented in each novel have sufficient internal consistency to test the metaphorical concepts. One important pre-condition for effective testing is a cogent fictional setting replete with a consistent social environment.

The article begins by showing how the SFF present an ideal testing ground for the use of organizational metaphors. It then goes on to describe and then apply complexity theories, as metaphors, to Golding and Clark's novels. This is followed by a discussion and evaluation of this approach for studying organizations and organizational change. The article concludes by summarizing the methodological guidelines and business contexts for implementing literary praxiphorical analysis.

2. SFF as a testing ground for organizational metaphors

There is a range of works supporting the proposition that SFF writings can provide an optimal testing ground for organizational metaphors (Refs????). Many writers in this genre are actually scientists or engineers, but their voices have traditionally been excluded from

mainstream cultural life (Barnett, 2002). It is by definition a speculative fiction, creating a huge number of hypothetical social conditions that far surpasses the social realism of contemporary literature (Banks, 1988).

As early as the 1960s, popular SFF fiction explored, for example, the social impact of genetic manipulation. The Star Trek episode introducing the genetically-enhanced superhuman Khan Noonien Singh (The Space Seed) is of considerable interest in this regard. Of course, a number of SFF authorities have also explored this issue, not least Philip K Dick and Ridley Scott in Blade Runner (Dick, 2007) and Robert Heinlein in *Methuselah's Children* (1986). Is it possible that the current debate about the moral implications of genetic enhancement of plants, animals and humans could learn much from such narratives. In X's book, the various fictional super humans' refusal to accept the limitations of democratic government furnishes us with valid warnings about the dangers of 'improving' people. In sum, the value of praxiphorical analysis lies in its capacity to transcend mere abstract discussion of scientific and social developments by presenting cogent metaphors of its various social applications.

As a number of writers have shown, SFF fiction allows for frank discussions of controversial subjects that literary fiction tends to avoid (Ref????). SFF fiction under communism in the Soviet Union is a good example of this. Such writers could explore social and economic issues that more conventional Soviet authors dared not touch (). Even in the Anglo-American context, the genre has always been at the cutting edge of social commentary. This tradition started with the Well's () Time Machine, the first great science fiction novel in the Anglophone world.

If we are trying to link organizational analysis with the natural and social sciences, SFF fiction provides a metaphorical environment to simulate their practical operation. In addition, SFF writers are often trained scientists (both Arthur C Clarke and William Golding studied the sciences, for example). This means they are familiar with expressing abstract scientific concepts and, moreover, to understand them. Although praxiphorical analysis should accommodate non-scientific management concepts, it is especially well-suited to testing scientific concepts for the reasons discussed. Therefore the organizational theories researched here are derived from the natural sciences.

SFF fiction has a long and ongoing tradition of metaphorical exposition. Frank Herbert's Dune, for example, still serves as a valid satirical exploration of the West's over-reliance on Middle-Eastern oil reserves (Herbert, 1982). It has to be recognised, though, that such texts are at best only an approximate truth. For example, one of the working texts used here, The Lord of the Flies, fails to reflect the true reality of life on a desert island. The green-coloured clays the boys use to camouflage themselves are rarely found in nature, for instance. Wild pigs are large and probably too ferocious for children to hunt. The major characters symbolize specific social types. With the Samneric twins representing the likeable but fickle working classes; Ralph represents democratic leadership; Piggy symbolizes academic intellectualism; Simon the spiritual way of life; Jack and Roger authoritarianism.

Given that complexity theories are concerned with the emergence of order in dynamic nonlinear systems operating at the edge of chaos, we can see why they can be applied fruitfully to the works of Clarke and Golding. In so doing, we will show that praxiphorical analysis can be used to help organizations to envisaged and bring about a desired future state. This is especially the case for organizations that are still at the planning stage, recently

created or in some other way unique and incomparable. If there is no extant organization from which to adduce examples of autonomous or emergent order functioning in those settings, it can provide viable literary comparisons. This would give researchers important clues as to how the planned organizations might behave under certain hypothetical pressures or conditions, permitting the formulation of palliative and positive procedures to facilitate their smooth and effective functioning. In the following sections, we will look at two prominent complexity theories, the dissipative structures model and autopoiesis. As stated earlier, these will be applied praxiphorically to William Golding's Lord of the Flies and Arthur C. Clarke's The City and the Stars.

3. Complexity Theories: the Case of Dissipative Structures and Autopoiesis

One of the first things that strikes the reader when approaching complexity theories for the first time, is the plethora of strange and exotic terms, such as autocatalytic change, fitness landscapes, non-linearity, bifurcation, eigenbaum constants, Mandelbrot sets, strange attractors and many, many more (Burnes, 2005). 1998). This is the language of mathematics, and very exotic mathematics at that. Without mathematics, there would be no complexity theories. The origins of complexity theories lie in attempts by meteorologists to build mathematical models of weather systems (Lorenz 1993). Subsequently, biologists, chemists, physicists and other natural scientists sought to apply a similar approach to their areas of research (Styhre 2002). Though the advocates of complexity see it as a means of simplifying complex systems, in practice, complexity is anything but simple (Manson 2001).

