Generic Agency Theory, Cybernetic Orders and New Paradigms

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Abstract

Purpose: Anticipating behaviour and responding to the needs of complexity and the problematic issues that they generate occurs through modelling processes. This paper discusses generic modelling for living systems theory, and shows how higher cybernetic orders model can be generated through generic constructs under complexity.

Design: The paper develops a general theory for the generation of cybernetic orders. It uses a cultural agency generic model to anchor the notion of fourth cybernetics.

Findings: Cultural agency theory can be used to generate higher orders of cybernetics through principles of recursion, and hence to create a potential for the generation of families of new paradigms.

Research limitations/implications: Essential philosophical attributes of generic modelling have not been discussed in any depth.

Practical implications: The cultural agency can be used to structure problem issues that may otherwise be problematic, within both a top-down and bottom up approach.

What is original/ what is the value of the paper? A theory of generic modelling is offered that corresponds to cybernetic order, and from which improved anticipation is possible.

Keywords: Anticipating behaviour, complexity, generic modelling, cybernetic orders, paradigm, cultural agency theory, recursive models.

Introduction

Social systems are living systems (Beer, 1980), and have pathologies that affect their viability and capacity to anticipate their future behaviour. Anticipation is important since it enables a system to adapt to future conditions (Collier, 2006). Pathologies have been responsible for the development of the 2007/8 western economic crisis which shook western socio-economic viability, where analysis has revealed "conflicts of interest in regulatory bodies, inadequate control processes (e.g., the failure of regulators, the credit rating agencies, and the market itself), no control of financial excesses, and ultimately the use of the wrong models to guide control processes (Levin & Coburn, 2011). This especially includes a lack of understanding of the complex dynamics of microscopic processes from which macroscopic processes arise…" (Yolles & Fink, 2013: 4). So, anticipating the future is pathology dependent.

Anticipation requires a *good model* of an object of attention and its situation. A good model is one that generates a *satisfactory* way of viewing a situation by being able to respond to the variety that might occur in it through the generation of its own (requisite) variety (Ashby,

1968). It should also have three pragmatic goals (Weinberg, 1975:140): *completeness* (broad enough to encompass all phenomena of interest in order to reduce surprise); *minimalness* (to integrate the states of situations that are unnecessarily discriminated in order to make inquiry easier; *independence* (decomposing a set of *inquiries* into non-interacting qualities in order to reduce metal effort. Another attribute of *minimal* is the amount of work that is needed to adequately validate a model's propositions. Anticipation is structure determined (Schwarz, 2001; Yolles & Dubois, 2001), so a *complete* model should also have a strong structure that allows quality anticipation under complexity. So how is such a structure created?

Rosen (1985) adopted the term *anticipatory* [living] *system* to indicate that an anticipatory model enables what we shall call *dynamic projections for potential behaviour*, the model being structured according to the particular insights of its modeller. For Dubois (2000) this constitutes model-based *weak anticipation*, rather than system-based *strong anticipation*. The two can be distinguish as follows: (1) model-based approaches adopt *particular* (arbitrary) structures and conceptual constructs, (b) system-based approaches adopt generic (non-arbitrary strong) structures with *generic* conceptual constructs which arise from *axioms* that are culturally *undeniable*, and result in generic models.

So, generic models are also anticipatory with conceptual constructs which, when socially supported, are reflected as paradigms (Kuhn, 1970; Yolles, 1999) which Morgan (1980) notes have three attributes: (1) *constructs* (giving a complete view of reality or way of seeing); (2) *social organisation* (creating new schools of thought), (3) *concrete use of tools and texts* (for the process of scientific puzzle solving. Without (2) there is no paradigm, and new paradigms arise then at least (1) and (2), or (2) and (3), are satisfied.

Using a modelling process that originates with *Knowledge Cybernetics* (Yolles, 2006) developed from a dynamic complex systems platform of Schwarz (1994), we shall: consider the nature of generic structuring and its implied strong anticipation; use it to define cybernetic order - where higher orders are proportional to greater modelling complexity; and illustrate generic structuring for fourth (*order*) cybernetics – where we use the convention of dropping the word *order*. We shall also propose a *general theory of potential paradigmatic evolution* through increasing cybernetic orders. This adopts principles of cultural agency theory (Yolles, 2006; Yolles & Fink, 2011), where agency has the properties of purpose, teleology (autonomy, coherence, and identity), self-organisation, adaptation, and viability through *efficacy* – a task specific potency of general effectiveness occurring across multiple tasks occurring as part of a complex network of processes.

Generic Modelling

An embryonic modelling theory that can be associated with generic modelling is cybernetic order. Examples are first and second cybernetics (Glanville, 2004), and third cybernetics (Taschdjian, 1978; Boxer & Kenny, 1990; Boxer & Cohen, 2000; Pocock, 1999; Yolles & Dubois, 2001).

Higher cybernetic order facilitates simpler modelling under increasing complexity. Thus, while the models become more complex with increasing order, they are simpler relative to increasing complexity. Each higher order has a potential to create a family of paradigms through new ways of seeing.

There are various ways of marking the distinction between the orders of cybernetics. First cybernetics is positivist; second cybernetics is relativist; and third cybernetics is constructivist (Yolles, 2006). If this philosophical transitional process continues, then fourth cybernetics constitutes a perspective that perhaps lies "beyond constructivism" (Osborne, 1996; Aviram, 2000), leaving the philosophical nature of fifth and higher cybernetic orders unexplained. To resolve the unknowns, another approach is needed. We adopt invariant generic constructs: these are conceptual devices that determine *ways-of-seeing*, and have complementary variant generic construct that are epistemic state systems.

Invariant generic constructs are ontic dynamic networks of processes that manifest "orders" of agency attributes across related state systems that occupy some part of a defined supersystem. The networks are invariant in their epistemic (processing) nature, but the *order* that they take refers to rank in a hierarchy the meaning of which can change with context. The construct may be explained as a semantic manifold that acts as a channel between at least two ontologically coupled state systems (in a supersystem), each independent. While the invariant generic construct manifests epistemic content dynamically between the systemic domains, its nature is not subject to epistemic variation. Examples are autopoiesis (Maturana & Varela, 1979; Mingers, 1995) and autogenesis (Csányi & Kampis, 1985), which are constructs that can each respectively be seen as a network of first and second order processes that manifest meaning trans-ontologically. While contextual frames of reference may change for invariant generic constructs, the nature of their relative manifesting functions do not.

Variant generic constructs are an interconnected ontological assembly of state systems in which meaning can vary as its epistemic properties change with context, thus making them semantically susceptible to recursive processes. In other words, variant generic constructs have the capacity to change because they are state systems with context sensitive epistemic content.

We can now offer a proposition: the relationship between cybernetic order and generic constructs for a given supersystem's invariant constructs define the order of the cybernetic model, while the variant generic construct acts as the invariant construct complement. One could not exist meaningfully without the other. There are always the same numbers of invariant generic constructs (including a "collective" feedback) as there are variant generic constructs.

