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Life-skill Learning from Animal Shareholders and Collaborators

Cognitive opportunity for engaging radically with a complex world in crisis

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Introduction

Much is made of the deterioration of the environment, loss of wildlife, and the challenges of formulating a viable lifestyle. Much is also made of the need for creativity and new thinking to respond to conditions with respect to which authorities are proving to be ever more incompetent. Essentially individuals are increasingly left to their own resources and ingenuity -- and possibly encouraged in that modality by those same authorities.

The recommendations by "authorities" or exemplars might be briefly clustered as:

- reliance on science and technology, possibly in its intermediate and alternative forms
- reliance on religion, possibly through the alternative forms of belief offered by cults and sects
- reliance on "do it yourself" construction of shelters, educational programmes, cultivation of foods
- reliance on philosophy as a means of transcending life experience as it may be necessary to experience it
- reliance on distraction through sport and other recreations, including food, drink and meaningful drugs
- reliance on community and family interactions as offer a sustaining pattern of meaning
- reliance on identification with initiatives in defence of the status quo, or in an effort to change it

The argument here is that these can all be understood in systemic terms. The ultimate "authorities" in thriving through systemic crises are however the millions of species in the biosphere -- whether plants or animals. It is evident that these have explored and developed every variety of "trick" to adapt to the challenges to which they have been exposed.

It is difficult to argue that such modalities have not been extensively tested over millions of years in response to particular conditions. In this sense they constitute a vast repertoire of viable strategic resources. The title of this review offers the provocative reminder that, with humans, animals can also be fruitfully considered "shareholders" in a vast collective enterprise involving a varieties of forms of "collaboration".

The systemic organization of species may be explored in terms of the patterns of structural order they variously embody, as noted by such as [Christopher Alexander](#) (*The Nature of Order: an essay on the art of building and the nature of the universe*, 2003-4). Far less obvious are the patterns of behaviour associated with such order -- invisible in specimens pinned and mounted in museum displays, or severely constrained in zoos.

Increasing recognition for this source of insight is however evident as [biomimicry](#) -- the study of biomimetics and its technical applications -- currently evident in the design of drones in the light of the aerodynamic abilities of a variety of species. The approach can be considered as an indication, or template, for psychosocial possibilities, as separately argued ([Engendering a Psychopter through Biomimicry and Technomimicry: insights from the process of helicopter development](#), 2011). A brief overview is offered by a BBC summary ([Animal and plant adaptations and behaviours](#))

However, rather than focusing on the proven technical possibilities, there is also the implication of cognitive possibilities and of "being otherwise" according to circumstance. These have been poorly recognized and explored. The question is whether the organization and behaviours of biological species are suggestive of alternative cognitive modalities that are relatively accessible to the individual, if not immediately.

The argument here is that, rather than depending on authorities anxious to ensure that their particular worldview is faithfully reproduced (however ineffectual), individuals may in effect be free to adopt and test alternative modalities at will. The corresponding challenge for authorities is whether they can prove that their conventional recommendations are of more meaningful consequence to individuals -- who increasingly perceive their effectiveness to be questionable.

The question here is how better to frame this possibility in order to facilitate and enable such exploration. This has been variously approached in previous arguments (*My Reflecting Mirror World: making my World Summit on Sustainable Development worthwhile*, 2002; *En-minding the Extended Body: enactive engagement in conceptual shapeshifting and deep ecology*, 2003; *En-joying the World through En-joying Oneself: eliciting the potential of globalization through cognitive radicalization*, 2011; *Being the Universe: a metaphoric frontier*, 1999).

The focus here is on cognitive possibilities especially with regard to global geometry and associated dynamics, as partially discussed separately (*Metascience Enabling Upgrades to the Scientific Process: beyond Science 2.0 in the light of polyhedral metaphors?* 2014). Of particular interest is whether systemic comparison of animal strategies could be developed such as to enable insightful comparison with the strategies advocated by international organizations and constituencies. Some 32,000 of these had notably been profiled in the [Global Strategies Project](#).

Clues to cognitive possibilities of "being an animal"

A surprising range of contexts and practices suggest that people associate significance to varying degrees with a particular relation with specific animals. Whilst this may be deprecated as superstition, these different practices variously suggest some form of cognitive enhancement through the process. There is a sense in which the process bears some resemblance to donning a cognitive exoskeleton -- readily deprecated as belief in the possibility that qualities can in some way magically "rub off" through that association. The following instances are presented in no particular order.

"Being an animal": Whether with respect to those in combat or competitive roles (where the quality may be appreciated) or in other roles (where it is typically deprecated), the relevance of the descriptor is readily recognized as meaningful. In either case it may be applied to sexual intercourse.

Biomimicry for management: A form of biomimicry is of course to be recognized in management texts such as that of Dudley Lynch and Paul Kordis (*Strategy of the Dolphin: scoring a win in a chaotic world*, 1988). This blends the latest findings in psychology, physics, sociology and business strategy to contrast the subtleties of thinking/acting like a dolphin with that of carps (prey) and of sharks (predators). Management is urged to think like a "dolphin", rather than a "shark", in order to keep on top of the "carps". A reviewer in a management journal greeted it as "*a welcome respite from other management books that urge us to think like samurais, Attila the Hun, or members of the Prussian General Staff.*".

The theme has also been developed by Stefan Swanepoel (*Surviving Your Serengeti: 7 skills to master business and life*, 2011). This merits comparison with a checklist by Earth Rangers indicating how small creatures like beetles and ants can stand up to bigger species (*Top Ten Strangest Animal Survival Strategies!* 14 April 2011). It is less evident that there is any suggestion there that humans can learn anything from those animal strategies, such as the behavioral evolution of optimum resource utilization (G. A. Parker and R. A. Stuart, *Animal Behavior as a Strategy Optimizer: evolution of resource assessment strategies and optimal emigration thresholds*, *The American Naturalist*, 1976). The same question is raised by the study of Raghavendra Gadagkar (*Survival Strategies: cooperation and conflict in animal societies*, 2001) and by the extensive literature on cooperative animal behaviour reviewed by Jan Komdeur (*Variation in Individual Investment Strategies among Social Animals*, *Ethology*, 2006).

The point to be made, as discussed separately, is whether a more systematic approach is required to discover what metaphors are beneficial to management thinking under what circumstances (*Governance through Metaphor*, 1987; *Metaphoric Revolution: in quest of a manifesto for governance through metaphor*, 1988). It may indeed be useful to think like a shark, or like a carp, under certain circumstances. A more surprising metaphor has been explored by Greg Hearn (*If Your Company Were a Cockroach: how to survive in the new business ecology*, 2007). Again it should not be forgotten the frequency and ease with which animal-like attributes are associated with corporate bodies -- "rat", "wolf", "snake", etc. Admiration is attached to "tiger" -- as with the so-called [Four Asian Tigers](#) (Hong Kong, Singapore, Taiwan, South Korea).

More provocative is the use of "dinosaur" to refer to corporate entities (E. Lawler III and J. Galbraith, *Avoiding the Corporate Dinosaur Syndrome*, *Center for Effective Organizations*, March, 1994; *Are States Dinosaurs Waiting to Die*), as discussed separately (*Systemic Biomimicry of Dinosaurs by Multinational Corporations: clearing the ground for future psychosocial evolution*, 2011).

Totems of indigenous peoples: In some non-western cultures [animal totems](#) have played an even more powerful role in providing a metaphoric view of the world (James Cowan, *On Totems, Resurgence*, 1990). The totem is usually an animal or other natural figure that spiritually represents a group of related people such as a clan. **Totemism** is recognized as a system of belief in which each human is thought to have a spiritual connection or a kinship with another physical being, such as an animal or plant. The totem is thought to interact with a given kin group or an individual and to serve as their emblem or symbol.

Mascots: A more commonly recognized form of "totem" is the widespread use of [animal mascots](#) -- and the importance attached to them in relation to individual or group identity. *Wikipedia* distinguishes: [sports mascots](#), [corporate mascots](#), [school mascots](#), [military mascots](#),

and [mascots in music](#). These may take the form of real animals, animal caricatures, statues, or amulets.

Auspicious animals: Partially by extension of the use of totem and mascot, particular importance may be attached in certain cultures to animals that are held to be omens of either good luck or bad luck, whether encountered in daily life or in dreams:

- **auspicious animals:** As in the case of Buddhism, especially Tibetan Buddhism, the [four auspicious animals](#) represent sacred qualities and attitudes that Bodhisattvas develop on the path to enlightenment; qualities such as awareness, vast vision, confidence, joy, humility and power.
- **inauspicious animals:** Animals of bad omen are variously distinguished in many cultures. They may notably include snakes and bats (see *Superstitions of Nature*).

Deities depicted in animal form: These include so-called [animal deities](#) and may imply a degree of [animal worship](#). *Wikipedia* indicates a distinction between [outward form](#) and [inward meaning](#).

Spirit animals: Particular cultures, now reinforced from a New Age perspective, may cultivate "spirit animals" as offering guidance in life, as suggested on various websites ([Spirit Animals and Animal Totems](#); [Animal Totem Meanings and Animal Symbolism](#)). A particular point is made by the question: *Ever felt an odd connection to wildlife? Do you have Native American Roots? Take this quiz to find your Native American Totem Animal! (What Totem Animal Are You?)*.