By the 1990s, there were so many competing and confusing definitions of complexity that Horgan (1995), surveying the topic in the journal Science, entitled his paper 'From Complexity to Perplexity'. Given the explosion of interest since then, it is not surprising that

the range of definitions has increased yet further (Brockman, 2013; Parellada 2002). Though this has created some confusion as to what exactly complexity is (Corning, 2002), Lissack (1999: 112) does point to some common ground among complexity researchers; he argues that it is:

> … a collection of ideas that have in common the notion that within dynamic patterns there may be underlying simplicity that can, in part, be discovered through large quantities of computer power …

In this article, we will apply two complexity theories, dissipative Structures and autopoiesis, to fictional situations in order to demonstrate the usefulness of praxiphorical analysis to understanding and managing organization change. These two complexity theories will be briefly discussed before applying them, respectively, to the Golding and Clarke novels.

3.1 The Dissipative Structures Model

Dissipative structures are so called because they dissipate unless energy is fed in from outside to maintain them. Dissipative structures are most closely associated with the work of the Nobel-Prize winning chemist Ilya Prigogine and concerns self-organization in physical and chemical systems (Prigogine and Stengers, 1984). In essence, the theory uses thermodynamic principles to emphasize the role of chance in system development, especially in terms of how systems operating under ‘far-from-equilibrium’ conditions achieve ‘order through fluctuations’.

Prigogine argues that systems that are in a state of equilibrium are featureless and chaotic. They have a maximum number of possible arrangements of molecular particles. No effect-producing differences are discernible anywhere. Far-from-equilibrium systems are the opposite of this state. Living organisms and social organizations are good examples. They are not 'finished' forms, but remain continually open to the outside world and dynamically active.

This openness and activity allows far-from-equilibrium structures to escape from entropy and spontaneously generate new levels of order (Brockman, 2013). For order to emerge in far-from-equilibrium systems, energy from the exterior must compensate for energy lost through internal processes. Davies (1987) uses the example of a pendulum to show how far-from-equilibrium structures draw on external energy to achieve a new organizational structure. If a pendulum has no friction to dissipate its energy, it will continue to follow the same path, maintaining the same form, indefinitely. When the pendulum's motion is subjected to friction however, the pendulum loses its form and grinds to a halt.

In a system open to outside influence, the pendulum will lose its existing form via friction while assuming another driven by energy from the exterior. Energy input must always exceed entropy production for new order to merge. This is the first condition for self-organization. The system minimizes entropy production, spontaneously generating a new structural order without compromising the laws of thermodynamics (Figure 1). These structures have been called 'dissipative structures' because they are defined by the dissipative flows and reaction characteristic of far-from-equilibrium activity.

Please insert Figure 1 here

Compensation of entropy produced by energy gained from the exterior is the first pre-condition for far-from-equilibrium systems to produce self-organization. The second is the presence of non-linear interaction mechanisms between the microscopic elements of the system. These arise naturally in far-from-equilibrium processes (Prigogine and Stengers, 1984). Linear relationships between elements are so called because they can be described with a straight line. A good example would be the relationship between an orange and its

price (Coveney and Highfield, 1995). In a linear or straight line relationship five oranges would cost five times more than one orange, and ten oranges would cost ten times more. This is a straightforward ‘additive’ process, in which we can predict the relationship between price and the number of oranges through straight line extrapolation. However, if two oranges are free for every 12 bought, and six for every 18, the nature and form of the relationship can no longer be described using a straight line. This is a simple example of a non-linear relationship. The relationship between the variables is disproportionate. The feedback results from non-linear processes, as process outcomes trigger additional changes which are impossible to predict.

Prigogine uses similar non-linear processes such as auto or cross-catalytic reactions to explain chemical self-organization. Here, the product of a chemical reaction is involved in its own synthesis. Because of their extreme sensitivity to initial conditions, all mathematical descriptions used to predict these reactions are inadequate. An initial description of the behaviour of all variables accurate to a hundred thousand decimal places is still inadequate to describe their interactions. Non-linear processes could theoretically be accurately described, if sufficiently accurate mathematical descriptions of the initial conditions were available. Since they are not, however, complex non-linear processes remain unpredictable (Davies, 1987, pp.23-25). They are their own best description. As Kelly describes non-linearity: 2+2 = apples (Kelly, 1994).

The unpredictable nature of non-linear processes produces 'fluctuations', or deviations from the average values which are maintaining the system's steady state. These are of central importance to the phenomena of self-organization. It is because of these fluctuations that the evolution of a system containing non-linear mechanisms is not uniquely determined by the

equations which govern the interacting variables. Chance exercises are an important influence on the system's historical development. Fluctuations are also called 'bifurcations' or “bifurcation points”.

If the system's original trajectory prior to a fluctuation was stable, the effect of the fluctuation will be damped and the system will return to it. This process is shown in Figure 2.

Please insert Figure 2 here

The solid line shows the system's trajectory. The dotted line shows a fluctuation, or 'choice' for the system. But if the system's original trajectory was unstable, the system will be driven down a new bifurcation branch towards a completely unpredicted solution. This process is shown in Figure 3.

