THE LIFE CYCLE OF A COMPLEX ADAPTIVE SYSTEM AND ITS IMPLICATIONS FOR HUMAN LIFE

Victor MacGill
1 Moncrieff Avenue,
Brittania Heights,
Nelson 7010
New Zealand

ABSTRACT

The models and theories used in the systems sciences tend to follow a structural approach of describing parts and wholes and the interactions between the parts or a process approach focussing on the developments over time. This paper attempts a synthesis of models and concepts from both approaches to form a generalised mapping over time valid for all complex adaptive systems (CAS). The adaptive cycle is used as the prime process-based model highlighting the underlying tensions active at a given time that drive the changes of state from phase to phase of the adaptive cycle. The applications of this model will be focused on living systems or systems that include living systems to be applicable to the world we live in.

CAS with only a few members need no formal infrastructure. As the number of parts grows, difference increases and requisite variety grows larger improving the effectiveness of the system, however, conflict arising from the difference between the parts and the level of inequality also grows. Eventually, the gains of requisite variety are overshadowed by the increase in conflict. The system must then find a way of re-organising itself to contain the entropy or face extinction.

A common strategy is for some members to take on a co-ordinating role by agreement or force that can absorb the entropy that individual members are unable to contain. While this increases effectiveness, it further increases inequalities of power and control over resources. We now have systems of systems each with their own priorities and values that can clash, often observed as the changing dynamical balance of autonomy and connectivity, where one or other can dominate to the detriment of others. If the co-ordinating group is still not able to contain the entropy of the system a further hierarchical controller level might emerge, containing chaos but yet further exacerbating inequality.

Many aspects that are critical to human life are already evident in the underlying dynamics of systems. Even the most basic CAS has identity, value, conflict, error and error detection, future orientation, will to live, purpose, agency/power, need to connect, rules and enforcement, tensions of commitment to various levels, attenuation and more. All CAS have an identity and values enshrined in a worldview, belief, or value system that operate as mapping, which is often mental, to guide decision making. Behaviours that support the worldview are enhanced and supported. Typically, there will be rebel members challenging the dominant worldview, who must be managed for the system to maintain sufficient coherence. As soon as an identity forms marking the uniqueness of the CAS, the concept of "other"; that which is not selected beyond the boundary of self-identity also arises. That which is selected is familiar and known and more likely to be trusted. The marginalised other which is not selected is less known and less familiar and therefore less trusted. The fear and distrust of strangers and their difference is evident at all levels of life.

Over time the seemingly limitless growth phase of a CAS will hit constraints that herald the conservation phase and then a release phase where many structures previously established are no longer viable. The system falls apart, but this dissolution carries the possibilities of reorganising in new and better ways into a new cycle and a new growth phase. Once the theoretical foundation is set, the implications at the biological, psychological and social levels are investigated.

Keywords: Complex adaptive system, adaptive cycle, autopoiesis, requisite variety, rebel

INTRODUCTION

Theories that attempt to understand human behaviour and find better ways for us to organise ourselves range from the biological (Peterson and Wrangham, 1997; Wrangham, 2019) to the psychological (Beck, 1979; Lineham, 1987) to social (Foucault, 1972; Weininger, 2005). While each contribute to the overall mosaic of influences and tensions that drive living systems, they miss the wider context that can provide a more nuanced, multi-perspectival overview of the three fractally nested layers. It is proposed that there is a foundational systems layer beneath them that lays down the constraints evident at all higher levels. Those constraints shape the way higher levels are structured and how they can function as emergent, nested layers.

Snowden (n.d.) outlines four types of system: obvious, complicated, chaotic, and complex. All living systems and all systems that include living systems are not only complex but are complex adaptive systems (CAS) which embody the constraints that give coherence. Those constraints are evident at all higher levels. We will gain a grounding in the structure of CAS to then develop and understanding of CAS as processes.