We have referred to recursion, but what is this? Recursion constitutes a procedure that can repeat itself indefinitely. It has been defined by Yolles (1999) as the application of a whole concept or set of actions that occur at one systemic level of consideration to a lower logical systemic level of systemic consideration. It may also be argued in the following way. If *action* as a functional operator is applied to some *object/subject* at one focus in a system hierarchy, then applying the same action to an object/subject at a lower focus constitutes recursion. However, any epistemic content that is part of those actions likely changes with context during the transformation from one focus to the other. So, recursion is facilitated through the capacity of variant context-sensitive generic constructs to change (Yolles, 2006).

It is useful to distinguish between different cybernetic orders. A philosophical explanation of ***first cybernetics*** may occur in terms of Newtonian mechanical objectivity, and so is positivist through the way systemic objects are "observed." The relationship between a set of interactive systemic objects is explored through purpose, teleology, control and feedback. Feedback is related to recursive processes where the present state of a system is a function of

its preceding states so that the future is always a result of the past, and leads to a system outcome that has an implied causality. Feedback implies that interactive feed-forward has occurred. While a system can have internal pathologies, many of its problems can be expressed through *generic pathologies*. These can occur in a feedback system (shown symbolically in Figure 1 – noting that not all objects may be interconnected) by the bars that cut across system interaction and feedback loops. These bars indicate that the processes of interaction/feedback may not be efficacious, or that the nature of the interactions may be inconsistent with interactive or control needs (if there are any) of the systemic objects involved in the interaction. It may also indicate poor communications, or inappropriate/ inadequate action in the interactive processes. While Rosen (1985) was interested in feedback in general terms (Louie, 2010), a concrete example of such a modelling approach is *System Dynamics* (Forrester, 1971) which, related to Checkland's (1981) *Rich Pictures*, explores the interconnected network of objects through their feedback and mutual influences offering vectored linkages with estimable intensities. Here then, in first cybernetics, there is one invariant generic construct: feedback. All other aspects of the modelling process are a consequence of particular propositions.

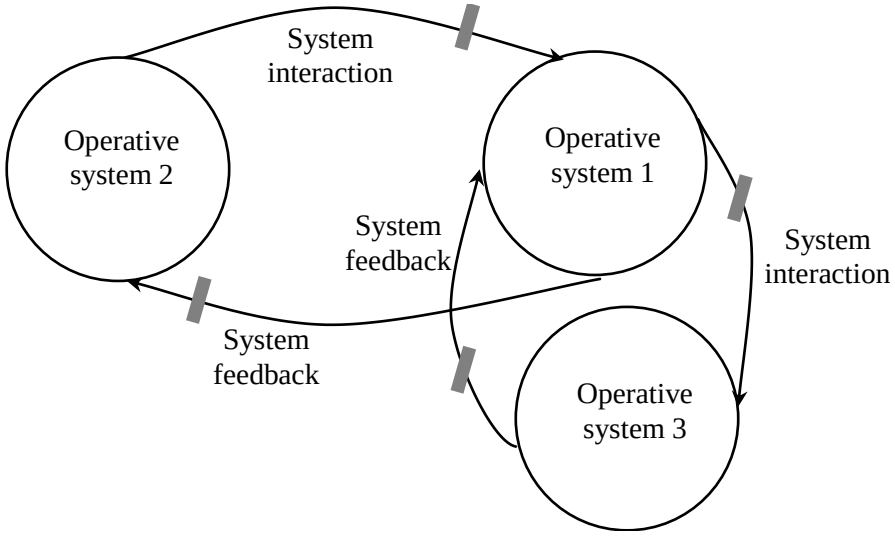


Figure 1: Illustration of first cybernetic model with invariant generic construct of feedback, showing interaction and feedback between three operative systems, with generic pathologies.

Second cybernetics is a significant advance on first cybernetics, and offers probably the simplest "living system" model. From a philosophical perspective it is relativistic, post-positivist, and traditionally deals with "observing systems" and their subjectivity. It relates to work developed by Maturana and Varela (1979) on autopoiesis. Contrary to Newtonian mechanics, data cannot be obtained objectively and its collection in uncertain environments is dependent on experimentation. However, experimentation is ultimately worldview dependent and this not only impacts on the measuring process itself (Yolles & Frieden, 2005), but more obviously on the transformation of data into information.

Taking a broader explanation than that offered for a social context, second cybernetics may be defined through its invariant generic constructs: autopoiesis and feedback that relate to an agency though its operative systems. Beer (1979, 1980) has discussed a pair of ontological constructs which are effectively the operational system and the controlling metasystem. These have a closed logical relationship between them (Beer, 1979: 260) that *facilitates* though does *not* constitute self-referentiality. In particular the system and metasystem have a autopoietic/self-producing relationship. Beer's modelling process enables the operative

system to be used recursively, and at each recursion a *local* metasystem may be identified. In other words, the model is recursive, and both the metasystem and operative system may therefore be seen to constitute variant generic constructs as they change their meaning with every recursive application. All other aspects of the modelling process are particular. A symbolic illustration of a second cybernetic generic model is shown in Figure 2 (not a representation used by Beer). We refer to this as an *autopoietic coupling*. It involves two invariant generic constructs: autopoiesis and feedback. It is also capable of drawing in first order cybernetic models, as illustrated by Schwaninger & Pérez Ríos (2008) who connect *System Dynamics* to Beer's (1979) second cybernetic *Viable System Model*.

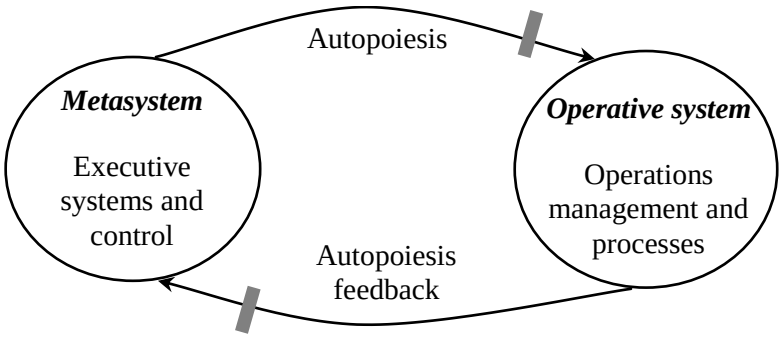


Figure 2: Symbolic illustration of a second cybernetic model illustrating an *autopoietic coupling* between a system and metasystem, with generic (autopoietic) pathologies

In Figure 2 the relationship between the operational system and its metasystem is such that cognitive and behavioural attributes are linked through a process of logical organising, and we have already noted that the connection between the system and metasystem is logically closed. An autopoietic system defines its own boundaries relative to its environment, develops its own code of operations, implements its own programmes, reproduces its own elements in a closed circuit, lives according to its own its own dominant paradigms, and its operations cannot be controlled from outside its boundaries. Schwarz (1994) notes that autopoiesis is essential to the viability of a system since it enables it to "digest" any unexpected fluctuation. It does this through what he calls entropic drift to regenerate the system's structure, and through autopoiesis by modifying structures and fluxes (form and behaviour), and by changing the causal networks that derive from their paradigms and methods for achieving goals.