"Animal spirits": The term "[animal spirits](#)" is widely cited following its use by [John Maynard Keynes](#) to describe emotions influencing human behaviour and measurable in terms of consumer confidence (*The General Theory of Employment, Interest and Money* 1936). As discussed separately with regard to *Wrangling with animal spirits* (2012), there is a degree of ambiguity in use of the term "wrangling". The historical British meaning of "[wrangler](#)" is a person who excels at debate. In North America, however, a [wrangler](#) is a person employed to handle animals professionally. For some of religious persuasion, "wrangling with the devil" is a life-long challenge, or a skill attributed to exorcists (cf. *Catholic Church sets up exorcist hotline*, *RT.com*, 1 December 2012).

Psychotherapy: Some practices and exercises explore the metaphoric use of animals, possibly understood as mythical archetypes. These are used to guide personal transformation, often through forms of meditation or interpretation of dreams.

Affinity with animals: A variety of patterns merit recognition:

- **animal pets:** the experience of affinity with animal pets is widely acknowledged. The choice of pet in terms of such affinity is also widely acknowledged -- even to the point of according a degree of recognition to behaviour of the owner being echoed to some degree in that of the pet. The point is made in a particular way by the work of [Rupert Sheldrake](#) (*Dogs That Know When Their Owners Are Coming Home*, 1999). Other understandings of empathy have been widely illustrated in movies (*The Horse Whisperer*, 1998; *Dances with Wolves*, 1990).
- **working animals:** these clearly point to the special affinity with guide dogs, hunting dogs, sheep dogs, guard dogs, and sniffer dogs. Also noteworthy is the relationship with horses, donkeys, water buffalo, elephants, and the like.
- **domesticated animals:** as characteristic of animal husbandry
- **military animals:** this is an extension of the previous category. In both cases, the animals involved may receive awards for actions "beyond the call of duty" -- even in the case of [war pigeons](#).

Animal wisdom: Various animals are recognized, through the legends and stories of different cultures, as inherently "wise" -- most notably in the case of the owl and the elephant (Jessica Dawn Palmer, *Animal Wisdom*, 2001). This understanding has been the subject of research by Michael Archinal (*Animal Wisdom: stories from an Australian vet on what animals can teach us about love, health happiness*, 2013). Drawing on scientific research from around the world and heart-warming stories from his own practice, the author shows how animals have perfected the art of eating, exercising and sleeping according to their needs; using stress in a positive way; and, most importantly, strengthening the bonds that create a sense of security and well-being. He argues that sharing our lives with animals gives us the opportunity to understand how to use our intuition and ancient animal instinct to increase our happiness and health, and improve our relationships. Use of "wisdom" indeed implies the possibility of "learning from animals", which is the focus of other studies (as noted below).

Use of animal names: Attribution of names of animals to sports teams, scout troops, and vehicles is a common practice. This is especially the case in their use by the military in naming combat units, fighter jets, missiles and naval vessels, typically with the names of fearsome carnivores (wolf, leopard, hawk, falcon, etc).

A related process is evident in advertising, as with the slogan: *Put a tiger in your tank*. Individuals may be given animal names, or be so nicknamed in the light of their perceived affinity with particular species. In the community [Federation of Damanhur](#), the full membership of an individual is indicated by adoption of the name of an endangered species -- subject to approval of the appropriateness of the choice by the community.

Logos and clothing: Extensive use is made of [animal imagery on logos](#). These may notably be associated with personal clothing (helmets, T-shirts, etc).

Emulation of animals: This may feature in a variety of cultures and circumstances:

- **form:** animal masks and costumes are widely known in traditional cultures, folk celebrations, and fancy dress
- **movement:** whether wearing masks or costumes, animals may be deliberately emulated in dance, especially as much-valued in certain cultural traditions, as with the Australian Aborigines. Specific movements in the martial arts, such as *kung fu*, may be recognized in terms of animal forms, notably the [Five Animal](#) style involving [Tiger](#), [Crane](#), [Leopard](#), [Snake](#), and [Dragon](#) (Floyd Burk, *The Combat Techniques of Shaolin Kung Fu's Legendary Animal Styles, Black Belt*, 2011) and others (Mark Cheng, *Praying Mantis Kung Fu Methods and Monkey Kung Fu Movements, Black Belt*, 2011).

- **posture:** particular postures in yoga and sexual intercourse may be named according to the animal of which they are reminiscent.

Game-playing with animal roles: *Dominant Species* (2010) is a board game that has engendered comment on the [strategies suggested by different animals](#): mammals, reptiles, birds, amphibians, arachnids, insects (see [tutorial](#)).

Ecosystemic embedding: This is indicative of particular forms of collaboration: symbiosis, commensalism, parasitism, allopathy, synnecrosis, amensalism, predation, allotrophy, or none. These have been configured by [Edward Haskell](#) into a general model of cognitive significance (*Full Circle: The Moral Force of Unified Science*, 1972). The collaborative arrangements are evident as:

- embedding of humans in ecosystems with animals, recognized as part of a [food chain](#)
- embedding of animals within the human body (Rob Stein, *Exploring the Invisible Universe that Lives On Us -- And In Us*, 4 November 2013; Charles Raison, *Bacteria and Human Behavior: peering into the universe within you*, September 2013; Erin Allday, *100 trillion good bacteria call human body home*, *SFGate*, 5 July 2012; Neil Shubin, *The Universe Within: the deep history of the human body*, 2013; Ed Yong, *Our bodies are a global marketplace where bacteria trade genes*, *Discover*, 31 October 2011).

Animal allegories in folk-tales: Much-valued examples of complex sets of tales include the:

- *Jataka Tales of the Buddha*: these 547 stories are meant to teach the values of self-sacrifice, honesty, morality and other didactic values.
- *Panchatantra*: this Hindu collection of stories about relationships between animals (known in Europe as the *Fables of Bidpai*) serves as a manual for the conduct of a prospective ruler and is widely used by parents in guiding children towards values in human life, since each story has a moral.
- *Aesop's Fables*: over 655 European tales are in this collection, each with an associated moral.
- *Br'er Rabbit* stories
- *Mulla Nasrudin's* tales, many of which involve animals.

Animal stories for children: This is an extension of the previous category, and partially overlapping with it

Strategic descriptions: Traces of animals and their behaviour are evident in descriptors for certain strategies such as a "sting" or a "pincer movement" (termed a "buffalo horn" formation by Zulu impis). Related use is made of terms such as "pecking order". Reference is made to the "wings" of a military formation and to "legs" of any infantry army.

It is to be expected that other insights emerge from classical strategic texts, as with [Sun Tzu](#) (*The Art of War*). Related insights are associated with the Chinese classic, *The Thirty-Six Stratagems*, variously adapted and employed, as with *An Electronic Art of War in 36 Stratagems* -- and especially associated with the tiger (Gao Yuan, *Lure the Tiger Out of the Mountains: the thirty-six stratagems of Ancient China*, 1992; Kaihan Krippendorf, *Hide a Dagger Behind a Smile: use the 36 Ancient Chinese strategies to seize the competitive edge*, 2008).

Varieties of animal behaviour of potential strategic value to humans

Animal testing of human strategies? As noted above it can be readily argued that animal behaviour has been extensively tested over millions of years in response to particular conditions. Kevin M. Passino argues that there are many highly effective optimization, feedback control, and automation systems embedded in living organisms and nature (*Biomimicry for Optimization, Control, and Automation*, 2005). As he stresses, evolution persistently seeks optimal robust designs for biological feedback control systems and decision making processes.

In this sense Nature constitutes **a vast repertoire of "pre-tested" strategic resources** -- perhaps thereby implying another understanding of the so-called [global brain](#) or of the [noosphere](#). This understanding is noteworthy in that the ecosystemic connectivity enabled by animal behaviour is effectively a precursor underlying that which is celebrated in the electronic connectivity of the internet and anticipated as a potential with respect to the noosphere (*From Information Highways to Songlines of the Noosphere: global configuration of hypertext pathways as a prerequisite for meaningful collective transformation*, 1996).

There is therefore a degree of tragic irony to the fact that some 80 million animals are now killed per year to "test" pharmaceutical and related products for their value to sustaining human health. "Animal models" may be developed for that purpose and to avoid the slaughter (Allan B. Haberman, *Animal Models for Therapeutic Strategies*, 2010). As a repertoire of structures and behaviours, it is however possible that the relationship with animals can be more fruitfully explored -- both for the benefit of humans and for the sustainability of the ecosystem which humans share with animals and other species. Is it possible that some animals employ strategies especially relevant to human survival and thrival in current circumstances?

Systematics: It is of course the case that very extensive attention has been given to the range of animal species and to their placement in [animal taxonomies](#) according to their form, structure and genetic makeup -- as has been done with plants. This placement is governed by the *International Code of Zoological Nomenclature* which rules on the formal scientific naming of organisms treated as animals.

Curiously the possibility of a taxonomy of animal behaviour has not been developed to that degree, although it has been argued that there are systemic behavioural equivalences between quite different species which would allow for such clustering in terms of dynamic behaviour.

Behaviour of organisms -- understood primarily as human: Research on behaviour is widely recognized to have been strongly influenced by the title and focus of the classical study by [B. F. Skinner](#) (*The Behavior of Organisms: an experimental analysis*, 1938). As noted by Bryan Roche and Dermot Barnes (*The Behavior of Organisms?, The Psychological Record*, 1997):

The term "organism" enjoys a revered place within the vocabulary of behavior analysis, most notably perhaps within the title of Skinner's seminal work (*The Behavior of Organisms*, 1938). The exact status of this term, however, is unclear. For instance, the term does not appear to be a technical one. Nevertheless, its widespread use in the behavior-analytic literature suggests that it is masquerading as such. The present paper appraises the scientific utility of the term "organism" within the domain of behavior analysis and discusses some possible reasons for its widespread use.