COMPLEX ADAPTIVE SYSTEMS

CAS are complex systems that can change their state to enhance their ability to survive and thrive in the environment in which they find themselves. CAS sense changes in themselves and their environment, make sense of the information gleaned and respond in ways that maintain the flow of matter, energy and information through them, and cope with perturbations that arise both internally and externally. All the while the system must remain within critical parameters enabling life. The system produces a boundary between

itself and the outside environment that can control necessary flows through the system. A CAS can repair itself to maintain all internal processes necessary for its continued existence. A CAS must be able to undertake this autopoietic (Maturana, 1981, 2002) sensing, making sense and responding function without an external controller.
Since a system is always less complex than the environment it is embedded in (Luhmann, 1995), it can never fully understand itself and its relationship to its environment. Error is inherent in all CAS (Louie, 2010), which can therefore only make its best guess about what is happening. There are errors of sensing where critical information is missed, attenuated out (Espejo and Harnden, 1990) or misperceived, and errors where mistakes are not noticed. There are errors of sense making, of wrongly attributing meaning to patterns observed and errors of responding either due to the inability to act as is required or a faulty action. CAS learn to be deceptive (Ettinger and Jehiel, 2010) in an attempt to trick other systems into doing things they might otherwise resist.

Since a CAS works to maintain its existence over time, it is future oriented (Louie, 2010; Rosen, 2012). It not only responds to the immediate situation it finds itself in but will have some form of mapping of itself and its environment to predict future outcomes to aid decision making. Even the simplest life form like a paramecium measuring glucose levels can make a choice that increases the likelihood that it will have enough glucose to survive into the future.

With an understanding of the needs of a CAS to sustain its existence, we can move on to also see CAS as processes occurring through time to enrich our knowledge of the dynamic nature of CAS. A number of concepts and models will be introduced, each reflecting a different perspective on CAS.

The adaptive cycle (Gunderson and Holling, 2002; MacGill, 2011) will be used as a process-based explanation of the dynamic functioning of a CAS, exploring the structural changes over time as its response to the recursive dynamics and inherent tensions play out.

THE LIFE CYCLE OF A COMPLEX ADAPTIVE SYSTEM

Parts come together and interact because they can achieve more together than apart. The most basic CAS only has a small collection of parts co-operating. This is the beginning of the growth (or sometimes called exploitation) phase of the adaptive cycle. The parts have little experience and learning, and are not well connected making them not very productive. They are vulnerable at this initial stage and the whole system can be easily destroyed. There is a low level of complexity, so every part has access to every other part. Coming to a group consensus is generally quite easy. Communication is direct and equal. Differences can be generally resolved within the group, so the overall behaviour of the parts is sufficiently harmonious and supportive of the goals of the group. No formal infrastructure is needed at this level of functioning.

An example of a CAS at this stage might be a new group of five or six people coming together to form a support group. At first, they do not know each other well, but they quickly come to know about each other as they enter into recursive interactions of learning for mutual gain.

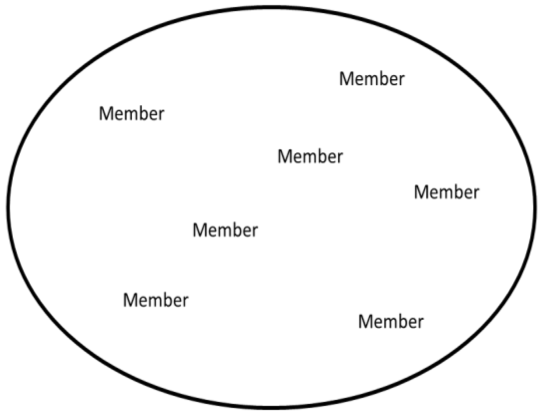

Figure 1. A basic CAS with only a few members. The word "members" is used for convenience, but the agents could be molecules, computers, seagulls, trees or whatever.