Generic pathologies can occur in a second order cybernetic generic agency model as shown by the bar across the two invariant generic constructs of autopoiesis and feedback. In discussing autopoiesis, Beer (1979: 408-412) suggests that pathologies might occur when the metasystem of the agency attempts to control, not just to satisfy agency purposes, but rather for the sake of control itself. Organisations having conditions like this are said by Beer to have pathological autopoiesis. This type of pathology may be reflected in Figure 2, the bar meaning that autopoiesis may not be efficacious through some network break or physical/cognitive impairment, damaging the agency's potential for viability and autonomy.

Constructivist ***third cybernetics*** comes traditionally from the notion that the observed system and the observing systems together form another system from which a new relativistic interactive worldview arises from self-observing viewers that have self-observed worldviews. The concepts of self-observing and self-observed, however, are likely only to be meaningful within social contexts, outside of which a generic explanation may be more useful. From a

cybernetic perspective it embraces self-referentiality (Boxer & Kenny, 1990), and we have already indicated that second cybernetics could *facilitate* this. Establishing a third cybernetics generic agency model narrows the need to explore the interaction between model based processes and the human activity systems they represent. A generic explanation is that third cybernetics embraces an extension of Schwarz's (2001) work, seeing autopoiesis as a first order invariant generic construct, supported by a higher order network of processes called autogenesis. Autogenesis influences the autopoietic coupling in the agency model shown in Figure 3 that links the figurative and operative systems. It is responsible for manifesting identification information to the strategic figurative system and to the operative system such that it can be understood. In addition elaborating information is manifested through autopoiesis to the operative system. The figurative and operative systems together form an autopoietic coupling that generates feedback for the referent cognitive system. Feedback "collectively" constitutes the third invariant generic construct.

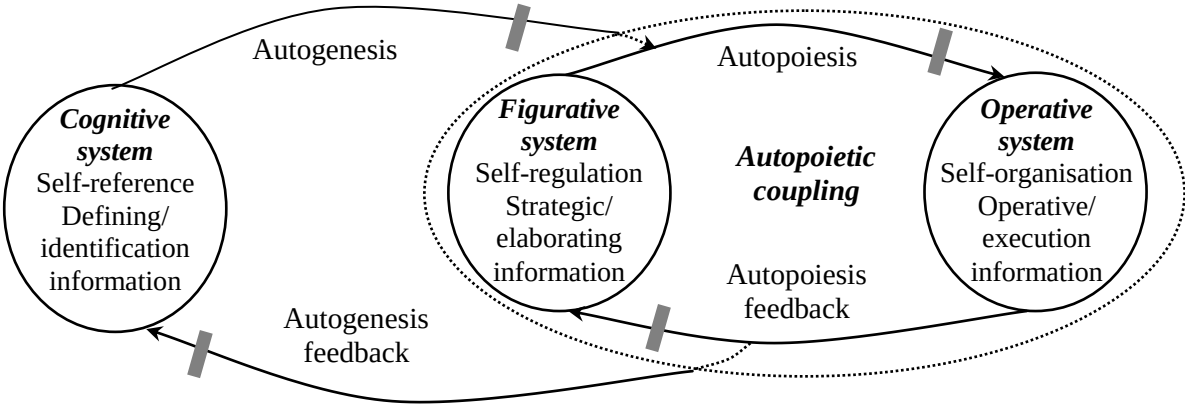


Figure 3: Third order cybernetic agency model with two invariant generic constructs, with generic pathologies

The variant generic constructs have a capacity for context sensitivity that enables third cybernetic models to be recursive as are second cybernetic models (if differently specified). Beyond the generic constructs, all other modelling aspects are particular, but they necessarily occur within the generic frame of reference (which limits arbitrariness), and hence reduces the potential for differences between the modelling process and the system being modelled. Figure 3 is an illustration of a third cybernetic model, with two invariant generic constructs (autopoiesis and autogenesis) each with its indicative feedback.

In this model there is an autopoietic coupling (between the figurative and operative systems) and an autogenetic coupling (between the cognitive system and the autopoietic coupling), the latter constituting self-production of the rules of production for the autopoietic coupling through its connection to the cognitive system. Autogenesis is thus a second order form of autopoiesis which *defines* the state of full autonomy for the autopoietic coupling, and like autopoiesis it is logically closed. Autogenesis is a *channel* operating as a network of second order processes, manifesting *defining information* into the autopoietic coupling and sedimenting information that facilitates the development of strategic structures like goals, ideologies and ethics in the figurative system.

The model in Figure 3 shows the cognitive, figurative and operative systems: these are variant generic constructs, each with epistemic natures that can change with modelling context. The generic pathologies indicated by the autopoiesis/autogenesis bars refer to

inefficacious, inadequate, inappropriate or damaged networks of first/second order processes that impact on the capacity of the agency to manifest cognitive information strategically or operatively. Third cybernetic models can embrace second cybernetic models, as shown for instance by Yolles & Fink (2011).

There have been few attempts to explore ***fourth*** cybernetics. Bozicnik & Mulej (2011) define it in terms related to *holistic-referentiality* that connects with their *Universal Dialectical Systems Theory*, and where post-constructive (Aviram, 2000) *holisticism* extends third cybernetics self-referentiality. There are others who make propositions about fourth cybernetics in terms that are directly related to earlier orders, but until now these appear to raise more questions than answers (Judge, 2007).

So Judge has posed an implicit challenge of interest: to find relationships between different orders of cybernetics: thus a theory of cybernetic order emergence. Generic constructs offer this: consider an (n+1) cybernetic order agency model (Figure 4) which connects a referent system with an (n+1) order autopoietic coupling (implying an autopoietic hierarchy) that has a recursive structure composed of nth order autopoietic coupling, where n = 1, 2, 3, 4, 5,… The nature of the referent systems is determined by context, where lower order couplings have been recursively generated. Its origin (n=1) is a system with a definable semantic nature. The (n+1) referent system may be seen as an n^{th} order metasystem for the n^{th} order autopoietic coupling (a recursively defined operative super/system), this simplifying a complex modelling process.