Please insert Figure 3 here

The solid line shows the system's actual trajectory before and after a fluctuation. The dotted line shows the hypothetical course of the system initially after being driven off its normal course by a chance fluctuation, or 'choice' for the system**.** Therefore far-from-equilibrium systems have much higher sensitivity to external conditions than those in equilibrium.

The 'history' of the system depends on which fluctuations occur. Each system has a unique history depending on its environment and the chance decisions it follows during development. The system therefore has unusual adaptive potential. It can adapt to subtle changes in external conditions through assisted bifurcation. Any state of the system will only remain stable if it adapts to environmental conditions. The sophisticated communications of dissipative structures aid this adaptive capacity. Dissipative structures behave coherently, as

though each molecule were ‘informed’ about the state of the whole system (Davies, 1987; Prigogine and Stengers, 1984; Styhre, 2002). The entire evolutionary process of such a structure over time is presented in Figure 4.

Please insert Figure 4 here

As the chemical system is pushed further from equilibrium, the straight lines showing the system's steady state reach various thresholds of stability. Fluctuations then occur. The solid lines show the system's actual trajectories. The dotted lines show potential courses ignored by the system after a series of fluctuations, or random 'choices'. The bifurcation points create a unique 'history' for the system as it develops over time. Both chance and environmental influences determine the 'choices' made.

A dissipative structure (like all non-linear systems) can be statistically described, yet is so sensitive to initial starting conditions that such descriptions cannot preclude the possible emergence of chance behaviour and fluctuations. It is not necessarily possible to deduce the historical development of a non-linear system from the equations governing the interacting variables. Each system will have its own unique history and potential set of outcomes. As a system develops, chance and determinism interact, the deterministic equations governing steady state conditions damping or amplifying random fluctuations. Auto-catalytic feedback is the major influence on this amplification process.

‘Order by fluctuation’ is a paradigm which can be applied equally well to the study of systems which are described in terms of basic units having themselves an internal structure and containing mechanisms governing their interaction with the environment and other

elements of the system (Allen and Sanglier, 1978). This can be seen also in the following discussion of autopoiesis.

3.2 Autopoiesis

As might be expected given that autopoiesis is a complexity theory, it shares many similarities with Prigogine's dissipative structures model, especially in terms of self-organisation. However, this model, it did not originate in the physical sciences, but in the biological sciences. It was developed in 1972 by two Chilean biologists, Humberto Maturana and Francisco Varela (1980). Its primary purpose is to provide an explanation of the development and continuation of living systems. One of the main contributions of this theory is its rejection of the possibility of objectivity; it argues that living organisms see other living organisms only in a self-referential, subjective manner and not in an objective manner but in (Varela et al, 1974). The theory created a new definition of life based upon the ability of a system to reproduce its own structural network rather than merely reproduce. This is why Maturana (1980: 52-53) defines an autopoietic system as a:

> …network of productions of components that a) through its interactions recursively regenerate the network of productions that produced them, and b) realize this network as a unity by constituting and specifying its boundaries in the space in which they exist.

In essence, it is an explanation of self-organization in nature, which of course aligns with the self-organization perspective of other complexity theories (Burnes, 2005). Autopoiesis describes how the recursive relationship between the components and the whole ensures that the system develops a self-organizing response to external perturbations. The perturbed components influence all other components in the system. In response, the whole maintains its integrity by further perturbation of the components where necessary. By this recursive process, the system continually adjusts to its environment without direct engagement (Zeleny, 1980). An autopoietic system is necessarily autonomous and self-referential. Having defined

its own borders from within, it achieves autopoietic 'take-off' or radical autonomy which lasts indefinitely or until external perturbations exceed the capacity of its self-organized responses. Biological systems will frequently self-organize themselves. This is in a manner, which is similar to that of the order-through-fluctuations model characteristic of far-from-equilibrium chemical systems. For example, termite nests begin when a single termite leaves some of its attractant hormone on the ground. This is the equivalent of a chance fluctuation. The hormone attracts other termites. These termites leave more hormones and also drop earth onto the spot. The fluctuation is amplified into a new termite mound by an accretive, non-linear process (Prigogine and Stengers, 1984). This process corresponds to one stage of a bifurcation tree, with a single fluctuation being amplified all the way into a new state. Nonetheless, it intimates how social self-organization might proceed.

Perturbations, or fluctuations caused by physical stress, can also arise in biological structures. For example, the directionality of snail shells (that is, their tendency to right or left-handedness) is thought to have originally arisen from a minute perturbation created by universal weak forces at an early stage of their development (Stewart and Golubitsky, 1993, pp.176-182). This perturbation was then amplified via genetic replication. Most bifurcations at a biological level arise from the tendency of organic systems to oscillate or buckle, so losing their original single-state symmetry, when subject to a stressing physical forces. Other examples include the natural tendency for animal locomotion methods to break symmetry when stressed (Stewart and Golubitsky, 1993).