Already at this basic level there are some key qualities that are apparent that will become increasingly obvious and sophisticated as the system becomes more complex moving up from the biological through to the social levels.

The whole system develops an identity. Identity is that which must be conserved for the system to exist. At higher levels of complexity, the identity to be conserved becomes self-conscious (Maturana and Verden-Zoller, 2008). The conservation of identity is driven by the will to live (Damasio, 2000) inherent in the adaptive capacity of a CAS.

The group forms a boundary between itself and the environment within which it finds itself with its unique qualities that distinguish it from the world outside. The parts within the system will also have their own identity that they strive to maintain. This means each part is different and has a relationship to the other parts and to the system depending on their particular natures. It will have its own perspective based on itself within the wider system and its relationship to the other parts (Cabrera and Cabrera, 2015). The parts within the system must be able to exercise autonomy through the power to act. Each part can change its state in ways that fit within its values that it determines to be in its best interests. That determination may be conscious or unconscious as in a paramecium.

That which is included within the boundary tends to be more familiar and thus less threatening that that which is beyond the boundary(Midgley and Pinzón, 2011; Ulrich, 1983). This builds greater trust and willingness to co-operate within the boundary and suspicion and antagonism beyond the boundary.

Because the parts are different there will be requisite variety (Ashby, 1947). Requisite variety in a system increases the possible responses available to any change in the system or the environment making the system more effective. As requisite variety increases, however, so too does the difference between parts and thus the level of conflict to be resolved by the parts. Increasing requisite variety also means sub-groups with commonalities will emerge within the whole system. In a group of people, a subgroup may share a common cultural background, gender, political belief etc. that is not held by others and they may start to form alliances. These may be informal or may become formal entities in their own right within the wider system.

As requisite variety increases inequality also increases as the individual parts differ in abilities, access to resources, criticality to the functioning of the whole system and so forth. Particularly as they interact over time, positive feedback loops accentuate the difference resulting in power law distributions (Newman *et al.*, 2000) where the rich get richer and the poor get poorer. This eventually destabilises a system.

The fundamental goal or purpose of a CAS is to maintain and increase wellbeing, which will be shaped by its particular context. Actions that increase the viability of the system are valued and fostered over actions to be avoided or prevented that decrease the viability of the system. The values become enshrined in the identity of the system. As systems become more complex the way identity and values drive the system also increases in complexity. Identity and values become embodied as rules that must be adequately followed to maintain the coherence of the whole system.

In living systems, the parts are typically CAS in themselves, which echoes the Viable Systems Model (Beer, 1984) claiming that viable systems are composed of viable systems, such that we end up with systems of systems (Troncale and Friendshuh, 2012). This creates a tension between autonomy of the part and the connectivity of the whole. The needs and desires of the part, which is a whole in itself, may clash with the needs of the greater whole in which it is embedded. Parts are often called upon to make sacrifices for the good of the whole that are detrimental to their individual wellbeing. Ideally, the overall gains for the part arising from it being embedded in the whole will be greater that the loses due to sacrifice, in which case the part is generally willing to make the sacrifice.

As group size grow linearly, the complexity of the interactions between the parts grows exponentially and thus containing entropy quickly becomes problematic. Making shared decisions is generally easy with six or seven members, but with a hundred or more there is no quick, definitive way to have everyone involved in every decision, especially if there are time constraints involved.

One of the key ways that more complexity can be absorbed avoiding system overwhelm, is to cede the authority to a subgroup to co-ordinate the activities of the whole system (Stewart, 2018). This may be done by agreement or by force. This co-ordinating group might just be a single leader or a group that takes responsibility on behalf of the whole.