In 1956, [Benjamin Bloom](#) headed a group of educational psychologists who developed a classification of levels of intellectual behavior important in learning. This became a taxonomy including three overlapping domains; the [cognitive](#), [affective](#) and [psychomotor](#) ([Benjamin Bloom's Taxonomy of Behavioral Objectives](#)).

The difficulty, given the preoccupation with influencing human behaviour, is that research neglects forms of animal behaviour considered irrelevant to that objective -- according to criteria which could prove highly questionable. Ironically this corresponds to the manner in which the insights of those considered unqualified are considered in the event of crisis ([Enabling Collective Intelligence in Response to Emergencies](#), 2010).

Human behavioural change: Notably cited in the literature is therefore a focus on a taxonomy of behaviour change techniques, primarily focused on humans ([Susan Michie](#), Michelle Richardson, et al. [The Behavior Change Technique Taxonomy of 93 Hierarchically Clustered Techniques: building an international consensus for the reporting of behavior change interventions](#), *Annals of Behavioral Medicine*, 2013; Charles Abraham and Susan Michie, [A Taxonomy of Behavior Change Techniques Used in Interventions](#), *Health Psychology*, 2008).

As noted in the *Psychlopedia* with respect to [Taxonomies of behavioral change](#):

One of the main roles of many psychological interventions is to change the behavior of individuals. Individuals, for example, may be encouraged to exercise more often or regulate their temper.

Researchers and practitioners have recommended hundreds of practices that can be applied to initiate and to maintain these changes. For example, individuals can be asked to imagine changing their behavior for several minutes...

Until recently, researchers had not developed a taxonomy or inventory of the practices, techniques, or interventions that can be utilized to facilitate change. Such a taxonomy or inventory would provide many benefits, apart from merely offering practitioners a range of alternatives they can apply to facilitate behavior change in clients.

In particular, without this inventory, researchers cannot readily describe the techniques they utilized in their studies. Several researchers, for example, may claim they utilized "motivational strategies" to encourage people to exercise. Yet, each researcher may have applied a different technique, but used the same label.

Of some relevance to the argument here, the literature on behaviour taxonomy includes a particular focus on:

- **leadership:** (Gary Yukl, Angela Gordon and Tom Taber, [A Hierarchical Taxonomy of Leadership Behavior: integrating a half century of behavior research](#), *Journal of Leadership and Organizational Studies*, 2002; Angel Barrasa, [Hierarchical Taxonomy of Leadership Behavior: antecedents, structure, and influence in work group's effectiveness](#), 2004)
- **information usage:** namely how information systems and technology are used (Mark Bennett and Miles Kehoe, [Behavior Based Taxonomies: Far Better](#), *New Idea Engineering*, 6, 2004; Diane H. Sonnenwald and Mirja Iivonen, [An Integrated Human Information Behavior Research Framework for Information Studies](#). *Library and Information Science Research*, 1999). The latter notes:

Human information behavior is emerging as an important component of information studies. As in many emerging research areas, one challenge is to identify important facets of human information behavior and understand how different methods can be best used to research these facets. This paper presents the framework of an approach to designing and synthesizing research studies in human information behavior.

Taxonomy of animal behaviour? The comment above does not envisage the insight that might be derived from "animal information behaviour", given the variety of animals and the conditions in which they are obliged to survive and thrive through the most effective "knowledge management". Biomimicry has focused especially on tangible applications using insights from selected species: the movement of legs (for robotics, exoskeletons design), wings (aerodynamic development of planes and drones), fins (development of submarines), and swarming (development of intelligent agents).

Seemingly missing is a more generic approach to the behaviour of animals and the repertoire which any taxonomy might constitute. Such possibilities are obscured by the manner in which species are exposed in display cases in museums and confined in zoos. Their recorded behaviour in video documentaries is not designed to enable generic insight as a source of human inspiration.

Evolutionary stable strategies: One approach is that described by Michael Breed ([Evolutionary Stable Strategies](#), *Animal Behavior Online*, 2003):

The concept of the evolutionarily stable strategy, or Ess, is an important part of [game theory](#). An Ess is a strategy which, over evolutionary time, is able to withstand the invention of new strategies. Although Maynard Smith and Price (1973) visualized strategies as being genetically encoded, this same logic applies to strategies which are learned during the course of an animal's

life. In most models of the [prisoner's dilemma](#) the "tit for tat" strategy is evolutionarily stable; over time it can beat any other strategy that you might invent for this game.

Analyses of fighting behavior are particularly well suited for game theory analysis (Breed and Rasmussen 1980, Reichert 1984, 1996). In fights, each animal has clear-cut tactics which it can employ, and these can be analyzed as a series of interchanges within the fight. The choices of which tactic to play, when to escalate, and when to submit or flee are all moves in a game. Assessment of the opponent's strength, size, and commitment to winning the fight are important in many animal conflicts, and assessment can be included in the model.

Animal behaviour: taxonomy vs. phylogeny: Another approach is the use of animal behavioural characteristics in order to facilitate phylogeny reconstruction, as argued by A.E. Stuart, et al. (*Using behavioural characters in phylogeny reconstruction, Ethology, Ecology and Evolution*, 2002):

Behaviour remains underrepresented in phylogeny reconstruction, possibly because the term 'behaviour' incorporates a wide range of phenomena, not all of which are equally applicable to understanding evolutionary history. We assessed the character [homology](#) (i.e., potential problems with coding) and [homoplasy](#) (i.e., lability or convergence) for each of four types of behaviour (behavioural categories, reaction stimuli traits, the specific movements of animals and quantitative information relating to each of these behaviour types) and determined the broad applicability of each behavioural type for phylogeny reconstruction. When using behaviour to reconstruct a phylogeny we recommend the following order of behavioural types: (1) animal movements; (2) quantitative components (providing that the animal movements are homologous); (3) reaction stimuli traits; (4) behavioural categories.

The situation had been usefully framed previously by [John W. Wenzel](#) (*Behavioral Homology and Phylogeny, Annual Review of Ecology and Systematics*, 1992):

The sociobiology debates of the 1970s increased interest in the biology of behavior. At the same time, the growth of cladistics increased interest in how to do systematics and phylogenetic reconstruction. Yet, there are surprisingly few recent papers dealing explicitly with behavior from a phylogenetic perspective. Lack of communication between students of behavior and students of systematics is partly to blame.... **Determining homology among behaviors is no different than determining homology among morphological structures.** Behavior is not special, it is only more difficult to characterize. Ethology (the study of behavior) is a relatively young science and does not yet have the benefit of centuries of debate and consensus, but that provides more reason for us to take up the challenge now. [*emphasis added*]

The emphasis on evolutionary phylogeny in behavioural terms is seemingly more fruitful than a "taxonomic" approach. As noted by Terry J. Ord and Emilia P. Martins (*Behavioral Phylogeny: the evolutionary origins of behavior*, In: Michael D. Breed and Janice Moore (Eds.), *Encyclopedia of Animal Behavior*, 2010, pp. 87-92):

Animal behavior is the result of millions of years of evolutionary history, but how do we study the evolutionary origins of behavior?... A phylogeny or phylogenetic tree is a visual diagram by which we describe the evolutionary relationships among species. By considering species-typical behavior in a phylogenetic context, we can learn a great deal about how behavior evolved... By mapping behavioral traits onto a phylogeny we can interpret their evolutionary origins more accurately. For example, we are able to determine if different animals share behavior through common ancestry (homologous behavior) or whether similar behavior has evolved via independent evolutionary events in otherwise distantly related animals (convergent behavior). Behavioral phylogenies are also essential for teasing out evolutionary pressures or constraints, such as ecological forces that act on behavior.

The article cited includes one such map. Missing -- with respect to the argument here -- is **how the approach might be related to human learning from animals in the course of an individual life time and in response to social pressures of a society in crisis.** Of particular relevance is how such insights might be freely explored -- rather than socially imposed through [behavioural conditioning](#) in support of hidden agendas.

Implication for identity of embodiment of the mind in movement

Embodiment of mind: There is increasing interest on the part of cognitive psychology in the embodiment of mind ([George Lakoff](#) and [Mark Johnson](#), *Philosophy In The Flesh: the embodied mind and its challenge to Western thought*, 1999; [Francisco Varela](#), E. Thompson, and E. Rosch, *The Embodied Mind: cognitive science and human experience*, 1991). Johnson in particular has developed this understanding following his earlier work (*The Meaning of the Body: aesthetics of human understanding*, 2007; *The Body in the Mind: the bodily basis of meaning, imagination, and reason*, 1987).

The argument is taken further with respect to embodiment of the mind in movement by [Maxine Sheets-Johnstone](#) (*The Primacy of Movement*, 2011). The process is especially well illustrated by sports involving acrobatics and aerobatics. How might a reactionary experience and define identity through any such practice?

With respect to movement, the question can be raised as to whether individual identity is felt to be intimately associated with movement rather than with conventional understandings of stasis as exemplified for legal purposes by certification, photo-identities and DNA

samples. Such possibilities have been explored separately with respect to both cyclic identity and identification with a wave form (*Emergence of Cyclical Psycho-social Identity: sustainability as "psychically" defined*, 2007; *Psychology of Sustainability: embodying cyclic environmental processes*, 2002; *Being a Waveform of Potential as an Experiential Choice: emergent dynamic qualities of identity and integrity*, 2013; *Being Neither a-Waving Nor a-Parting: cognitive implications of wave-particle duality in the light of science and spirituality*, 2013).