4. Applying the Dissipative Structures Model to Lord of the Flies

Having discussed complexity theories, we will now apply the dissipative structures model praxiphorical to Golding’s Lord of the Flies. In particular, we will show that the model’s

explanation of ‘order-through-fluctuations’ in nature has parallels with Golding's description of group transformation in his novel. This in turn offers insights into how complexity theories can be applied to organizational settings. The plot of Lord of the Flies is simple. In the midst of a wartime evacuation, a British plane containing a group of public schoolboys crashes on or near an isolated island in a remote region of the Pacific Ocean. At first, they try to construct a democratic culture with some success. This culture is associated with various objects and symbols such as a conch shell, a signal fire and a pair of spectacles. However, the necessity of survival in a hostile environment makes it hard to sustain themselves. The social system developed around the conch is put under increasing pressure. This stress drives the group towards a new trajectory better suited to the environment. This is the culture of hunting, violence and authority exemplified by Jack Merridew. As the pressure increases, the occasional fluctuations towards this new trajectory become more frequent. The group eventually adopts the new trajectory. Representatives of the old conch culture - Ralph and Piggy - become outcasts.

Prigogine's concept of order-through-fluctuations can largely explain this sequence of events. Prigogine argues that a system can achieve a new order - a new trajectory - if it acquires sufficient energy from the environment to compensate the energy it naturally loses through entropy. At first, the group only assumes the new trajectory on an occasional basis. The original trajectory is still stable enough to 'dampen' the fluctuation. Permanent assumption of the new trajectory is associated with a heavy storm, Simon's murder and the groups' collective encounter with the beast. This emotional and experiential input helps to create a new social order comparatively well adapted to the island environment. Figure 5 illustrates the sequence of events.

Please insert Figure 5 here

The new order arising from the major fluctuation creates a new organizational structure, not mere chaos. Jack cleverly hunts Ralph by sweeping the island with a line of hunters. Each member passes an ululation along the line. This alerts the whole group to the fugitive's presence. Indeed, the social order generated by the fluctuation is probably more highly developed than that of the initial trajectory. By definition, it is better adapted to the environment.

It is difficult to doubt that the novel uses Prigogine's concept to explain social change in the island organization. Internal consistency allows comparison of a process governed by metaphorical conditions with those that prevail in the management literature. Minor oscillations in the group's structure take a variety of forms. One of these is the conflict between Jack and Ralph. The group's attention focuses alternately on these two, and they accept the leadership of whoever prevails:

> "That's right. Keep Piggy out of danger."
>
> "Have some sense. What can Piggy do with only one eye?"

The rest of the boys were looking from Jack to Ralph, curiously (Golding, 1961, p.97).

The organizational literature tends to overlook the importance of leadership conflict during transformation through fluctuations (Burnes, 2014). Yet here, the group's attention focuses on two protagonists. Whichever prevails dominates the group. Finding a unit of analysis has always been problematic in applying Prigogine's concepts to social adaptation. Whilst

'energy' is a consistent unit in physical systems, it is not consistent in social systems. The energy that a social group requires to achieve new order has never been properly defined in the theoretical literature. The novel infers that extreme or unusual emotional experiences such as storms can provide the energy influx for a group to achieve a new mode of organization.

In the novel, physical objects are important in maintaining group cohesion. The destruction of the symbols associated with the conch culture leads to feed-back, reinforcing the new trajectory. Roger smashing the conch is the most obvious example of this. However, the new group trajectory also uses physical symbols. Most obvious of these are the colored clays used by the choir during their hunting.

According to Prigogine, natural manifestations of order-through-fluctuations such as the Brusselator are characterized by unified activity (Prigogine and Stengers, 1984). Molecules in the Brusselator appear to be able to ‘communicate’ with each other over vast distances, all knowing when to turn blue, and when to turn red. The ‘tick’ of this chemical clock as it rolls around the limit-cycle moat is a function only of certain physical properties of the Brusselator (Coveney and Highfield, 1995, p.162).

The excitations of heart muscles or the brain have similar operating principles (Goodwin, 1994, pp.56-62). Golding similarly describes oscillations in the group's initial trajectory. For, example, the climactic dance that leads to the bifurcation point is a unified, rhythmic process, like the Brusselator. The movement became regular while the chant lost its first superficial excitement and began to beat like a steady pulse. Roger ceased to be a pig and became a hunter, so that the centre of the ring yawned emptily. Some of the ‘littluns’ started a ring of their own; and the complementary circles went round and round as though repetition would

achieve safety of itself. There was the throb and stamp of a single organism (Golding, 1961, pp. 144-145).

Piggy, Simon and Ralph are seldom included in these group fluctuations/oscillations. The new social order that finally emerges leads to the persecution of the three boys. Pressure from the environment imposes unity on the group even before the major bifurcation. After the beast has taken possession of the mountain, the boys prepare to confront it as a single organic entity. The bright morning was full of threats and the circle began to change. It faced out, rather than in, and the spears of sharpened wood were like a fence (ibid., p.96).