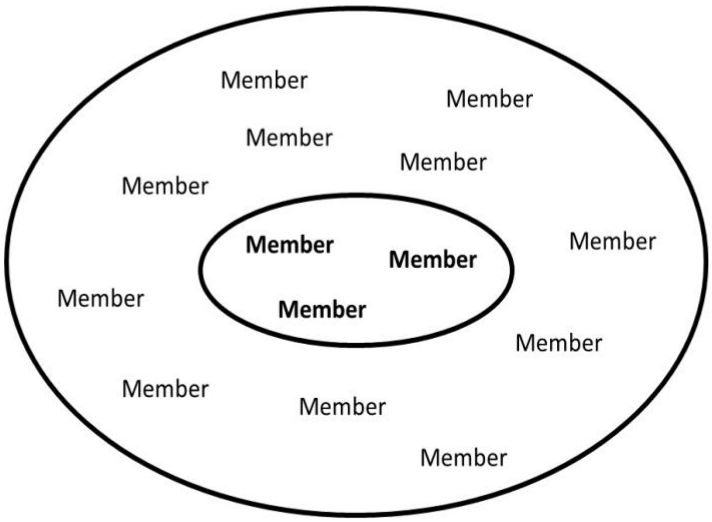

Figure 2. A subgroup of members form a leadership or co-ordinating group

A smaller subgroup that does not have the limitations of the growing complexity of the whole group can quickly and easily make decisions on behalf of the wider group membership. It takes on the infrastructural roles of co-ordinating the survival and wellbeing of the group. The subgroup co-ordinates efforts to ensure adequate flows through the system, that toxic elements are blocked or expelled from the system, and the effective use of the resources available. The co-ordinating subsystem can be fixed and formal or informal as members come and go within this group.

Just as the individual group members have an identity, value, relationships and perspectives, the co-ordinating group also has these attributes. The co-ordinating group must navigate the differences between its own values and desires and those of the system it has been ceded control. The subsystem formulates a vision that explains its purpose to the wider group. This might be done formally as in documents like the American Constitution or the Magna Carta or a shared mythic story explaining and contextualising the group within its environment (Campbell, 2012; MacGill, 1995)

The sense of identity is a CAS in its own right. There is a flow of experiences through the system it must adapt to. Identity must be fixed enough to be stable over time, but also flexible enough to adapt to changes in itself and its environment. It will respond to perceived threats and fight for its survival.

Once the vision is defined, the rules are established that constrain members' behaviours to those acceptable actions that fall within the attractor that has arisen. Since the individual parts still maintain their autonomy, they can behave in ways that support the whole group or chose to rebel and defect from the social contract (Hobbes, 2019). They might act in their own self-interest or in the interest of a subgroup of the whole group they are a part of rather than the whole system. The co-ordinating subgroup therefore needs to reward behaviour that supports the group purpose and punish transgressions.

Becoming a member of the co-ordinating group means taking on responsibility over and above that which they have as an individual. They absorb more than their share of the entropy to be contained. Typically, there is a reward offered to those in the co-ordinating structure, perhaps in the form of money, resources, or sexual privileges. Status is attached to taking on the role. Those on the co-ordinating subgroup are ceded the power to use and control the resources available to the system; a power that can be used or abused. Once in power it can be difficult to keep the co-ordinating group under control. There needs to be checks and balances on the co-ordinators to ensure they have the best interests of the system at heart, or tyranny can take over.

Whenever there are rules, there will be rebels who try to break the rules. They might not be capable of complying with the rules (Kegan, 2009) or feel justified in not conforming to the vision. Their allegiance may be towards a sub-system, another system or themselves. The system establishes enforcers to control the behaviour of rebels. The rebels might be freeloaders (Axelrod *et al.*, 1981; Stewart, 2018), partaking of the benefits but not willing to make the necessary sacrifice for the good of the whole.

Alternatively, they might think the vision has been lost and try to gain power to change the state of the system. There may be several competing rebel groups. What is labelled as a rebel might be just the disruption needed to bring the whole system back into harmony. The enforcers also need to be able to respond to external threats that might cause harmful perturbations and stop toxic elements from forcing or tricking themselves within the system. Very effective systems can have malicious intent making them all the more dangerous, or as Ackoff (2004) put it, "the righter you do the wrong thing, the wronger you become."