Identification: In a remarkable review of the literature of **deep ecology** and **ecophilosophy**, the understanding of identification in that context is clarified by **Warwick Fox** (*Toward a Transpersonal Ecology: developing new foundations for environmentalism*, 1995). He notes the importance attached to the process in the writings of **Arne Naess**. Fox argues (pp. 231-232; *italic emphasis in original. bold emphasis added*) :

When Naess or other transpersonal ecologists emphasize the importance of wider and deeper *identification*, it is important in interpreting them **not to get carried away in flights of imaginative fancy** but rather to understand what is being said as far as possible in a down to earth, ordinary, everyday sense. Identification **should be taken to mean** what we ordinarily understand by that term, that is, the experience not simply of a sense of *similarity* with an entity but of a sense of *commonality*.

To pursue this further, one can have a sense of certain *similarities* between oneself and another entity without necessarily identifying with that entity, that is, without necessarily experiencing a sense of commonality with that entity. On the other hand, the experience of *commonality* with another entity does imply a sense of similarity with that entity, even if this similarity is not of any obvious physical, emotional, or mental kind; it may involve "nothing more" than the deep-seated realization that all entities are aspects of a single unfolding entity... What **identification should not be taken to mean**, however, is *identity* -- that I literally am that tree over there, for example. What is being emphasized is the tremendously *common* experience that through the process of identification my *sense* of self (my experiential self) can expand to include the tree even though I and the tree remain physically "separate" (even here, however, **the word separate must not be taken too literally** because ecology tells us that my physical self and the tree are physically *interlinked* in all sorts of ways).

Expressing this point in another way, the realization that we and all other entities are aspects of a single unfolding reality -- that "life is fundamentally one" -- **does not mean** that all multiplicity and diversity is reduced to a homogeneous mush. As Naess says, the idea that we are

... 'drops in the stream of life' may be misleading if it implies that the individuality of the drops is lost in the stream. Here is a difficult ridge to walk: To the left we have the ocean of organic and mystic views, to the right the abyss of atomic individualism.

Whilst offering an admirable clarification, the expressions in bold are indicative of a form of dogma which is not the intention of the argument made here with regard to the freedom to interpret reality as one so chooses, as previously explored (*Being What You Want: problematic kataphatic identity vs. potential of apophatic identity?* 2008). It is of course the case that the bold emphasis conforms to one such choice.

Activating new metaphors: The approach advocated here, however, involves exploration of the possibility of activating new metaphors which can enchant, empower, explain and orient approaches to the problematique through the user's own comprehension of each metaphor's significance, whether amongst the governors or the governed. Such a use of metaphor is only new in that metaphors have not been deliberately used in this way before, despite the fact that everyone has access to them. In the words of **Kenneth Boulding**:

Our consciousness of the unity of the self in the middle of a vast complexity of images or material structures is at least a suitable metaphor for the unity of a group, organization, department, discipline, or science. If personification is only a metaphor, let us not despise metaphors -- we might be one ourselves. (*Ecodynamics; a new theory of societal evolution*, 1978, p.345)

Or, as expressed by the poet **John Keats**:

A man's life is a continual allegory - and very few eyes can see the mystery of his life - a life like the scriptures, figurative.

Framed as poetry, it may be asked why individuals are not enabled to understand themselves as poetry in motion, as separately argued (*Being a Poem in the Making: engendering a multiverse through musing*, 2012). The charm of it, as expressed by **Gregory Bateson** in concluding a conference on the effects of conscious purpose on human adaptation, is that it can be argued that **We are our own metaphor**.

One reason why poetry is important for finding out about the world is because in poetry a set of relationships get mapped onto a level of diversity in us that we don't ordinarily have access to. We bring it out in poetry. We can give to each other in poetry the access to a set of relationships in the other person and in the world that we're not usually conscious of in ourselves. So we need poetry as knowledge about the world and about ourselves, because of this mapping from complexity to complexity. (Mary Catherine Bateson. *Our Own Metaphor*, 1972, pp. 288-289)

Irrespective of how poetic or aesthetic it is held to be, there is little question that, in seeking to render website and web-surfing experience especially attractive, many opportunities are being explored for reframing personal identity in cyberspace. Striking examples are offered by adoption of [avatars](#) of animal form in some virtual environments (see [animal avatars](#)). How this might come to modify behaviour and a sense of identity is a matter for the future. Such avatars give a sense to the process of adopting a cognitive exoskeleton - if not a cognitive endoskeleton. The process can be recognized in dressing up for an occasion, or in choosing a set of clothes as part of an effort to "reinvent oneself".

Implications of animal-inspired proprioception and knowledge management?

The argument above has noted the extent to which animals inspire humans in a variety of ways -- to the point of their metaphorical use in management and military strategy (presumably variously extended to sport). Such usage contrasts with the literature of behaviourism and its primary focus on manipulation of human behaviour in support of the agendas of interested parties. The concern here is rather to enable individuals to learn from animals in new ways to enable them to act more effectively and fruitfully as they consider appropriate.

The question can then be framed in terms of innovations effectively "pre-tested" by animals faced with constraints, and how these are to be understood systemically. As noted, there appears to be no taxonomy of animal behaviour as such -- as that might otherwise be inspired by zoological taxonomies of form. A phylogenetic approach would seem to offer further insight, if it can be related to human engagement with animals.

There are necessarily many studies, more or less generic, relating to the following animal strategies as a means of understanding the organization of behaviour in systemic terms:

Animal strategies	
<ul style="list-style-type: none"> • hunting strategies • defence strategies • mating strategies • feeding strategies • migrating strategies • strategies for care of weaker members of a group • strategies of conservation (heat, food/hoarding, water, strength/endurance, and the like) 	<ul style="list-style-type: none"> • sheltering strategies • strategies of subterfuge • strategies of attraction • escape strategies • social group strategies • detection strategies (sight, smell, vibration touch, hearing) • strategies of anticipation (hunting, hibernation, etc)

Of interest is how species-specific are such studies -- and the extent to which they have been extended as might be required for phylogenetic comparison. However, **of greater interest is the possibility of understanding such strategies even more generally to render their insights relevant to those of human learning and behavioural possibilities.** As framed here, the concern is how strategic understanding by animals can be expressed in terms of [proprioception](#) and [knowledge management](#) -- as these cognitive and information processes might be readily comprehensible in human terms.

The approach might be termed behavioural biomimicry, although this would tend to obscure the cognitive and experiential dimension in favour of various technical preoccupations, as indicated by the following:

- *Fish Behaviour Inspires Design of Collision-Free Vehicles* (2013)
- *Social Biomimicry: Insect Societies and Human Design* (2010)
- *Biomimicry: looking to nature to solve human problems* (*The Guardian*, 15 November 2013)
- *Biomimicry for Business? (The Nature of Business, 19 June 2013)*
- *Biomimicry: why the world is full of intelligent design* (*The Telegraph*, 6 June 2009)
- *Smart Swarm: using animal behaviour to change our world* (by Peter Miller, 2010)

A web portal on [behavioural ecology](#) has been created to enable people to discover solutions provided by Nature.

Navigating the dynamics of information fluidity

All species can be understood as embedded in information flows which they variously apprehend and to whose features and characteristics they variously attach significance. The process can be framed in terms of cognitive stimuli, whether or not "cognitive" is necessarily the most appropriate term for those with a minimal nervous system.

The framing is useful in that it emphasizes the fluid nature of the information environment as recognized in terms of financial flows, movements of opinion, traffic flows, and the like. But is it experienced as a lake, a river, a waterfall, mist, a bog, a flood, a tornado, a storm, a gyre, a tide, a wave -- or otherwise, or any of them according to circumstance?

Distinguishing variety: Within that environment elements can be distinguished and variously ordered. Much is made of ordered arrays of categories in the case of humans. These can be usefully challenged from the perspective of cognitive psychology by the argument made with respect to mathematics by [George Lakoff](#) and [Rafael Nuñez](#) (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001) [see [review](#)]. Categories of any kind can themselves be understood as emerging in this way -- contrary to the assumption that their boundaries are tidily defined by other processes. In this sense the boundaries distinguishing categories can be considered as arbitrary to some degree and a matter of convenience -- irrespective of how those boundaries are variously "set in stone" by authorities.

The argument applies to species as is clear from the manner in which they may or may not be distinguished in different cultures -- or by an individual with little need to discern any variety amongst "birds" or "dogs". At a more fundamental level, the argument applies to the

subtlet concepts, including those of theology, as separately discussed with respect to [apophasis](#) and the merits of "unsaying" (*Being What You Want: problematic kataphatic identity vs. potential of apophatic identity?* 2008).

Framed in this way, an individual is to a significant degree free to engender or recognize categories as seems appropriate. This is clear in the case of species where 3 categories of bird might be distinguished, or 10, or 50. Enthusiasts would distinguish far more, but only specialists would presume to distinguish among the [3 to 30 million animal species](#). How many might the average person choose to distinguish?

How does this argument apply to other distinctions where some note many varieties? How is this distinguishing process constrained (as noted below)?

Role of metaphor: This suggests that for certain purposes engagement with a fluid information environment might call for 2 "fins" (or "feet", or "wings:), or possibly 4, or 6 or 8 -- or hundreds in the case of a centipede or dependence on [cilia](#). It would be convenient to alter the number of appendages (or sense organs) according to circumstance. Some form of "all terrain" cognitive vehicle could be envisaged.