Prigogine claims that a physical structure will act with systemic unity to achieve adaptive order if provided with sufficient energy (Prigogine and Stengers, 1984). The literary model links external pressure, energy influx, group unity and new organizational trajectories in an identical manner. External pressure on the group forms a continual backdrop in the novel. Natural phenomena while providing an energy influx, also represents an external stress. Under these influences, the group acts as a unity when oscillating into a new trajectory.

The novel provides psychological perspectives on the process of group fluctuation. Loss of self is synonymous with the boys who follow the new trajectory. Ralph, who stands between hunting and tradition, experiences this loss as 'a curtain' in his mind that obscures his ideas (Golding, 1961, p.162). The face paint adopted by the hunters is “liberation into savagery.” When Jack first regards his painted face, he sees “an awesome stranger” (ibid., p.61). The frenetic dances that actually lead to the new trajectory involve a loss of self. Freud referred to such feelings of ego loss as 'jouissance': an ecstatic overflow of oceanic feelings (Freud, 1991, pp.251-252). This psychological state is synonymous with spontaneous group

transformation in the novel. It is also associated with the same process in related literature (Euripedes, 1973).

Although the model of order-through-fluctuations explains most of what transpires, there are important exceptions. The fact that some group members resist the bifurcation presents interesting difficulties. Those who resist the fluctuation in the novel their fate is harsh. Such treatment might well characterize the treatment of non-conformists in conventional organizations.

Further, the transformation of the group occurs via a sequence of minor fluctuations or oscillations eventually culminating in bifurcation. The process is not instantaneous but incremental. In the early stages of the process, Jack's group is often autonomous. However, this autonomous behaviour never confronts the prevailing culture. It is, indeed, sub-cultural. Eventually, as the social system moves far enough away from equilibrium, the subculture assumes dominance. This has important implications for the study of subcultures in organizations confronting incremental changes in their cultures (for instance, the progressive marketization of the NHS and university sector).

5. The City of Diaspar considered as an Autopoietic System

The background to Arthur C. Clarke's The City and the Stars is Diaspar, the last city on earth. It has survived the ravages of time for a billion years. The plot concerns Alvin, a Unique who has no fear of the external world. Unlike like all other Diaspar inhabitants, Alvin yearns to leave the city.

As Diaspar is first described, we see it conforms perfectly to Varela's and Maturana's model of an autopoietic system. This is remarkable when one considers that the novel predates autopoietic science by more than a decade. Diaspar shields itself from the outside world. Completely autonomous, it has achieved autopoietic take-off from its environment. This results in a state of radical autonomy wherein the city remains unaffected by time. Men had built cities before, but never a city such as this. Some had lasted for centuries, some for millennia, before time had swept away even their names. Diaspar alone had challenged Eternity, defending itself and all it sheltered against the slow attrition of the ages, the ravages of decay, and the corruption of rust (Clarke, 1960, p.7).

The inhabitants of Diaspar have an autopoietic consciousness. The perimeters of the autopoietic system delimit their understanding. They have no knowledge of the environment beyond. What was beyond the walls of the city was no concern of theirs; it was something that had been shut out of their minds (Clarke, 1960, p.7). All inhabitants are terrified of the external environment. Millennia of autopoietic detachment have made them incapable of functioning outside the city. Even the thought of what lies beyond incapacitates them.

Diaspar's inhabitants have no need for the external environment. The city can sustain itself and its inhabitants indefinitely: "... the men who built this city, and designed the society that went with it, were lords of mind as well as of matter. They put everything that the human race would ever need inside these walls - and then made sure that we would never leave them" (Clarke, 1960, pp.31-32).

The city has an operating network of self-production, the Central Computer: "The Council ruled Diaspar, but the Council itself could be overridden by a superior power - the all-but-

infinite intellect of the Central Computer. It was difficult to think of the Central Computer as a living entity, localized in a single spot, though actually it was the sum total of all the machines in Diaspar" (Clarke, 1960, p.71). If this structural network alters, the city reshapes itself to the new configuration. However, Diaspar recursively informs the Central Computer of any need for change or adaptation:

Diaspar might be held in perpetual stasis by its eternity circuits, frozen for ever according to the pattern in the memory cells. But that pattern could itself be altered, and the city would then change with it. It would be possible to redesign a section of the outer wall so that it contained a doorway, feed this pattern into the monitors, and let the city reshape itself to the new conception (Clarke, 1960, pp.73-74).

In autopoietic systems, the structural network maintains all activities. Consequently, certain aspects of the structural whole must be inviolate to changes by components from within. Consequently every change in any of the components must affect the interactions among all other components in such a way as to yield a new counter-balancing response of the unity as a whole towards the maintenance of its integrity. The whole responds through a structural adaptation, i.e., by further deforming the field of its components. The behaviour of components is thus affected (or even determined) by such deformations, and so on. The whole and the parts reciprocally influence and determine each other (Zeleny, 1980, p.20).