The rebels can form into their own subgroup allying themselves against the power of the whole group. The rebels may form a whole alliance of subgroups wishing to subvert the power relationships in the whole system. From the rebel's perspective the system is an external threat.

The co-ordinating group utilises its power through all the means it has available to build the willingness for compliance and discourage defection. Once all other means have been used, the final tool is the use of violence, or coercively forcing compliance. This led Weber (1972) to define a state as, "the human community that successfully claims the monopoly of the legitimate use of physical force with a given territory".

There are times when the co-ordinating group is unable to contain the entropy that the members have not been able to contain. This leads to a new emergent level of hierarchy we might call controllers. Again, this may come about by agreement or by force. There can be many levels of management needed before the entropy is adequately contained. Whereas the members tend to be concerned with the day-to-day events, the higher up the co-ordinating hierarchy we go, the time span considered increases (Brand, 2000; Gunderson and Holling, 2002). Problems should be solved at the appropriate level of co-ordination and the right time span. If problems are taken on at a level that is too low, they do not have the capacity and oversight to make a good decision, but if it is made too high up valuable resources are wasted on trivial decisions for that level. The level of decision making over a given geographical region should be made by the right level of hierarchy that covers that region (Gunderson and Holling, 2002). Federal government should not be deciding factors better suited to state level decision making.

We are now at a point where we can combine our ideas into one diagram showing the functions of a CAS that has developed beyond the basic stage of just having a few members.

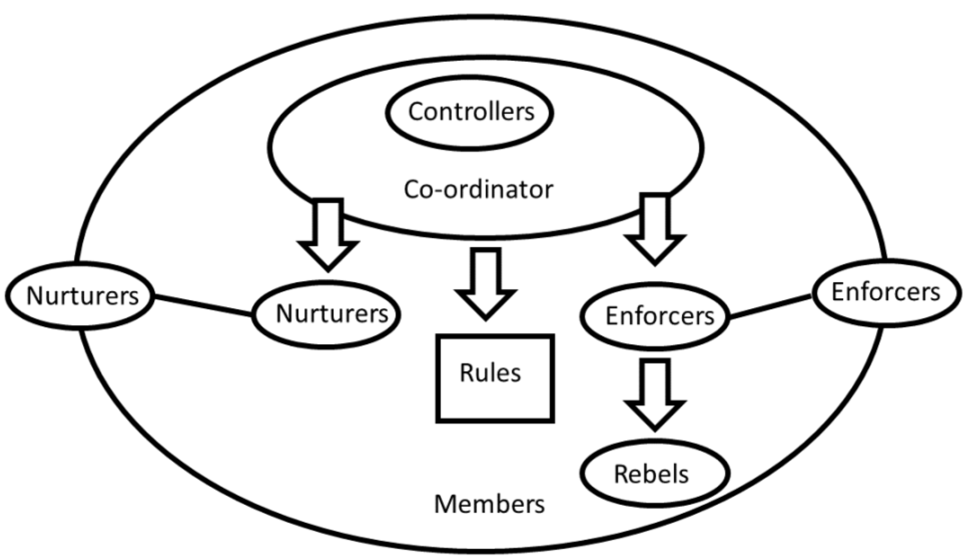

Figure 3. Diagram depicting a mature CAS with and the various subsystems and their relationship.

This system will, of course, come into contact with other systems with which it will be recursively structurally coupled (Maturana, 2002). The system must interact consistently so as to maintain the integrity of the system in line with its goals. Toxic systems not only have detrimental internal impacts, but also cause harm to those they interact with.