Rather than rigid conceptual "models", "metaphors" could prove to be the cognitive vehicles of the future, as separately argued (*Metaphors as Transdisciplinary Vehicles of the Future*, 1991). An imaginative stimulus for such investigation is provided by a science fiction scenario explored by a number of writers. It focuses on the challenge of comprehending high degrees of complexity in the information environment -- calling for decision-making under operational conditions (as is the case in global management). It can be stated as follows:

The problem is that of piloting or navigating a spacecraft through "hyperspace" or "sub-space", as imagined in the light of recent advances in theoretical physics and mathematics. Because of the inherent complexity of such environments, writers have explored the possibility that **pilots and navigators might choose appropriate metaphors through which to perceive and order their task in relation to qualitative features of that complexity** -- for example, flying like a bird, windsurfing, swimming like a fish, tunneling like a mole, etc.

The mass of data input derived from various arrays of sensors, and otherwise completely unmanageable, is then channelled to the pilot in the form of appropriate sensory inputs to the nerve synapses corresponding to his "wings" or his "fins". Perception through the chosen metaphor is assisted by artificial intelligence software and appropriate graphic displays. The pilot switches between metaphors according to the nature of the hyperspace terrain. Such speculations stimulate imagination concerning a possible "marriage" between metaphor and artificial intelligence in relation to governance.

Imposition of names: Such a possibility can be compared to the process of naming as a means of imposing a degree of order on a perceived information environment. Clearly people are potentially free to name the features visible from the perspective of their own worldview, without subscribing to those attributed by others.

This recalls the process of psychosocial appropriation of a space at the collective level, described as *land nam* by [Ananda Coomaraswamy](#) (*The Rg Veda as Land-Nama Book*, 1935), to refer to the Icelandic tradition of claiming ownership of uninhabited spaces through weaving together a metaphor of geography of place into a unique mythic story. This territorial appropriation process, notably practiced by the Navaho and the Vedic Aryans, was further described by [Joseph Campbell](#) (*The Inner Reaches of Outer Space: metaphor as myth and religion*, 2002):

Land nam ("land claiming or taking") was [the Norse] technical term for this way of sanctifying a region, converting it thereby into an at once psychologically and metaphysical Holy Land.... *Land nam*, mythologization, has been the universally practiced method to bring this intelligible kingdom to view in the mind's eye. The Promised Land, therefore, is any landscape recognized as mythologically transparent, and the method of acquisition of such territory is not by prosaic physical action, but poetically, by intelligence and the method of art; so that the human being should be dwelling in the two worlds simultaneously of the illuminated moon and the illuminating sun.

Knowledge management: In both the above cases the response can be understood as a particular style of knowledge management.

The relevance to this argument lies in the suggestion that individuals be enabled to adopt cognitively the behavioural form of an animal with particular skills in navigating in an information environment of a specific quality with characteristic challenges and opportunities. How many feet, wings or fins? What shape and size -- swallow, leopard, snake, elephant, mosquito?

Rather than life-long adoption of a totem animal, the issue is how to acquire the flexibility to shift between forms in terms of the circumstantial need for knowledge management. This adaptability has been suggestively anticipated by the much-cited study of [D'Arcy Thompson](#) (*On Growth and Form*, 1917) and by the work of [Rene Thom](#) (*Structural Stability and Morphogenesis: an outline of a general theory of models*, 1972), especially its cognitive and semiotic implications (*Semio Physics: a sketch*, 1990).

Rather than a single conventional entity, this might even take the form of a collective entity -- as with a flock, a swarm, a shoal, or a pack -- as suggested by the manner in which intelligent agents may come to be controlled and by current reflections on [crowdsourcing](#).

Framed in this way there is a strong case for considering the manner in which flows of information can be experienced and moulded,, namely how they engage, hold and channel attention. How does attention "ride" any "waves" of information -- perhaps understood as a [carrier wave](#)? The process is implied to a degree by "web-surfing". The question is whether there are more specific articulations of the process with which people could engage through creative imagining. Some possibilities include:

- **Movement of water and in it:** Remarkable insights have been associated with the flow of water as a consequence of the work of **Viktor Schaubberger** through his learnings from trout, as described separately (*Enabling Governance through the Dynamics of Nature: exemplified by cognitive implication of vortices and helicoidal flow*, 2010). The latter includes sections on:
 - Being "in the flow" -- learnings from a trout
 - Governance and the flow of information
 - Information flow: threads and vortices
 - Vortex generation and mandalas
 - Experiential application of vortex insights
 - Helicoidal integration of dynamics of self-referential initiatives?
 - Vortex management
 - Overcoming psychosocial fragmentation and buffeting
 - Navigating psychic space?
 - Global governance vs. Toroidal governance Technological innovation as template for cognitive innovation
 - Sustainable "global" governance through double helicoidal invagination?
- **Cognitive modulation understood through electrical metaphors:** The ability to switch perspective is especially striking in relation to the widely used **Smith Chart**, invented by the electrical engineer **Phillip H. Smith** (and independently by Kaneyuki Kurokawa, a Japanese engineer). This is a graphical aid for electrical and electronics engineers specializing in radio frequency engineering to assist in solving problems with transmission lines and matching circuits. A generalized **3D Smith Chart** based on the extended complex plane (**Riemann sphere**) and inversive geometry has recently been proposed (as discussed below). The relevance is extensively discussed separately with graphics and animations (*Modulating cognitive transformations: electrical metaphors and semiconduction*, 2012)
- **Attention flow and cognitive fusion as suggested by control of plasma in nuclear fusion:** Much is now made of the potential of nuclear fusion and of the design challenges in enabling it as the ultimate source of energy. As a challenge this might be compared with that of fruitfully controlling attention, as separately discussed (*Enactivating a Cognitive Fusion Reactor: Imaginal Transformation of Energy Resourcing (ITER-8)*, 2006).
- **Engaging with manifold abstraction:** As exemplars of imaginative creativity, mathematicians and physicists now articulate the most appropriate understanding of the complexity of reality through the abstraction of a **manifold**. This is a **topological space** of potentially high dimensionality that nevertheless resembles Euclidean space near each point. Whilst necessarily eluding normal comprehension, other than through the formalism of mathematics, the nature of the spaces so indicated is consistent with the quality of the intuited experience of the existential nothingness to which so many feel exposed in one form or another -- a place that is existentially terrifying (*Thinking in Terror*, 2005). The radical cognitive challenge may well be how to be attentively in that place more fruitfully -- how to embody the otherwise alien nature of any such surface as that from which any distinguished forms emerge. As separately discussed, this can be variously framed, notably through Buddhist understanding of "**dependent origination**" (cf P. A. Payutto, *Dependent Origination: The Buddhist Law of Conditionality*) or "dependent co-arising" (cf Thanissaro Bhikkhu, *Analysis of Dependent Co-arising*). The cognitive implications of this topological insight have been remarkably articulated by **Steven M. Rosen** (*Topologies of the Flesh: a multidimensional exploration of the lifeworld*, 2006; *Dimensions of Apeiron: a topological phenomenology of space, time, and individuation*, 2004). In subsequent work, Rosen has attached particular significance to recognition of the "animal within" (*Dreams, Death, Rebirth: a multimedia topological odyssey into alchemy's hidden dimensions*, 2013). One understanding of manifold by physics is as a multidimensional **brane** -- of which of which membrane is a two-dimensional instance. the question is how to engage cognitively and experientially with that insight, as may be speculatively explored (*Global Brane Comprehension Enabling a Higher Dimensional Big Tent? Strategic implication in encompassing nothing and coming to naught*, 2011).
- **Attentive association of information flow with *qi* (*ch'i*):** As noted by **Susantha Goonatilake** (*Toward a Global Science: mining civilizational knowledge*, 1999), the metaphors developed by Asian cultures could prove vital. As a specific example, the increasingly appreciative understanding of *qi* offers indications as to how attention might be integrated with information flows. Classically *qi* is understood as an active principle forming part of any living thing -- typically explained as "life force", or "energy flow". In the light of the above argument, it can be readily extended to the cognitive modality through which information is attentively managed. This is consistent with traditional recognition of its underlying role in Chinese medicine and martial arts.

The last example is helpful in enabling the individual to recognize how it is possible to be centered within a dynamically configured cognitive flow -- variously associated with information and knowledge, and variously moulded according to circumstance. It could be understood as unicellular, but is better understood as taking on -- according to circumstance -- any animal form to which evolution has given rise along the evolutionary pathways. This suggests that rather than thinking of evolution as taking place over millions of years, the forms it has explored are indicative of creative possibilities for (re)configuring attention in the moment. Ironically, there is a sense in which this can be understood as a particular form of "creationism" -- with the individual as the Creator variously elaborating and collapsing categories through functions playfully enacted.