The Jester Khedron, designed to provide Diaspar with a random element that can subvert the governing structure. He achieves this by manipulating the city's self-representation. Yet, as in the literature, certain aspects of Diaspar's overall structural network are inviolable. Without those aspects of the network that create and maintain components, the city would lose all self-

definition. Autopoietic networks inevitably defend their own structure in this way. Since the relational network was created by Khedron, it protects itself by recursively limiting his power to alter its definitive features:

Khedron must have a profound understanding of the machines and powers that ruled the city, and could make them obey his will in ways which no one else could do. Presumably there must be some overriding control which prevented any too ambitious Jester from causing permanent and irreparable damage to the complex structure of Diaspar (Clarke, 1960, p.58). Safeguards restrain the Jester's intrinsic nature to alter the structural network. Khedron was content with the order of things as it was. True, he might upset that order from time to time - but only in a small way. He was a critic, not a revolutionary (Clarke, 1960, p.61).

Khedron was the only other person in the city who could be called eccentric - and even his eccentricity had been planned by the designers of Diaspar. Long ago it had been discovered that without some crime or disorder, Utopia soon became unbearably dull (Clarke, 1960, p.55).

The Central Computer resembles the State in Jessop's writings (Jessop, 1990). Jessop argues that complex autopoietic systems require a simplified self-representation to prevent their own complexities overwhelming them. The State, for example, is an autopoietic self-representation of the political system that allows it to function. Without such a self-representation, the system would become lost in its own complexities. The Central Computer serves a similar function for Diaspar. It represents the system to itself, allowing recursive adaptation and development. An important distinction between Diaspar and autopoiesis in the

management literature involves the separation of structural networks from self-representation. In Diaspar, both functions reside in the Central Computer. The network is the representation.

There are other important differences between the autopoietic system in the novel and the organizational analysis literature. Most management writers on autopoiesis stress the importance of an operating code for the system. Jessop, for example, claims that a "Public-Private" code governs the State. It is difficult to detect any code in the literary model, however. Self-perpetuation is its sole reason for existing.

Morgan (1997) argues that autopoietic organizations see the external environment as a feature of themselves. They supposedly overemphasize their own importance. However, Diaspar has completely turned away from the outside world. The legends of Diaspar claim that mankind made an ancient pact with their conquerors, the Invaders, after a cosmic war. This allowed man to live unmolested as long as they remained on Earth. The ethos of the novel is in fact anti-autopoietic. Clarke infers that the autopoiesis is a less than ideal social state. Alvin, the hero, eventually leaves Diaspar in fruitful pursuit of wider experience.

The novel raises several important management issues questions in respect to autopoietic organizations. First, the system must have the ability to adapt internally, even in the absence of external knowledge or interest. An autonomous law of internal motion is an obligatory feature of autopoietic status. A social system might require a subject to initiate this movement; second what dissonant elements can the autopoietic organization allow? In the literary example, the system is reflexively intolerant of all non-assimilable elements. Allowing a subject with an imperfectly assimilated character into the system does it irreparable damage.

Second, the success of the city as an autopoietic system depends upon the perfect accuracy of its self-representation. Further, the representation can instantly shape the system. Present social systems can never attain this consistency of self-representation. The Central Computer does not need to abbreviate its self-representation to itself, since; being the self-representation it can comprehend the most complex representation. The actors in a social system can never match this level of comprehension. Since a single consciousness can never apprehend a social totality with which it experiences a recursive relationship (Hayek, 1989, p.79). Indeed, Jessop argues that some simplification is necessary for self-representation to aid system functioning. The question remains to what extent the system should undergo simplification. The literary model suggests that the maximum complexity permitted is preferable. Third, the literary example allows the network to be protected while still permitting the possibility of change from within. The minimum specifications required for the system to function are as being preferable in the novel. In the literary example, the city acquires total autonomy by designing its parts to fit the system. It achieves this ability only after a lengthy period of autopoietic autonomy. Self-design can only occur when the operating code subsumes all systemic elements.

6. Discussion: Complexity Theories and Organizations

A wide range of organisational theorists and practitioners have argued that organisations are complex, non-linear systems in which change emerges through a process of spontaneous self-organisation (Arndt and Bigelow, 2000; Burnes, 2014; Black, 2000; MacIntosh and MacLean, 2001; Stacey, 2003). These theorists argue that the best-run companies survive because they operate at the edge of chaos by relentlessly pursuing a path of continuous innovation brought about by a process that resembles self-organisation in nature (Brown and

Eisenhardt, 1997; Burnes, 2005; Frederick, 1998). However, Beeson and Davis (2000) make the point that whilst it might be fruitful to see organisations as non-linear systems, to do so will require a fundamental shift in the role of management. They point out that self-organising principles explicitly reject cause-and-effect, top-down, command-and-control styles of management. Brodbeck (2002) suggests that the belief by managers that order and control are essential to achieve their objectives should be rejected. For Tetenbaum (1998), the move to self-organisation will require managers to destabilise their organisations and develop the skill of managing order and disorder at the same time. Managers will need to encourage experimentation, divergent views, even allow rule-breaking, and recognise that 'people need the freedom to own their own power, think innovatively, and operate in new patterns' (Bechtold, 1997: 198).