There is a need for feedback loops (Bateson, 1987) all through the system to enable the information gained through sensing connecting to the appropriate place where sense

making and decision making can occur. Particularly if the co-ordination subgroup does not have timely, accurate information, the co-ordination of the system will quickly deteriorate. Lag times (Meadows, 2008) typically cause a system to oscillate, which can destabilise it and even overwhelm the system and its ability to cope. Any failures in the feedback loops either unintentionally or intentionally will impact on the effectiveness of the whole system.
Similarities will be noticed between this diagram and the Viable Systems Model (Beer, 1984; Hilder, 2005) where rough comparisons could be made: System 1 would be members, System 2 the nurturers, System 3 the enforcers, System 4 the co-ordinators and system 5 the controllers. The VSM is based on human anatomy and physiology. Within this model the enforcer and nurturer role link to the pain and pleasure pathways in the brain (Sapolsky, 2018).

This model can also be linked to four archetypes identified by Jung (1968) and added to by Gillette and Moore (1990). The King becomes the co-ordinator, the controller becomes the wise person, the nurturer becomes the lover, and the enforcer becomes the warrior. When these fall out of balance, the dragon is woken from its lair (MacGill, 1995)

We have now moved on from the initial part of the growth phase. Group members become more familiar with each other and the wider environment links are built forming networks. Members build relationship and become increasingly effective. As the system deepens within the growth phase, productivity and complexity rise dramatically but as choices are made by the system as to how to proceed, possibilities not chosen fall away, so the system loses resilience. The system becomes increasingly fixed and less flexible to adapt as needed.

No system can continue in the growth phase indefinitely. As Boulding (1968) succinctly put it, “Anyone who thinks exponential growth can go on forever is a madman or an economist”. Sooner or later there will be limiting factors constraining the growth. This leads us into the conservation phase of the adaptive cycle. We have already identified several places within the system that could constrain growth.

If the system grows too quickly and the necessary infrastructure has not been established the system cannot contain the entropy. If the flows of information, matter and energy are somehow impaired, the system will lose effectiveness. There could be poor boundary monitoring and control leaving the system vulnerable to external forces. Errors in formulation of the goals and purpose of the group or too much rebellion diverting valuable resources reduce the system’s effectiveness. There could be overenforcement or underenforcement of rebels and over nurturing or under nurturing of members. The co-ordinating and formulating controlling group can wield their power against members.

Since most situations that human try to resolve are wicked problems (Churchman, 1967), systems archetypes (Senge, 2006) reveal some of the difficulties that may be encountered, such as, one system improves at the expense of another, tragedy of the commons, shifting the burden, and drifting goals. All of these can occur even when those involved have all the best intentions, but they are usually much more destructive when damage is deliberate.

Tainter (2007) warns of the human tendency to pick the low hanging fruit. When a resource becomes available, we naturally choose the easiest resources to gather. We pick the easily reachable fruit first, explore the easiest oil deposits, seek out the obvious customers so that over time extracting the resource becomes increasingly costly and difficult. Tall ladders precariously perched against the tree are required to get the top fruit and fracking and other destructive and expensive ways of obtaining oil are used later.

There is a point at the top of the conservation phase called the rigidity trap where the system can be forced by manipulation into a limbo state where instead of moving into the following release phase, the system is trapped. A business could hold a monopoly. Having no alternative, customers must endure unfair treatment. A government can use military force to hold onto power when it would otherwise lose power. When the rigidity trap is finally broken, the descent into the release phase is that much quicker and dramatic.

The advantages of increasing requisite variety are now overshadowed by the conflict arising out of the variety. Continuing as before no longer becomes an option and the system moves into the release phase. This is often a difficult and painful process where much is lost, but if we are willing and able to accept change and adapt, it can even be a positive time.

At the end of the release phase, we are left picking up the pieces. Productivity and complexity are low, but it is a time when small choices can have enormous impacts (Lorenz, 1963) through the next cycle. The errors of one generation, the entropy they cannot contain, is bequeathed to their descendants.