The latter dynamic may well be en-joyed, as separately imagined (*En-joying the World through En-joying Oneself: eliciting the potential of globalization through cognitive radicalization*, 2011). It is however the existential terror of nothingness, indicated above as a reality of living, which merits recognition -- as fruitfully framed by **Omar Khayyám**, the polymath and "poet of uncertainty", in the *Rubáiyát of Omar Khayyám*, in quatrains such as the following:

*The Worldly Hope men set their Hearts upon
Turns Ashes -- or it prospers; and anon,
Like Snow upon the Desert's dusty Face
Lighting a little Hour or two -- is gone.*

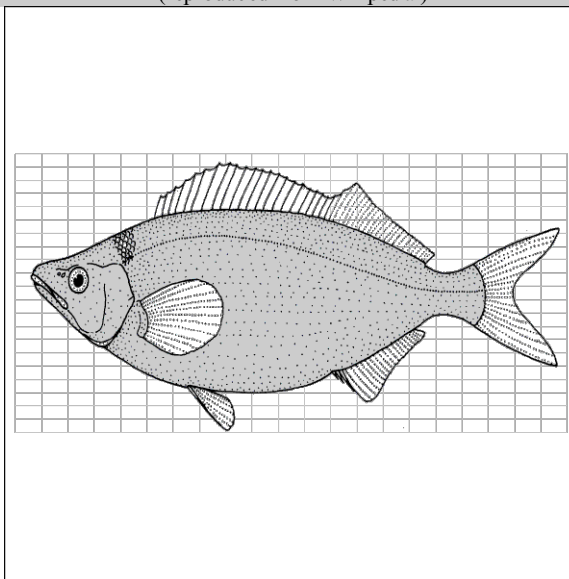
*And if the Wine you drink, the Lip you press,
End in the Nothing all Things end in -- Yes --
Then fancy while Thou art, Thou art but what
Thou shalt be -- Nothing -- Thou shalt not be less.*

Consideration of the cognitive possibilities is facilitated by recognition of the support provided by geometry as discussed and illustrated separately (*Metascience Enabling Upgrades to the Scientific Process: beyond Science 2.0 in the light of polyhedral metaphors?* 2014). However the inherent flexibility of *qi* as "attention in motion" can be usefully compared to current discussion of the experiential process of embedding in virtual reality environments. This suggests the possibility of geometrical configurations of greater than three dimensions with which identification is then possible. In this sense such configurations become viable dynamic vehicles for identity.

Especially interesting in this respect are those configurations capable of holding transformations which are otherwise considered as paradoxically impossible in three dimensions. This is exemplified by the nature of the [Klein bottle](#) and the process of [sphere inversion](#) (*World Introversion through Paracycling: global potential for living sustainably "outside-inside"*, 2013; *Psychosocial Implication of Without Within*, 2013). These are suggestive of complex forms potentially appropriate to individual self-reflexivity -- and its credible engagement with engendering corresponding collective forms vital for global governance (*Sustaining a Community of Strange Loops: comprehension and engagement through aesthetic ring transformation*, 2010).

The fluidity and malleability of form can be usefully illustrated and imagined through the diagrams originally presented by [D'Arcy Thompson](#) (*On Growth and Form*, 1917). Rather than reproduce his images, the process can be admirably illustrated by the manipulation of images using the functionality of Adobe Illustrator, as separately discussed (*Computer Use as Philosophy in Operation: metaphors of the inner game*, 2003). These are embodied in the animation below. He made the point that the appearance of many distinct species arose from a simply "distortion" of a geometrical framework.

Animation illustrating change of form between forms typical of a range of fish species
based on manipulation using Adobe of an image of the [Telescope fish](#)
(*Mendosoma lineatum*)
(reproduced from Wikipedia)



Enacting a cognitive array of systemic functions

Playing the Great Game: It is useful to recognize the extent to which the individual effectively engages in playing the great game through variously reframing the external environment, as discussed separately with respect to a social analogue (*Playing the Great Game with Intelligence: Authority versus the People*, 2013). In the terms of the current argument, one is then oneself "the Authority", and the diversity encountered is "the People".

As the key player, and central Authority, the individual can imagine acting in the role of:

- a military general obliged to deploy an array of forces with various skills
- a leader of a belief system, as with hierarchically organized religions (Catholicism, Mormonism, etc), obliged to deploy an array of cardinals with diocesan responsibilities (or their analogues), perhaps complemented by an array of distinctive religious orders with particular preoccupations
- a corporate chief executive officer, obliged to deploy an array of divisions with distinct responsibilities and competences
- a director of an international association (perhaps an NGO), obliged to deploy an array of sectoral and regional interest groups
- a president of a country, obliged to deploy an array of ministries, having a variety of responsibilities, through which governance is ensured
- a spymaster, obliged to deploy a range of distinct networks through which intelligence is obtained and by which covert activities are undertaken
- a "methodological leader", or exemplar, preoccupied with a particular form of knowledge, as with science and its questionably

ordered disciplines, as separately discussed (*Symbolic implications: ICSU as a case study*, 2014)

- a leader of a network of organized crime (as with the Mafia), obliged to regulate the relationship between crime families

In each of these leadership roles information is obtained through the array of divisions -- usefully understood in this argument as appendages (limbs, wings, fins) or sensory functions (antenna, etc). Instructions for response may be conveyed through that "chain of command" in the light of that information. Equivalents can be recognized in the more familiar challenge of the control of a complex vehicle -- whether an automobile, a helicopter, or a spaceship (as envisaged above).

Cognitive constraints in the face of complexity: Some sense of the complexity of the situation (to which response is required) may be recognized, obtained or assumed. This recalls the assessments of the [Situational Complexity Index](#) (SCI). In enacting any such deployment of functions, key constraints include:

- "Miller number" (7 ± 2): the much cited constraint reported by [George Miller](#) (*The Magical Number Seven, Plus or Minus Two: some limits on our capacity for processing information*, *Psychological Review*. 1956). Included in the SCI.
- "Spreadthink number": as identified by [John N. Warfield](#) (*Spreadthink: Explaining ineffective groups*, 1995). He states that this collective condition is generally neither recognized nor usually compensated for. Spreadthink reflects the fact that any time a group meets to work together on a complex issue using ordinary and familiar group processes, the individuals in the group will not agree on what are the most important sub-issues, and in general will not have a majority view on the merits of any of the many sub-issues. In the SCI, this is assumed to be 5. Warfield's related argument with respect to mindbugs has been developed by [Vladimir N. Tretyakov](#) (*Evolution Classification of John Warfield's Mindbugs*, 2012).
- "Dunbar's number": as formulated by [Robin Dunbar](#), This is a suggested cognitive limit to the number of people with whom one can maintain stable social relationships ([Christopher Allen](#), *The Dunbar Number as a Limit to Group Sizes*). These are relationships in which an individual knows who each person is and how each person relates to every other person. Proponents assert that numbers larger than this generally require more restrictive rules, laws, and enforced norms to maintain a stable, cohesive group. The limit has been proposed to lie between 100 and 230, with a commonly used value of 150.
- **Span of control** (aka span of management): The number of subordinates a leader can efficiently control or manage. As noted in an extensive discussion in *Wikipedia*, in the hierarchical business organization of some time in the past it was not uncommon to see average spans of 1 to 4, or even less -- one manager supervising four employees on average. In the 1980s corporate leaders flattened many organizational structures giving average spans in the range 1 to 10. Theoretical analysis now takes into account "Fayol's bridge", whereby allowance is made for direct communication between subordinate employees, given that their superiors had agreed upon this procedure.

Of potential relevance to this argument are the cognitive analogues to the fundamental biological constraints indicated by the:

- **Hayflick limit:** This is the number of times a normal human cell population will divide until cell division stops. Hayflick demonstrated that a population of normal human fetal cells in a cell culture will divide between 40 and 60 times.
- **Cilia:** Inside cilia and flagella is a microtubule-based cytoskeleton called the axoneme. The axoneme of primary cilia typically has a ring of nine outer microtubule doublets (called a 9+0 axoneme), and the axoneme of a motile cilium has two central microtubule singlets in addition to the nine outer doublets (called a 9+2 axoneme).

However all these are quantitative measures constraining the conscious articulation of functions. Potentially more complex are the qualitative distinctions to which the deployed functions may be assumed to be appropriately responsive -- and the capacity to engage with those distinctions. These might include various approaches to recognition of mindscapes and cultural biases, as separately reviewed (*Systems of Categories Distinguishing Cultural Biases*, 1993).

The issue is one of how many strategies can an individually be usefully aware -- or be able to recall when appropriate? If the role of distinctive species in the environment is readily ignored, as beyond the scope of human comprehension, why expect interest in their distinctive behaviour?

It is useful to note how constrained patterns of distinctions have been articulated in a variety of domains (*Patterns of N-foldness: comparison of integrated multi-set concept schemes as forms of presentation*, 1980).

Constrained pattern of appendages and functions: The following tentative exercise endeavours to indicate how appendages can be considered as increasing the number of functions deployed. The table design is obviously defective in not including other sensory organs (eyes, ears, etc).

Speculative framework associating species with number and character of functions (very tentative)						
(number effectively increased for pair-bound male+female)						
Potential "functions"						
	<i>Feet</i>	<i>+Arms / Wings / Fins</i>	<i>+Antenna</i>	<i>+Tail</i>	<i>+Tongue</i>	<i>+Penis</i>
Single	snake?					
2-fold	human, bird					
3-fold				kangaroo, etc		
4-fold	human (m+f)	human, bird				
5-fold		starfish		kangaroo, monkey, etc	humans, etc	
6-fold	insect				kangaroo, monkey, etc	humans, etc
7-fold						kangaroo, monkey, etc
	spider,	human (m+f)	0-winged insect			

8-fold	octopus	2-winged insect	(with 2 ant.)			
9-fold						
10-fold	decapoda	4-winged insect	2-winged insect (with 2 ant.)		human (m+f)	
11-fold						human (m+f)
12-fold			4-winged insect (with 2 ant.)			

The table raises interesting questions regarding any correspondence between the number of "functions" through which species interact with reality and the number of "dimensions" by which humans now consider it appropriate to define reality -- given the focus on the requirement by [superstring theory](#) for 10 dimensions and by [M-theory](#) for 11 dimensions. The 11-fold case in the table then clearly invites speculative comment regarding the number of "dimensions" that a human couple can handle -- potentially bypassing, as a couple, the constraint of the Miller and Warfield numbers, and that of span of control.