One of surprising things about the development of complexity theories is a that almost from their birth, social scientists have sought to apply them to their particular areas of study. Luhmann (1984, 1986) was perhaps the first researcher to do this. His work stressed that maintenance of social systems, which is what organizations are, requires self-referential production. Likewise, Teubner (1988, 1989) in his development of an epistemology of law, referred extensively to Luhmann's work. For Teubner, the network of legal communications refers only to itself as it develops, not to the external world of persons, i.e. it derives meaning from itself (Teubner, 1988, 1989). Kauffman (1976) applied autopoiesis to the study of bureaucracy; arguing that the self-organizing features of changeability and adaptiveness are used for the sole end of preserving its own the existence. This view of an autopoietic system is one characterized by radical autonomy (Jessop, 1990). An autopoietic social system continually defines its own boundaries and creates its own rules of governance. Blind co-evolution characterizes the relationship between different autopoietical systems in a society.

Jessop used the term "structural coupling" to describe the mutual relationship between co-evolving structures in the same social eco-culture. The state, itself characterized by autopoietic principles, can exert only the blind, limited, co-evolutionary influence on other organizations in the same society characteristic of 'structural coupling'. Many other writers have also sort to use complexity theories to understand organizations (see Morgan, 1997; Kickert, 1993; Takeuchi and Nonaka, 1995; MacIntosh and MacLean 2001; Stacey et al. 2002).

The problem with applying complexity perspectives to organizations is that it is very difficult to study such events taking place in real-time and in real organisations. Even more so, it is hard to see how organizations can use complexity as some sort of planning tool when seeking to establish new organizations or bring about major changes in existing ones. However, a praxiphorical approach may help to overcome this. One of the key planning tools which organisational utilise in such situations is the creation of organizational visions to explore possible future states (Johnson et al. 2011). Often the degree of success achieved by envisioning is limited by the knowledge and imagination of those concerned (Burnes, 2014). However, by applying complexity metaphors, which explicitly challenge concepts of stability and rationality, to fictional social settings an entirely new range of possibilities and understanding. Our praxiphorical application of complexity theories to Golding and Clarkes' work illustrates this.

In taking this approach to Lord of the Flies, the 'hyper-real' nature of Golding's simulated island society reveals order-through-fluctuations operating to an extent unprecedented in any real-world organization. With the process isolated and accentuated in its simulated setting, it becomes possible to adduce more details of its activities – details generally lacking in 'real

world' settings. Certain factors seem to stand out: first, Jack is a powerful, sociopathic agent of change; second, the creation and destruction of organizational symbols is crucial during the fluctuations (the conch); third, perturbations in the physical environment play an important role in shaping the fluctuations (storms are a good example of this); fourth, the more eroded physical conditions become, the more prone to adaptive fluctuation the organization becomes.

Exploring the first factor a little more, our praxiphorical analysis suggests that the role of dissident leadership is of great importance in achieving a new, adaptive social order under far-from-equilibrium conditions. In the novel, Jack Merridew is instrumental in this process. At the start of the action, a democratic social order prevails. By the end of the novel, Jack is the tyrannical ruler of the island while Ralph is a hunted fugitive. Jack's character traits are clearly of singular significance in this social transformation. The new discipline of evolutionary psychiatry argues that personality disorders persist in modern populations because they are – or might once have been – highly adaptive in certain circumstances (Stevens and Price, 2000). One claim is that schizophrenics might have led 'group splits' in hunter-gatherer communities, preventing over-exploitation of limited resources. We find a similar situation in the Lord of the Flies, with the sociopathic Jack leading a group-split that becomes a hegemonic take-over.

Golding gives repeated hints that Jack Merridew is psychologically abnormal. His eyes are variously described as "bolting and nearly mad", 'opaque' and 'staring'. He seems to be at least psychopathic and possibly psychotic. Students of entrepreneurship might thus have something to learn from this aspect of our praxiphorical research. Top innovators often initiate organizational conflict (Babiak and Hare, 2006) and this tendency is seen in our

praxiphorical source material. Indeed, some evidence suggests that certain personality disorders such as psychopathy might be conducive to business success (Dutton, 2012).

Moving on to Clarke's The City and the Stars, this is a text overflowing with imaginary devices and technologies, which makes it a very favourable arena in which to apply a praxiphorical approach. When the novel was written, most of the devices Clarke descrtibes were far beyond the scope of contemporary technologists. Today, however, computer networks, bespoke software and other digital technologies closely approximate Clarke's vision. Had organizational planners in the fifties and sixties studied Clarke's fictional facilitators, the technical devices he created to make his story work, practical analogies for them might have been found. Alternatively, they might have been mirrored by novel organizational procedures or management methodologies.

However, the true potential of praxiphorical analysis has only recently arrived, with the advent of networked computers in almost every workplace and public body. Software development has already reached a state of near-infinite plasticity that can easily express the most adventurous visions, at least in terms of functions and outcomes. In addition, ever-increasing processor-speeds have made the most complex software available on hand-held devices, ensuring ubiquitous social saturation. Praxiphorical analysis does not merely test organizational theories, but also unearths conceptual systems that might augment existing or proposed organizational contexts.