THE EVOLUTION OF COMPLEX ADAPTIVE SYSTEMS

The body is the foundation of all living systems. Everything a living system does to survive and thrive is achieved through changing the state of the body. Single celled creatures like a paramecium embody all the systems principles and concepts described above. The paramecium has a nucleus that co-ordinates its living processes. It has a sense of identity, an ability to seek reward and avoid punishment by automatic responses to the presence of glucose or toxic acids. It maintains its boundaries and effectively senses, makes sense and responds. More complex biological creatures are multicellular with more specialised parts and even the beginnings or neural networks. A reptile (MacLean, 1990) organises its behaviour unconsciously through instinctually based habit patterns such as the fight/flight response. The sense of identity at this level is attached to the body.

When a reptilian response became inadequate to meet the entropic challenges of the world they lived in, some animals formed a higher level, emergent co-ordinating limbic system that was capable of emotion, significantly expanding its repertoire of possible responses to the environment. The layers of the brain operate a bit like a person building a small cottage (reptile brain) for the family that over time proved insufficient to meet all their needs, so an add-on was built that was more complex and nuanced to cope with a wider range of environmental variety, but people still had to enter through the one cottage door. Some modification of the cottage was possible, but the design of the cottage put constraints on the additions that could be added.

When the emotional brain proved to be insufficient to survive in a world full of increasingly complex creatures, the excess entropy drove the emergence of the cerebral cortex with an ability for rational thought and much more complex social interactions.

Now there was yet another addition on top of the addition of the original cottage. The building now did not look much like the original cottage, but still there was only one entrance through the cottage. Wilber (2000) writes of transcending and including, so all earlier levels are still vital to continued functioning. The first decision any living system must make in any situation is "Is this life threatening?" and if so, must act immediately.

We now have three nested layers, each CAS in their own right with its own perspective, level of capability, and time scale. The reptilian brain is designed to cope in the immediate moment, the emotions a slightly expanded time scale and thinking can stretch out over extremely long periods of time if the situation allows.

For simplicity we can look at *fast* and *slow*. Kahneman (2013) writes of an automatics unconscious system for coping with simple, predictable, and non-critical events as System 1 and a slower conscious and deliberate process for complex, unpredictable or critical events as System 2. The two are in tension. If the creature's life is truly under threat, it does not have time to slowly think the situation through with System 2, so System 1 activates pre-emptively, often when there proves to be no threat. We often respond with an immediate fight/flight response, when a more considered rational response would be more effective.

As stated, the sense of identity for a reptile is its body. For a human being identity is body, reputation, status, beliefs, possessions, name, and more. A threat to name and reputation can feel as menacing to a human as the sight of a predator to an animal in the wild and triggers the same neural pathways. A human response that would be perfectly appropriate in a jungle context would be highly inappropriate in downtown Manhattan. System 1 sees system 2 as an external threat, while system 2 sees systems 1 as a rebel.

At the social level, rules and agreements become central as the foundation of culture. Shared values and beliefs are embedded from birth and enable much deeper co-operation. Identity becomes much socially constructed (Emirbayer and Johnson, 2008) and more about one's place in society. Status and reputation become critical to participation in social activities and access to power. Enforcement of rules and laws against rebels happen in new ways.

Throughout history different organisational regimes have been used. Early human communities were like the simple CAS in a support group. A small group of related humans who all knew each other well could live together and cope with the complexity about them. Especially as language became available the ability to communicate (Maturana and Varela, 1998) and form feedback loops to monitor all the critical aspects of life, they became increasingly complex and competitive in their environment. But over time, complexity grew until choosing a chief became the more effective means of co-ordinating tribal affairs. The chief would often have a council of elders supporting and nurturers promoting wellbeing. Enforcement typically became formalised especially since warriors were needed for defence against external threats.

The shared narrative became enshrined in mythic stories (Campbell, 2012). They would be appropriate for the geography, technology, social structure, and politics. Hunter gatherers have hunter gatherer mythologies and warrior societies have warrior myths.