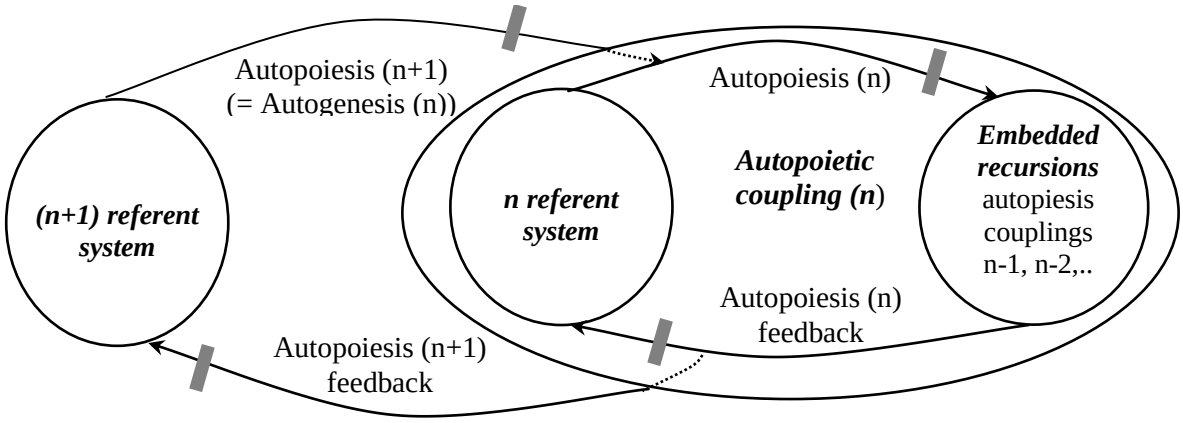


Figure 4: Recursive agency model for the generation of (n+1) higher order cybernetic models in an implied autopoietic hierarchy

This model can be made more specific by taking n=3 so illustrating a fourth cybernetic social agency model, as shown in Figure 5. Here, we could take the ((n+1)=4) referent system as a "defining system" that has a third order invariant generic construct linked to its lower order coupling. This constitutes a fourth order supersystem with operational attributes and just as second cybernetic embraces first cybernetic models, so this embraces third and second cybernetic models.

Figure 5 distinguishes between the cognitive system and the defining system by suggesting that it is through the defining system that the agency develops its attribute of *self-identity* (Turner, 1976; Hogg, Terry & White, 1995; Grandey, Fisk & Steiner, 2005). It is also here where defining information originates. The connecting channel between the defining system and the rest of the supersystem occurs through the invariant generic construct we call

autogenetesis: coming from *genetic* meaning "relating to or determined by the origin, development, or causal antecedents of something." So *autogenetesis* refers to a self-defining network of third order agency processes.

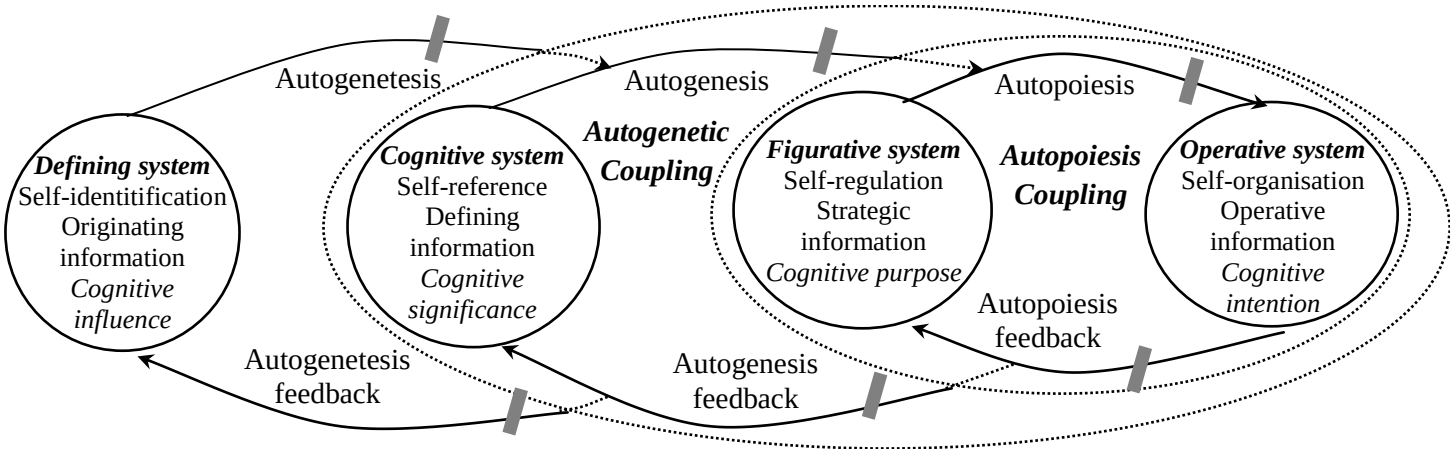


Figure 5: Illustration of a fourth cybernetic agency model, introducing a new invariant generic construct we have called autogenetesis/self-defining; each coupling is marked by a dotted line.