Also of relevance with respect to the relative movement of the above "appendages", as implying functions, is the work on gestures of Rafael Núñez (*A fresh look at the foundations of mathematics: gesture and the psychological reality of conceptual metaphor*, 2008).

Enacting as en-minding: Elements of the above argument have been developed otherwise (*En-minding the Extended Body: enactive engagement in conceptual shapeshifting and deep ecology*, 2003). This includes the following sections:

- | | |
|---|--|
| Sets of operational concepts in collective enterprises | Identity, invariance and enactivism |
| Sets of animal appendages | Unconscious models as beasts of the imagination |
| Animal movement and conceptual exoskeletons | Endangering species by rationalizing the environment |
| Dynamic coordination of sets in movement | Memetics as the under-explored analogue to genetics |
| Indigenous insights | Memetic engineering: a Western discovery ? |
| Animal locomotion: example of walking as a cognitive metaphor | Memetic engineering: an Eastern practice ? |
| Shapeshifting | Neurobiological clarification |
| Insights into shapeshifting from collective behaviour | Memetic engineering: Western magical arts ? |
| Conceptual endoskeleton vs Conceptual exoskeleton | |

Existential choice and feasibility: freedom to be otherwise

The possibility of individual or collective choice to engage "otherwise" with reality -- however radically or fantastic -- has been variously discussed separately (with extensive references):

- [Being a Waveform of Potential as an Experiential Choice: emergent dynamic qualities of identity and integrity](#) (2013)
- [Enabling radical reframing of reality by non-physicists](#) (2014)
- [Promoting a Singular Global Threat -- Terrorism: strategy of choice for world governance](#) (2002)
- [Cultivating Global Strategic Fantasies of Choice: learnings from Islamic Al-Qaida and the Republican Tea Party movement](#) (2010)
- [Radical choice \(Conditions of Objective, Subjective and Embodied Cognition: mnemonic systems for memetic coding of complexity](#), 2007)
- [Recovering a fundamental right and freedom](#) (Being What You Want: problematic kataphatic identity vs. potential of apophatic identity? 2008)
- [Being Other Wise: clues to the dynamics of a meaningfully sustainable lifestyle](#) (1998)
- ["Human Intercourse": "Intercourse with Nature" and "Intercourse with the Other"](#) (2007)

Readily recognizable examples of the "freedom to switch" imaginatively include:

- children's games: in which roles are taken on, possibly taken on in turn (being a cop, or a robber; a cowboy or an Indian, etc)
- theatre: in which roles are taken on for the play
- therapeutic processes: in which people explore various roles in relation to their particular trauma
- religious conversion: in which a religion is adopted or changed
- "changing one's mind": notably in response to political issues or appreciation of music or celebrities
- projection of identity into an object: "my car", "my rifle", "my sword", etc
- falling in love, or out of it

The change in question may be unrecognizable to others. Although possibly taken very seriously, and held to be deeply significant, the switch may well be simply understood as a change of attitude -- indicated separately as a highly individual form of cryptocurrency (*Circulation of the light: What flows? What circulates? Cryptocurrency?* 2014). The framing of any such change in terms of a "switch" metaphor, may however be usefully challenged (*Recontextualizing Social Problems through Metaphor: transcending the 'switch' metaphor*, 1990).

Transcending genocidal objectification

The argument has stressed the flexibility with which engagement with "otherness" can be enabled. It challenges the rigidity by which externalities are defined through categories. This can be variously discussed:

- [Reframing the Dynamics of Engaging with Otherness](#) (2011)
- [Existential challenge of "The Other"](#) (2007)
- [Snoring of The Other: a politically relevant psycho-spiritual metaphor?](#) (2006)

- *∫∫ Defining the objective ∞ Refining the subjective ?!: Explaining reality ∞ Embodying realization* (2011)
- *Conditions of Objective, Subjective and Embodied Cognition: mnemonic systems for memetic coding of complexity* (2007)
- *Framing the Global Future by Ignoring Alternatives: unfreezing categories as a vital necessity* (2009)

Such arguments then clarify the nature of the cognitive reification and **objectification** through which an "other" is transformed into an "it" with which there is a purely instrumental relationship -- unconditioned by any sense of empathy or compassion, namely a total indifference to its possible suffering. This can also be variously discussed (*Indifference to the Suffering of Others: occupying the moral and ethical high ground through doublespeak*, 2013; *Marrying an Other whatever the Form: reframing and extending the understanding of marriage*, 2013; *Us and Them: relating to challenging others*, 2009; *Transcending Simplistic Binary Contractual Relationships*, 2012).

The objectification process enables and legitimates phenomena such as the following:

- killing of animals, including
 - most notably on an industrial scale (in **slaughterhouses**)
 - systematic hunting (as exemplified by the case of the bison, or of whaling)
 - ocean fishing on industrial scales, irrespective of issues of **overfishing**
 - **culling** (in conformity with conservation and other controversial agendas)
 - **trophy hunting**
- killing of humans, including
 - warfare, most notably using weapons of mass destruction
 - mass shooting, irrespective of concerns relating to gun control
 - systematic genocide
 - most notably on an industrial scale (concentration camp gas ovens, etc)
 - **massacres**
 - capital punishment
 - legitimated killing of **infidels** and **apostates**.
 - **targetted killing**
- violence against humans, including
 - domestic violence
 - street violence
 - torture
 - **human experimentation**, most notably on prisoners, military personnel and the variously handicapped.
- **intensive animal farming** (including aquaculture), unconstrained by **issues of animal welfare**
- **animal experimentation**, most notably in pharmaceutical laboratories
- deforestation, together with indifference to the associated loss of habitat for many species

The violence against "others" -- typically in an effort to subsume or eliminate them -- precludes real possibilities of learning from them. This may well have profound implications for individual and collective health -- and survival in a global society in crisis, characterized by **lifestyle diseases** (*Cognitive Implications of Lifestyle Diseases of Rich and Poor: transforming personal entanglement with the natural environment*, 2010). These may be echoed and reinforced by "information diseases" (*Memetic and Information Diseases in a Knowledge Society: speculations towards the development of cures and preventive measures*, 2008).

Enabling imaginative possibilities

Exploring biological patterns, there is a case for seeing oneself at any one moment as conforming to dynamics of any amongst a wide spectrum of species, from all levels of the evolutionary diaspora. There is a way in which one can be an amoebic blob, a spider, a snake, a bird, a wolf, etc. To what degree are we all behavioural shapeshifters? Should shapeshifting be a part of our education -- as Merlin offered the young Arthur (in T H White's *Once and Future King*, 1958) and as in totemic education in many tribes? The possibilities are separately discussed (*Secret sharing, Shapeshifting and Embodiment Reintegration of a Remaindered World*, 2011).

How are we constrained in adopting particular behavioural patterns? When is there a case for experiencing reality as an amoeba? A doormouse? A tiger? What ecosystems do we then require in order to survive and thrive? How do we relate to others through such patterns?

People may have different degrees of access to such patterns. More intriguing is to understand the range of such patterns as being arrayed mnemonically in some way -- a global map of memetic possibilities, perhaps like a periodic table which one is free to play like an organ (*Periodic Pattern of Human Knowing: implication of the Periodic Table as metaphor of elementary order*, 2009; *Periodic Pattern of Human Life: the Periodic Table as a metaphor of lifelong learning*, 2009). The **Periodic Table** is especially significant in that it is considered to be one of the most comprehensive generalizations of science.

As noted above, there is indeed a literature on "learning from animals" (cf. Monique A. R. Udell and Clive D. L. Wynne, *Learning from Animals. Encyclopedia of the Sciences of Learning*, 2012; Louise S. Röska-Hardy and Eva M. Neumann-Held, *Learning from Animals?: Examining the Nature of Human Uniqueness*, 2008; Marc Bekoff, *Learning from Animals, Resurgence and Ecologist*, March/April 2012; Jeff Howlin, *Learning from Animals: why it matters*, 2012).

The emphasis here is however on the systematics of animal behaviour rather than on specific instances or general principles. It is such systematics that could enable the emergence of a global sense of pattern of strategic possibilities as a resource on which individuals could draw. A formal analysis of such possibilities, and their simulation, would then enable comparison with the kinds of strategy currently

advocated -- exemplified by the 32,000 profiled in the [Global Strategies Project](#) (as mentioned above)

The argument to be stressed is the role of the active imagination -- and the attraction this may have for the younger generations -- impoverished in that respect by their elders with regard to the world of externalities in crisis (*Existential Embodiment of Externalities: radical cognitive engagement with environmental categories and disciplines*, 2009; *Reimagining Principles Enabling an Existential Ecostery: engendering out-of-the-box awareness and its transformation*, 2013; *Imagining Attractive Global Governance: questioning possibilities and constraints of well-boundedness*, 2013).

How one dons and doffs such patterns in a continuing dance with reality is then the challenge. How can one learn to dance with greater elegance, elan, engagement and enthusiasm? How frequently to alternate between such patterns?

There is of course the challenge of how to live simultaneously in the "real world" and in that which it is possible to imagine as more meaningfully consistent with the challenges of living, as discussed separately (*Living as an Imaginal Bridge between Worlds: global implications of "betwixt and between" and liminality*, 2011).