The gods as interpreted by a shaman would be the final arbiters of truth (Bjorkman, 2019) in tribal societies. Modes of art and clothing helped identify roles and differentiate tribal members from others. Languages developed dialects and unique vocabularies further differentiating members from other groups. They typically had strong internal bonds and a strong distrust of strangers or anyone different.

Anyone rebelling against the tribe would be swiftly sanctioned. The threat of exile was immensely powerful as a lone individual was very vulnerable and often would not survive. Often rebel groups would split off to form new tribes. Indigenous stories abound with arguments between two brothers who parted ways (Kawaharada, 1999; Salmond, 2005).

As the number of tribes increased, tribes formed alliances by agreement or conquest, ruled by an emperor, king or queen. Warriors from all the tribes could be amalgamated into an army that would be difficult to resist. Written laws, taxes, mathematics were typically necessary to co-ordinate a stable imperial rule.

As ever, the temptation of the co-ordinators or controllers to act in their own interests rather than the whole system led to despotic rule in many empires. Resources are blocked or diverted to the controllers. Enforcers use violence to maintain control and force compliance (Eisler, 1988). In line with Weber's definition of the sovereign, the rule of emperors was often very cruel.

Empires formed by amalgamating diverse tribal groups needed a unified narrative to build coherence and legitimacy. It is no co-incidence that the unifying belief systems of Islam, Christianity, Judaism, Buddhism, and other beliefs all arose within a relatively short period of time known as the axial age (Armstrong, 1993) as empires grew in power. Stacey (2011) writes of a dominant narrative and a recessive narrative that often arises in response to the officially sanctioned narrative that can be a clarion call for a rebel cause.

As populations and technology in particular increased, the competitive pressures that led to rebellions and revolutions through the western world and the formation of democratic nation states. This changed who had power and how members might move into the co-ordinator or controller subgroups (Harari, 2016).

It is interesting to compare the USA and the USSR in terms of the autonomy/connectivity tension. The USSR was highly centralised formulating one set of rules for the whole system and when the entropy rose that centralised control was unable to cope and the union was broken into 15 nation states. USA had strongly autonomous states that could make regional decisions and a federal government only deciding on national issues, making it much more adaptable when the international environment changed. If states become too powerful, national unity is threatened.

Today there is a keen understanding of the importance of the narrative to shape the perceptions and sense of meaning as a tool to gain control (Lent, 2017). Postmodernism showed no narrative was absolutely true, but was only a convenient construct that only works as long as people are willing to pledge allegiance to it (Danaher *et al.*, 2000). Humans cannot live without a narrative to guide sense making and decision making, however, today we are left bereft of a narrative to bind us, since it is deconstructed (Derrida, 1997) as soon as it is formed.

There is great power in being able to control the narrative (Burawoy, n.d.; Foucault, 1977; Hoare and Smith, 1992). This has led to a battle for social control through controlling narratives. Three significant groups active today are right wing Trump supporters, conspiracy theorists and identity politics followers. Digital media in many ways has replaced guns and swords in the ever-shifting power dynamics of groups seeking the power to co-ordinate and control society (Vesa *et al.*, 2020).

SUMMARY

Having concepts that combine both structural and process approaches enable a dynamic view of CAS and gives insight into the forces, constraints and influences that drive them through the patterns that arise. The systems diagrams described above are applicable at the biological, psychological, and social levels and help us make sense of many of the dynamics we struggle with as human beings. The model shows the tension within any holon (Koestler, 1990) as to which of the systems and subsystems it is a part of will be given priority in terms of the action chosen and how that generates conflict in and between systems. As human beings have become increasingly complex, the ways the underlying dynamics unfolded have changed. In earlier human history physical force was the main determinant of power and control but now the controlling narrative is more influential. The underlying dynamics of humans are changing in their manifestations, but at least as apparent as they have always been.

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