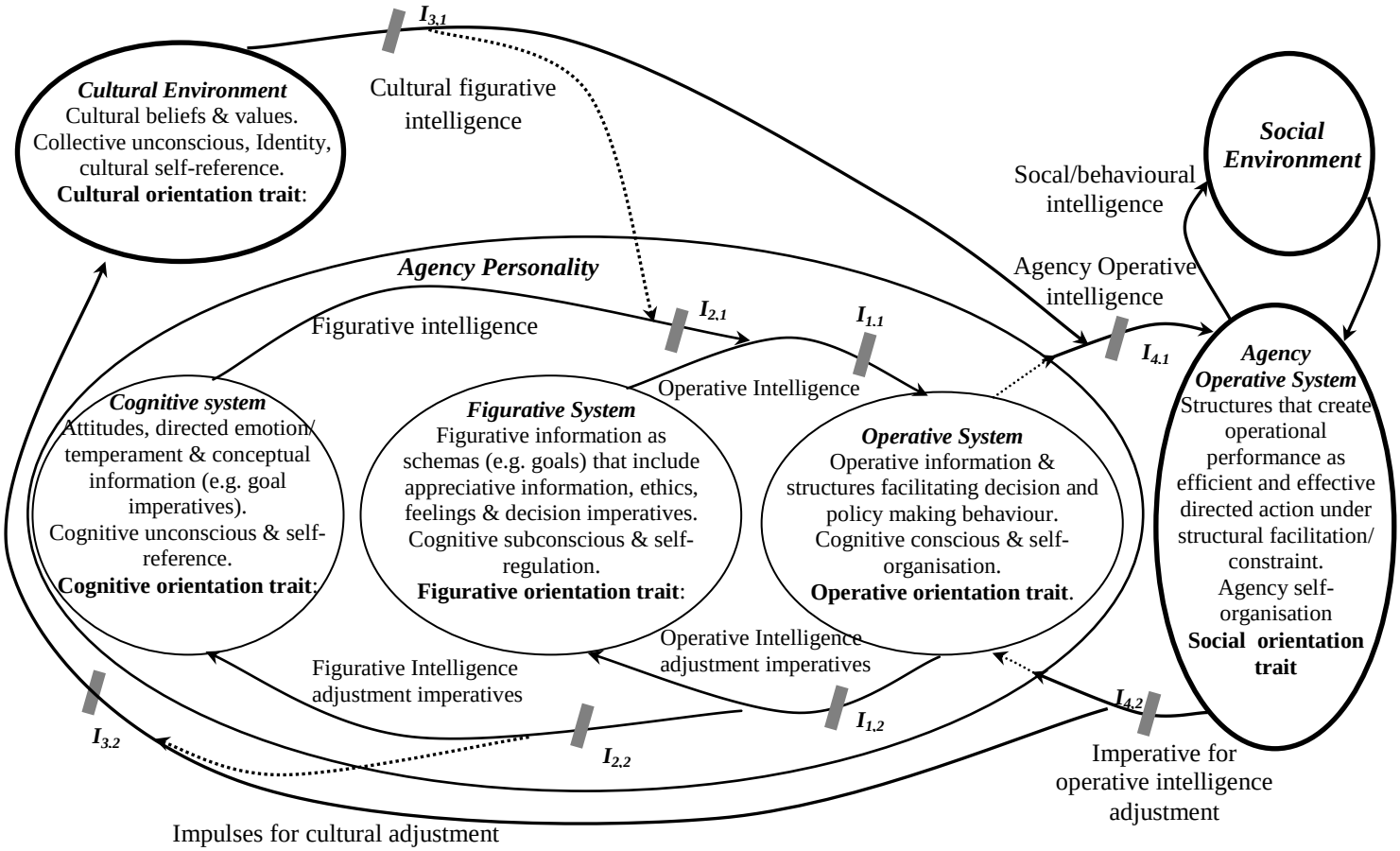
Other well-known system "self" attributes beyond identity shown in Figure 5 include self-reference, self-regulation and self-organisation, as well as cognitive attributes of influence, significance, purpose and intention. While these are functional relative to the defining (referent) system, the epistemic natures of the variant generic constructs in Figure 5 are understood from context. The manifestation of information between these occurs through the orders of invariant generic construct in a way that is generic pathology dependent. Originating information is directly manifested to the cognitive system and the autopoietic coupling, but coded information may also be taken indirectly through the autogenetic coupling to the autopoietic coupling. Figure 5 also constitutes an autogenetesic coupling.

For Cohen & Stewart (1995) simplicity can emerge from complexity. Since each order of autopoiesis has the potential for the generation of a new family of paradigms that are capable of simplifying complexity through new higher order generic constructs, so this too constitutes a process of emergence. The consequence of Figure 4 is that such emergence can occur through recursion.

Agency Theory and Higher Cybernetic Orders

Using the third cybernetic agency model (Figure 3) recursively (Yolles & Fink, 2011), we can model the cognitive agency by increasing cybernetic order and highlighting a potential family of paradigms through invariant generic constructs. We illustrate this modelling outcome in Figure 6. Here, the origin of the figure is the *personality operative system*, which is an important modelling fulcrum for the dynamic invariant generic constructs. The figure involves four types of these constructs as shown in Figure 5 using Piaget's (1950) [implicitly third cybernetic!] intelligences. While the use of these intelligences as invariant generic constructs is relatively new (Yolles, 2007; Yolles, 2009b), adopting *cultural figurative intelligence* as a third order construct is *quite* new (Yolles, Fink & Dauber, 2011) and represents autogenetesis. This agency model also includes variant generic constructs of cultural, personality and agency operative systems, the personality being a recursion of

Figure 3.



Note: intelligences *Ii,j*, order *i=1,4* have feedforward/feedback *j=1,2&* pathologies through *intelligence limitation* and impeded *efficacy*

Figure 6: A Generic Agency Model Involving a "Personality," the implied Dotted Arrows Creating a Higher "Cognitive" Cybernetic Order.

So can one relate Figure 5 and 6? Yes, through three steps. ***Firstly*** one needs to realise that the personality operative system is a natural fulcrum, allowing us to distinguish between the left and right hand sides of Figure 6. ***Secondly*** we extrapolate agency operative intelligence to the operative system of the agency personality (dotted $\boldsymbol{I_4}$ arrows – both feed-forward $\boldsymbol{I_{41}}$ and feedback $\boldsymbol{I_{42}}$). This is because the conscious operative system directs the structural processes of the agency, so distinguishing the agency operative system from the rest of agency. ***Thirdly***, the *personality* operative system can take on the second cybernetic role of the agency metasystem - connected with the agency operative system. This shows how reducing the cybernetic order of the model (by assigning the cognitive structures of personality and culture to a horizon of influences) limits generic explanations for operative processes in the personality and hence agency anticipation.

In the cultural system symbolic epistemic material (knowledge) is manifested (as types of information) to the personality and to the *agency* operative system (as behavioural norms). Dotted arrows occur between $\boldsymbol{I_3}$ and $\boldsymbol{I_2}$ showing that symbolic epistemic material may be directed to the operative system (and back as un/supportive imperatives) using this manifestation route. This enables $\boldsymbol{I_3}$ to be seen as a third order invariant construct of the personality permitting it to emerge as a cognitive (culture and personality) fourth cybernetic

model. Incidentally this construction appears to link with Lucas's (2002) exploration of levels of consciousness associated with cognition.

The $\boldsymbol{I_3}$ constructs are called cultural figurative intelligence, an agency capacity to represent cultural values/beliefs as a coalescence of normative ideological, ethical and behaviour standards that ultimately indicate social legitimacy. Efficaciousness improves system viability while inefficaciousness impedes it. So efficacious cultural figurative intelligence can moderate the potential for conflict and hence increase system viability under a plurality of competing cultural factions.

The generic constructs of autopoiesis, autogenesis and autogenetesis constitute a basis for a family of paradigm shifts since each offer new ways-of-seeing. However, is there any supportive evidence that this has happened? There is a significant support in the literature for autopoiesis creating a paradigm shift (e.g., Li, Clark & Winchester, 2010), but no clear view that autogenesis constitutes a paradigm shift (Schwalbe & Schwalbe, 1991), probably because of the lack of agreement concerning its nature (Paecht-Horowitz, M., 1973; Csányi & Kampis, 1985; Drazin & Sandelands, 1992). However, Piaget's operative/figurative intelligences (functionally equivalent to autopoiesis/autogenesis) have constituted a paradigm shift (DeVries, 1991).

This brings us to *autogenetesis*, an unsupported newly proposed term. Through recursive modelling and the use of Piaget's (1950) intelligences, autogenetesis takes the contextually sensitive name *cultural figurative intelligence*. So has this third order invariant generic construct the potential to generate a family of paradigms creating greater simplicity in complexity? A reduced form of this is called *cultural intelligence* (Earley and Ang, 2003: 3; Thamas & Inkson, 2009). For Ang, Van Dyne & Tan (2011) it is an ability to adapt to change while at the same time being an ability to function efficiently under cultural diversity. If *cultural intelligence* is a basis of a new family of paradigms, then so is the broader cultural figurative intelligence.