7. Conclusion

The idiomatic approach to examining organizational concepts developed in this paper has indicated that analyzing theoretical models within a literary setting can illuminate them as

practical applications. This transcends the typical use of metaphor in organizational studies, which involves merely associating processes with concepts derived from science or biology. Though this may reveal new aspects of organizational operation, it cannot intimate how the concepts might operate under extreme hypothetical conditions. Certain practical guidelines for successfully approaching "literary praxiphorical" analysis naturally emerged from the study. Where an organizational management paradigm is present in a fictional context, systemization of effective (praxiphorical) methods needs directing:

- To isolate the effect of metaphorical conditions on the organizational paradigm.
- To compare the effect of metaphorical conditions surrounding the organizational paradigm with typical conditions.
- To isolate how effects of metaphorical conditions illuminate the organizational paradigm.

If the literary context is sufficiently rich to achieve these goals, then a successful analysis is more likely to result. Finding a text that contains the relevant organizational concept also involves ensuring it contains sufficient depth to allow rigorous examination in terms of the three criteria outlined above.

To apply these insights effectively, the researcher needs to ascertain two things:

i. Is the organizational theory present in a given fictional context? If the theory is new, is its expression in the literary context sufficiently proximal to provide a meaningful model for further investigation?

ii. Is the fictional context sufficiently proximal to an actual or proposed organizational environment to be of value as a metaphorical test-case?

Once the researcher is certain that these things are in place, they can proceed with the analysis. The focus on individual characters and their reactions to events can be very useful. Special attention should be paid to their subjective reactions towards conditions and events. When the organizational theory under examination is change-focused (such as the order-through-fluctuations theory), it is better to focus on the novel's pivotal moments of social transformation. Above all, the researcher should try to expose shortcomings in the theory's praxiphorical application. Does the praxiphorical social organization survive or fail?

Which science fiction works are most appropriate for this kind of study? In the simplest sense, it is those stories containing social environments that can be linked to actual or planned organizational environments. For instance, self-organization. The genre is often viewed as tangential to practical real-life concerns, even its anti-thesis. This paper, however, attempts to demonstrate that classic science fiction can create sufficiently cogent environments for management theories to be both detected and analysed therein. Although the two theories chosen are derived from experimental fields of organizational studies, more conventional theories could also be 'tested' in the same manner.

The 'added value' adhering to praxiphorical analysis of science fiction relates to the 'bleeding edge' environments that characterize this literary genre. Works produced in the fifties, sixties and seventies are only now becoming meaningful metaphors for today's organizations and their management. For example, Arthur C. Clarke's The City and the Stars was originally published in the fifties but only since the rise of information technology has it

become a meaningful analogue for real-world organizations. Another example would be the Space Seed and its spin-off films and novels, since it has only become a valid praxiphorical media text with the advent of applied genetics. Similarly, classic works by Vernor Vinge (Vinge, 2000), William Gibson (Gibson, 1996), Robert Heinlein (Heinlein, 2008) and Philip K. Dick (Dick, 2000) all have this 'contemporary' significance despite being first published at least twenty years ago. Of course, more recent authors such as Ian M Banks and Charles Stross present an even more tempting proposition for those planning organizations today. These writers have internalized the mass computer revolution and are shaping worlds that will doubtless be relevant to management and organizational theorists fifty years from now.

The challenge for researchers is to select science fiction literature with the essential internal cogency, and bleeding-edge vision to serve as conceptual testing grounds worthy of their chosen theory. By this means, problems and opportunities can be identified in proximate practical environments.

In our selection of praxiphorical texts, special attention should be given to classic works that have stood the test of time. After all, praxiphorical consistency is a benchmark of 'classic' status. This conservative approach also allows the layperson to select a limited number of high-quality texts, avoiding the danger of fruitless study. Selecting works by writers who have won Hugo and Nebula or Arthur C Clarke awards would also act as an automatic quality control. Of course, this cautious approach will generally furnish the researcher with texts of value only in the present, since contemporary society is the future they describe (we have furnished the reader with many examples in this essay). By definition, contemporary works have not yet undergone the same process of quality-selection, leaving the reader with fewer guidelines for effective text-selection.

Another way to facilitate successful praxiphorical analysis is to select science fiction works with a specifically 'social' focus. Frank Herbert's novel Dune is often said to represent a shift in the focus of science fiction. Prior to Dune's first publication in 1965, the genre tended to focus on space travel between star-systems and planets. By contrast, Dune describes the ecology of an alien world in minute detail. This same attention to detail applies to the cultures that arise there (Herbert, 1982). Herbert's Arrakis is a cogent, inter-consistent environment that shapes the customs, language and values of its native Fremen in unique and profound ways. It is, in short, a definitive praxiphorical context.

Post-Dune science fiction is therefore of particular interest to praxiphorical analysts, in that it tends to focus on cultures in alien contexts rather than space travel. By applying Herbert's distinctive approach, authors like Gene Wolf, Brian Aldiss and Chris Beckett have built worlds of similar ecological and cultural complexity. Such texts are ideal for literary praxiphorical analysis not merely because of their 'social' focus, but also because of their intensely-imagined detail.

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