Cultural intelligence was introduced by Earley and Ang (2003) and conceived during a period of unprecedented globalisation and interconnectedness (Held, *et al*., 1999) that Ionescu (1975) indicates represents a *centrifugal society*. However, the attendant increase in intercultural interactions enhances the probability of cultural misunderstandings, tensions, and conflicts (Ang, Van Dyne, & Tan, 2011). The concept of cultural intelligence can now provide compressed explanations for resolving such situations, thus creating a simpler view of complexity and *contributing to* the rise of new paradigms (Seed & Tomasello, 2010; Chen, Liu & Portnoy, 2012). For Blum (2009) the multiple cultural perspectives highlighted by cultural intelligence *do* constitute a paradigm shift. Support for this construct as the basis of new paradigms may take time to materialise *social organisation* development, and may currently be a "virtual paradigm" (Yolles, 1999) on the way to become a paradigm.

We can now explore Figure 6 in broader terms. The modelling concept for this is bedded on recursive principles of systemic hierarchy (Yolles, 2006), where living systems are structured as a hierarchically nested set of recursively embedded systems, one within another creating more complexity in the modelling process (Williams & Imam, 2006), but with more explanatory power. Here, the agency supersystem consists of a cultural system, a personality system - a normative supersystem with its own interconnected cognitive system with culturally based "identification" information; figurative system with strategic "elaboration" information; and operative system with "execution" information. At both levels, the 'higher'

agency level and the 'lower' recursive normative personality level, the same principles apply for self-identification, self-regulation, and self-organisation.

This generic framework allows complex "bottom-up" interpersonal interrelationships to be modelled through a multiplicity of interconnected reasons that are often taken as a principle of *emergence* or "*emergent causation.*" Lower level interactions, i.e. countless repeated petty acts, "cause" higher order systemic forms to emerge, where complexity becomes reduced to an invisible horizon of meanings. Under normal circumstances, through legitimization of selected patterns of behaviour (by institutions for instance) top-down influences can constrain the nature of the interactions at the lower level. However, such constraints by legitimization may become ineffective in post-normal situations (those experiencing uncertainty such that they may be at the edge of stability), especially in situation of crisis which teeter on instability (Dempster, 1999; Tognetti, 1999). Thus, the modelling approach adopted for Figure 6 can represent networks of processes at the individual and small group level, as well as their impact on the higher level social influence networks of processes and vice versa (Yolles, 2006).

This now brings us to further consideration of the capacity to anticipate patterns of cultural agency behaviour. The generic model of Figure 6 represents a plural agency which is durable (and hence viable) when it maintains a stable culture and which embraces learning and development through its cybernetic processes, with a normative personality, an operative capacity, and an environment. The agency operates through invariant generic constructs of Piagetian intelligences, adapts to changing situations, and creates and implements its own policies. It enables specific relationships to be introduced within and across systemic domains, as necessary and according to the logical processes that may be proposed within socio/economic/political situations. The cultural orientation traits orients agency behaviour towards cultural norms of the cultural environment, which can be followed or neglected; and the social orientation traits towards the social environment within which the agency interacts with other agencies. Here, countless repeated petty acts are performed, which in the end constitute cultural practices within a social frame.

The intelligences we have referred to are susceptible to pathologies (Yolles & Fink, 2014c). Pathologies in systems emerge when important processes within the agency are neglected and dysfunctional behaviour emerges. In Figure 6, generic pathologies are seen as a function of ***neglect*** indicated by grey bars, e.g. the bar at $\boldsymbol{I_{3,1}}$ indicates that the second order agency element does not comply with the cultural norms of the higher order social whole. The bar at $\boldsymbol{I_{4,1}}$ indicates that the deployed behaviour, i.e. the action of the normative personality, does not conform with behavioural rules in the social frame.

The traits belonging to the state systems of Figure 6 may take epistemic bipolar values. Without higher order invariant generic construct pathologies, cultural trait values directly influence the other agency trait values. These values contribute to formative anticipation of patterns of behaviour, while emotive components can impact on these patterns. Thus, cultural trait values adopted by an agency can act as attractors for the other traits, resulting in the agency tending towards becoming either Individualist or Collectivist in its cognitions and behaviours (Yolles & Fink, 2013; 2014b; 2014d). This enables some significant capacity to anticipate patterns of behaviour given known environmental contexts.

Conclusion

This paper explains that there is a need to be able to create projections into the future of the

behaviour of social agencies. Such projection is referred to as *anticipation*, rather distinct from more post-/positivist prediction. Rosen adopted this term in relation to a model-based approach. For Dubois such model-based projections constitute weak anticipation, rather than system-based (generic) strong anticipation. In system-based approaches generic attributes like autopoiesis and autogenesis are axiomatic concepts that do not require validation as long as their model-based representation is satisfactory. Anticipation is still model-based, but the model is generic.

The base approach in the development of a theory of generic modelling arises from the principles of Knowledge Cybernetics which have been generally applied in the development here. It has led during the last decade to a cultural agency theory, which has facilitated the general theory of cybernetic orders proposed here. It is from this theory that a recursive generator for higher order cybernetic generic models results, each of which is therefore also a potential generator of a family of thematic paradigms.

The general model for nth order cybernetic models is given in Figure 4, where higher orders of autopoiesis are indicated. This general model has been mapped into a cultural agency context as shown in Figure 5, creating a generic model that facilitates the structuring of particular modelling components through propositions that can be explored through model building activities or empirical investigation. Thus for instance, propositions could be raised concerning shifting contexts, endogenous agency problems, or issues of inefficacy in any of the intelligences, and any of these factors will have an impact on agency trait values with a consequential impact on its patterns of behaviour. To make issues more problematic, emotive attributes could be introduced since these condition (energise an agency towards or away from) particular patterns of behaviour. They also create a regulatory influence on cognitive thinking processes (Bradley et al, 2001: 276).

In Figure 6 only the cognitive attributes (culture and personality) of the agency are able to be represented by fourth cybernetics. The knowledge embedded in the cultural system is of course related to the cognitive information of the personality. The distinction between them is that knowledge is a structured pattern of symbolic concepts at some horizon that can provide cognitive meaning when sampled, while information is a concrete selected context sensitive symbolic pattern of epistemic concepts that has been manifested to the personality.

We will recall that autopoiesis/self-producing/operative-intelligence is a network of first order processes, autogenesis/self-creating/operative-intelligence is a network of second order processes, and this allows meaningful comparison between Figures 5 with 6. The fourth cybernetic model of Figure 5 is consistent with the cognitive component (involving culture and personality) of Figure 6. This means that culture and personality operate together as a fourth cybernetic model creating a potential for a new family of paradigms, and enabling complexity to be simplified through the new invariant generic construct referred to in Figure 5 as autogenetesis/self-defining, but which from Figure 6 we can see to be represented as cultural figurative intelligence. In other words, according to the theory proposed here, Figure 6 is not only an extended representation of a third cybernetics model, but actually constitutes the basis of a family of new paradigms through the new invariant generic construct of cultural figurative intelligence.

So, this suggests that the recursive principle of third cybernetics can be used to generate new orders of cybernetic model, providing higher orders of invariant generic construct that

can be meaningfully explained.

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References

Ackoff , R.L., 1979, The Future of Operational Research in the Past, *J.Opl Res. Soc*., 30,93-104.

Ang, S., Van Dyne, L., Tan, M.L. (2011). Cultural Intelligence, Sternberg, R.J., & Kaufman, S.B., The Cambridge Handbook of Intelligence, NY: Cambridge University Press, pp582-603

Ashby, W.R., 1968, Principles of Self Organising Systems. In Buckley, W., *Modern Systems Approach for the Behavioural Scientist*. pp.108-118. Adline Pub. Co., Chicago, USA

Aviram, A., 2000, Beyond constructivism: Autonomy-oriented educaton. *Studies in Philosophy and Education*, *19*(5-6), 465-489, http://inelmen.boun.edu.tr/amr/erol03/philo03/israelcons.pdf, accessed June 2014.

Beer, S. (1979), The Heart of the Enterprise, Wiley, Chichester.

Beer, S. (1980), Autopoiesis: The Organization of the Living, pp. 63-72, preface to Maturana, H. and Varela, F.J., Autopoiesis and Cognition, Boston Philosophy of Science series, Vol. 40, available at: http://www.cogsci.ed.ac.uk/,jwjhix/Beer.html

Blum, E., 2009, Cultural Intelligence: Cultural Complexity is today's Business Reality, http://iloapp.culturalintelligence.org/blog/www?Home, accessed May 2014.

Bozicnik, S., Mulej, M., 2011, A new – fourth order cybernetics and sustainable future, Kybernetes,. 40(5/6), 670-684

Boxer, P. J., Cohen, B., 2000, Doing time: The emergence of irreversibility. *Annals of the New York Academy of Sciences*, *901*(1), 13-25.

Boxer, P., Kenny, V., 1990, The economy of discourses: a third order cybernetics?. *Human Systems Management*, *9*(4), 205-224.

Bradley, M.M., Codispoti, M., Cuthbert, B.N., Lang, P.J., 2001, Emotion and Motivation I: Defensive and Appetitive Reactions in Picture Processing, 1(3) 276–298

Checkland, P.B., 1981, *Systems Thinking, Systems Practice*, Wiley, Chichester

Chen, X. P., Liu, D., & Portnoy, R., 2012, A multilevel investigation of motivational cultural intelligence, organizational diversity climate, and cultural sales: Evidence from US real estate firms. *Journal of applied psychology*, *97*(1), 93.

Cohen, J., Stewart, I., 1995, *The Collapse of Chaos*.Viking, Penguin Books, London.

Collier, J., 2006, Conditions for fully autonomous anticipation. In *Computing Anticipatory Systems, CASYS'05(AIP Conference Proceedings)(Volume 839)* (Vol. 839, pp. 282-289). www.academia.edu/download/30868284/collier-Corrected-April-8-2006.pdf, accessed June 2014.

Csányi, V., Kampis, G., 1985, Autogenesis: the Evolution of Replicative Systems, *J. theor. Biol.* 114, 303-323.

Dempster, B., 1999, *Post-normal science: Considerations from a poietic systems perspective*, School of Planning, University of Waterloo, online publications, http://www.fes.uwaterloo.ca/u/mbldemps/pubs/futures1999/index.html

DeVries, R., 1991, *The cognitive-developmental paradigm*. W. M. Kuirliner, & J. L. Gertz (Eds.). Hillsdale, NJ: Erlbaum.

Drazin, R., Sandelands, L., 1992, Autogenesis: a Perspective on the process of organising, Organization Science, 3(2), 230-249.

Dubois, D, 2000, Review of Incursive Hyperincursive and Anticipatory Systems - Foundation of Anticipation in Electromagnetism, CASYS'99 - Third International Conference. Edited by Dubois, D.M. Published by The American Institute of Physics, AIP Conference Proceedings 517, pp3-30.

Earley, P. C., & Ang, S. (2003). *Cultural Intelligence: individual interactions across cultures*. Stanford Business Books, Stanford, CA.

Fink, G., Dauber, D., Yolles, M.I., 2012, Understanding organisational culture as a trait theory. *European Journal of International Management*, *6*(2), 199-220.

Forrester, J. W., 1971, Counterintuitive behavior of social systems, *Technology Review*, 73(3) 52-68.

Glanville, R., 2004, The purpose of second-order cybernetics. *Kybernetes*, *33*(9/10), 1379-1386.

Grandey, A.A., Fisk, G.M., Steiner, D.D., 2005, Must "Service With a Smile" Be Stressful? The Moderating Role of Personal Control for American and French Employees, Journal of Applied Psychology, 90(5)893–904, http://psycnet.apa.org/journals/apl/90/5/893/, accessed March 2014.

Held, D., McGrew, A., Goldblatt, D., Perraton, J., 1999, *Global Transformations: Politics, Economics and Culture*. Polity Press, Cambridge Also see www.polity.co.uk/global/globocp.htm, accessed May 2003

Hogg, M.A., Terry, D.J., White, K.M., 1995, A Tale of Two Theories: A Critical Comparison of Identity Theory with Social Identity Theory, *Social Psychology Quarterly*, 58(4, Dec.), 255-269.

Ionescu, G., 1975, *Centripetal Politics*. Hart-Davis, MacGibbon, London

Judge, A., 2007, Consciously Self-reflexive Global Initiatives, Laetus in Praesens, www.laetusinpraesens.org/docs00s/thirdord.php, accessed May 2014.

Kuhn, S.T., 1970, *The Structure of Scientific Revolutions*. University of Chicago Press, Chicago

Levin, C., Coburn, T., 2011, Wall Street and The Financial Crisis: Anatomy of a Financial Collapse (Majority And Minority Staff Report), United States Senate Permanent Subcommittee on Investigations Committee on Homeland Security and Governmental Affairs, http://www.ft.com/cms/fc7d55c8-661a-11e0-9d40-00144feab49a.pdf, accessed November 2012

Li, Q., Clark, B., Winchester, I., 2010, Instructional design and technology grounded in enactivism: A paradigm shift?. *British Journal of Educational Technology*, *41*(3), 403-419.

Louie, A.H., 2010, Robert Rosen's Anticipatory Systems, Foresight, 12(3),18-29

Lucas C. A Logic of Complex Values, in Smarandache, F. (ed.). Proceedings of the First International Conference on Neutrosophy, Neutrosophic Logic, Neutrosophic Set, Neutrosophic Probability and Statistics, pp. 121-138. Xiquan, Phoenix, 2002. (http://www.calresco.org/lucas/logic.htm), also see www.calresco.org/lucas/eiem.htm

Maturana H.R., Varela F.J., 1979, Autopoiesis and Cognition. Boston: Boston Studies in the Philosophy of Science.

Mingers, J., 1995, *Self-Producing Systems*. Plenum Press, New York and London

Morgan, G., 1980, Paradigms Metaphors, and Puzzle Solving, Administrative Science Quarterly, 25(4), 1-18.

Osborne, J. F., 1996, Beyond constructivism. *Science education*, *80*(1), 53-82.

Paecht-Horowitz, M., 1973, The Origin of Life, Angewand Chem, 12(5),349-438

Paris, C., Hall Johnston, J., Reeves, D., 1998, A Theoretical Framework and Measurement Strategy for Training Team Tactical Decision Making. Available at: www.dodccrp.org/proceedings/ DOCS/wed00000/wed000e6.htm, accessed May, 2006.

Piaget, J., 1950, *The Psychology of Intelligence*, Harcourt and Brace, New York; Republished in 1972 by Totowa, NJ: Littlefield Adams.
Pocock, D., 1999, Therapist reflection: Loose ends, *Journal of Family Therapy* (1999) **21**: 187–194
Rosen, R., 1985, *Anticipatory Systems.* Pergamon Press: New-York
Schwalbe, M. L., Schwalbe, M. L., 1991, The autogenesis of the self. *Journal for the Theory of Social Behaviour*, *21*(3), 269-295.
Schwaninger, M., Pérez Ríos, J., 2008, System dynamics and cybernetics: a synergetic pair, System Dynamics Review 24(2) 145–174
Schwarz, E., 1994, A Metamodel to Interpret the Emergence, Evolution and Functioning of Viable Natural Systems. Presented at the European Meeting on Cybernetics and Systems Research, Vienna, and in Trappl, R., (ed.), April, 1994, Cybernetics and Systems '94, World Scientific, Singapore, pp1579-1586
Schwarz, E., 2001, Anticipating Systems: an Application to the Possible Futures of Contemporary Society, Invited paper at CAYS'2001, Fifth International Conference on Computing Anticipatory Systems, Liege, Belgium, August 13-1
Seed, A., Tomasello, M. (2010). Primate cognition. *Topics in Cognitive Science*, *2*(3), 407-419. http://onlinelibrary.wiley.com/doi/10.1111/j.1756-8765.2010.01099.x/full, accessed May, 2014.
Taschdjian, E., 1978, The third cybernetics and temporal logic. *Kybernetes*, *7*(3), 177-183.
Thamas, D.C., Inkson, K., 2009 *Cultural Intelligence: Living and Working Globally*, Berrett-Koehler Publishers, Inc., San Francisco.
Tognetti, S.S., 1999, Science in a double-bind: Gregory Bateson and the origins of post-normal science, Futures 31, 689–703. See www.sylviatognetti.org/data/tognetti1999.pdf, accessed June 2008.
Turner, R. H., 1976, The real self: From institution to impulse. *American Journal of Sociology, 81,* 989–1016.
Weinberg, G.M., 1975, *An Introduction to General Systems Thinking*. Wiley, New York
Williams, B., Imam, I., 2006, Systems Concepts in Evaluation: An Expert Anthology, American Evaluation Association, http://preval.org/files/Kellogg%20enfoque%20sistematico%20en%20evaluacion.pdf, accessed 2008.
Yolles, M.I., 1999, *Management Systems: A Viable Approach*. Financial Times Pitman, London.
Yolles, M.I., 2006, Organizations as Complex Systems: an introduction to knowledge cybernetics, Information Age Publishing, Inc., Greenwich, CT, USA
Yolles, M.I., 2007, The Social Psychology of Collectives, and their Pathologies, Keynote talk, XIV Congress of International Association for Fuzzy-Set Management and Economy, *Computational Intelligence Applied to NewDigital Economy and Business Ecosystems*, Poiana Brasov – Romania, November 1– 3.
Yolles, M.I., 2009, A Social Psychological basis of Corruption and Sociopathology, *J. of Organizational Change Management*, 22(6) 691-731.
Yolles, M.I., 2009a, Migrating Personality Theories Part 1: Creating Agentic Trait Psychology? *Kybernetes*, 38(6) 897-924.
Yolles, M.I., 2009c, A Social Psychological basis of Corruption and Sociopathology, *J. of Organizational Change Management*, 22(6) 691-731.
Yolles, M.I., Dubois, D., 2001, Anticipatory Viable Systems. *International Journal of Computing Anticipatory Systems*. **9**: 3-20. http://www.ulg.ac.be/mathgen/CHAOS/IJCAS/IJCAS_9_MY_DD.pdf.

Yolles, M.I., Fink, G., 2011, Agencies, Normative Personalities, and the Viable Systems Model, *Journal Organisational Transformation and Social Change*, 8(1)83-116
Yolles, M.I., Fink, 2013, Exploring the Common Roots of Culture, Politics and Economics, Keynote address given by Yolles and the International Symposium The Economic Crisis: Time For A Paradigm Shift - Towards a Systems Approach January 24-25, 2013, Universitat de València, Facultat d'Economia, Spain.
Yolles, M.I, Fink, G., 2014a, Personality, pathology and mindsets: part 1 – Agency, Personality and Mindscapes, Kybernetes, 43(1) 92-112
Yolles, M.I, Fink, G., 2014b, Personality, pathology and mindsets: part 2 – Cultural Traits and Enantiomers, Kybernetes, 43(1) 92-112
Yolles, M.I, Fink, G., 2014c, Personality, pathology and mindsets: part 3 –Pathologies and Corruption, Kybernetes, 43(1) 135-143Yolles, M.I., Fink, G., 2014a
Yolles, M.I., Fink, G., 2014d, Modelling Mindsets of an Agency, J. Organisational Transformation and Social Change, 11(1), 69–88
Yolles, M. Fink, G. Dauber, D. 2011, Organisations as emergent normative personalities: part 1, the concepts, *Kybernetes* (5/6), 635 – 669
Yolles, M.I., Fink, G., Frieden, R., 2012, Organisations as Emergent Normative Personalities: part 2, predicting the unpredictable, *Kybernetes*, 41(7/8)1014-1050
Yolles, M.I., Frieden, B.R., 2005, A Metahistorical Information Theory of Social Change: The Theory, *Organisational Transformation and Social Change*, 2(2)103-136
Yolles, M.I., Frieden, R., Kemp, G., 2008, Toward a formal theory of sociocultures: A yin-yang information-based theory of social change, *Kybernetes*, 37(7)850-909