Irrespective of human challenges, there remains the issue indicated by reference in the title to animals as "shareholders" and "collaborators" in this global enterprise. In a world dominated by a financial mindset, it is appropriate to extend the metaphor and recognize that animals are also "stockholders", "bondholders" and "stakeholders" in the enterprise -- in addition to many being "employees", if only within each human body. They can in fact be usefully recognized as "majority shareholders".

It is in this sense that the provocative argument of [Ayn Rand](#) (*Atlas Shrugged*, 1957) can be reinterpreted. The danger is that, as majority shareholders, animals may effectively "shrug". Given the evident challenge from a financial perspective of maintaining shareholder confidence, it is appropriate to ask whether "shrugging" might take some form of "biological action" (like the [bee colony collapse](#), rather than "industrial action"). How then to sustain confidence, as speculatively explored (*Primary Global Reserve Currency: the Con? Cognitive implications of a prefix for sustainable confidence*, 2011)?

References

Charles Abraham and Susan Michie. A Taxonomy of Behavior Change Techniques Used in Interventions. *Health Psychology*, 27, 2008, 3, pp. 379-387 [[text](#)]

David Abram. *The Spell of the Sensuous: perception and language in a more-than-human world*. Random House, 1997 [[review](#) | [review](#) | [review](#)]

John Alcock. *Animal Behavior: an evolutionary approach*. Sinauer Associates, 2013

Christopher Alexander:

- Harmony-Seeking Computations: a science of non-classical dynamics based on the progressive evolution of the larger whole. *International Journal for Unconventional Computing (IJUC)*, 5, 2009 [[text](#)]
- New Concepts in Complexity Theory: an overview of the four books of the Nature of Order with emphasis on the scientific problems which are raised. 2003 [[text](#)]
- The Nature of Order: an essay on the art of building and the nature of the universe. Center for Environmental Structure, 2003-4. [[summary](#)]
- A Pattern Language: towns, buildings, construction. Oxford University Press, 1977

S. Altran. *Cognitive Foundations of Natural History: towards an anthropology of science*. Cambridge University Press, 1993

Michael Archinal. *Animal Wisdom: stories from an Australian vet on what animals can teach us about love, health happiness*. Macmillan, 2013

David Aubin. Forms of Explanations in the Catastrophe Theory of René Thom: topology, morphogenesis, and structuralism. In: M. N. Wise (Ed.), *Growing Explanations: historical perspective on the sciences of complexity*, Duke University Press, 2004, pp. 95-130 [[text](#)]

Dermot Barnes and Y. Holmes. Radical behaviorism, stimulus equivalence, and human cognition. *The Psychological Record*, 41, 1991, pp. 19-31

Gregory Bateson. *Mind and Nature; a necessary unity*. Dutton, 1979

Marc Bekoff. Learning from Animals. *Resurgence and Ecologist*, 271, March/April 2012 [[text](#)]

Mark Bennett and Miles Kehoe. Behavior Based Taxonomies: Far Better. *New Idea Engineering*, 6, 2004 [[text](#)]

Janine Benyus. *Biomimicry: innovation inspired by nature*. William Morrow / Quill, 1998

Kenneth Boulding. *Ecodynamics; a new theory of societal evolution*. Sage, 1978.

Michael D. Breed and Janice Moore (Eds.). *Encyclopedia of Animal Behavior*. Academic Press, 2010

Michael D. Breed and Janice Moore. *Animal Behavior*. Academic Press, 2011

James Cowan:

- On Totems. *Resurgence*, 138, 1990, pp. 30-34
- Myths of the Dreaming: Interpreting Aboriginal Legends. Prism, 1994

- *Mysteries of the Dreaming: the spiritual life of Australian Aborigines*. Prism, 2001

Terrence W. Deacon:

- *Incomplete Nature: how mind emerged from matter*. W. W. Norton, 2012
- *The Symbolic Species: the co-evolution of language and the brain*. W. W. Norton, 1997

Diana Delgado and Linda J. Hayes. The Acquisition of a Conceptual Repertoire: an analysis in terms of substitution of functions. *The Behavior Analyst Today*, 8, 2007, 3, pp. 307-316 [[text](#)]

Bill Devall. *Simple in Mind, Rich in Ends: practicing deep ecology*. Peregrine Smith, 1988

W. H. Edmondson:

- *A Taxonomy for Human Behaviour and Human-Computer Interaction*. In: G. Salvandy and M.J. Smith (Eds.), *Advances in Human Factors/Ergonomics 19B: Human-Computer Interaction: Software and Hardware Interfaces*, Elsevier, 1993, pp 885-890
- *A Taxonomy for Users' Behaviour in Human Computer Interaction*. In: M. M. Taylor, F. Néel and D. G. Bouwhuis (Eds.), *The Structure of Multimodal Dialogue II*, John Benjamins, 2000, pp 335-348

Warwick Fox:

- *Toward a Transpersonal Ecology: developing new foundations for environmentalism*. Green Books, 1995
- *Approaching Deep Ecology: a response to Richard Sylvan's Critique of Deep Ecology*. University of Tasmania, 1986 [[overview](#)]

Raghavendra Gadagkar. *Survival Strategies: cooperation and conflict in animal societies*. Harvard University Press, 2001

Susantha Goonatilake. *Toward a Global Science: mining civilizational knowledge*. Indiana University Press, 1999

Peter Harper. A Microcosm of Life; the way we organize our gardens reflects the way we organize our lives, our society, our politics, our businesses and our knowledge. *Resurgence*, 164, 1994

Mark Patrick Hederman. *Dancing with Dinosaurs: a spirituality for the 21st Century*. Columba Press, 2011

Chris Hedges. *Dancing with Dinosaurs*. *The New Humanist*, 122, 2, March/April 2007 [[text](#)]

Douglas Hofstadter and Emmanuel Sander. *Surfaces and Essences: analogy as the fuel and fire of thinking*. Basic Books, 2013

Jeff Howlin. *Learning from Animals: why it matters*. 2012 [[text](#)]

Camilo Hurtado-Parrado. *A Non-Cognitive Alternative for the Study of Cognition: an interbehavioral proposal*. 2009 [[text](#)]

Emilio Ribes Iniesta. A theoretical and experimental program on human and animal behaviour. *International Journal of Psychology*, 41, 2006, 6, pp. 436-448 [[abstract](#)]

Clay A. Johnson. *The Information Diet: a case for conscious consumption*. O'Reilly Media, 2012

Mark Johnson:

- *The Meaning of the Body: aesthetics of human understanding*. University of Chicago Press, 2007
- *The Body in the Mind: the bodily basis of meaning, imagination, and reason*. University of Chicago Press, 1987.

J. R. Kantor:

- *An analysis of the experimental analysis of behavior*. *Journal of Experimental and Analytical Behavior*, 13, 1970, 1, pp. 101-108
- *Interbehavioral Psychology*. Principia Press, 1959

Jan Komdeur. Variation in Individual Investment Strategies among Social Animals. *Ethology*, 112, 2006, pp. 729-747 [[text](#)]

George Lakoff and Mark Johnson. *Philosophy In The Flesh: the embodied mind and its challenge to Western thought*. Basic Books, 1999

George Lakoff and Rafael Núñez. *Where Mathematics Comes From: how the embodied mind brings mathematics into being*. Basic Books, 2001

Dudley Lynch and Paul L. Kordis. *Strategy of the Dolphin*. Ballantine, 1988

Alan Marshall:

- *Wild Design: ecofriendly innovations inspired by nature*. North Atlantic Books, 2009
- *The Unity of Nature: wholeness and disintegration in ecology and science*. Imperial College Press, 2002
- *This Pointless Thing Called Life*. Graphically, 2013

Emilia P. Martins:

- *Phylogenies and the Comparative Method in Animal Behavior*. Oxford University Press, 1996
- *Adaptation and the Comparative Method*. *Trends in Ecology and Evolution*, 15, 2000, pp. 295-299

Magoroh Maruyama:

- *Polyocular Vision or Subunderstanding?* *Organization Studies*, 25, 2004, pp. 467-480
- *Individual Types: Subcultural or Transcultural*. *The General Psychologist*, 36, 2001, 3, pp. 64-67
- *Mindscapes, social patterns and future development of scientific theory types*. *Cybernetica*, 1980, 23, 1, pp. 5-25

Susan Michie, Michelle Richardson, et al. The Behavior Change Technique Taxonomy of 93 Hierarchically Clustered Techniques: building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, 46, 2013, 1, pp 81-95. [[abstract](#)]

Peter Miller. *The Smart Swarm: how understanding flocks, schools, and colonies can make us better at communicating, decision making, and getting things done*. Avery, 2010

Edward K. Morris, Stephen T. Higgins, and Warren K. Bickel. The influence of Kantor's interbehavioral psychology on behavior analysis. *Behavioral Analysis*, 5, 1982, 2, pp. 159-173 [[abstract](#)] [[text](#)]

Arne Naess. Identification as a source of deep ecology attitudes. In: Michael Tobias (Ed.), *Deep Ecology*, Avart Books, 1985, pp. 256-270

Rafael Nunez. A fresh look at the foundations of mathematics: gesture and the psychological reality of conceptual metaphor. In: Cienki, Alan and Cornelia Müller (Eds.), *Metaphor and Gesture*, 2008, pp. 93-114 [[abstract](#)]

Terry J. Ord and Emilia P. Martins. Behavioral Phylogeny: the evolutionary origins of behavior. *Encyclopedia of Animal Behavior*, pp. 87-92 [[text](#)]

Jessica Dawn Palmer. *Animal Wisdom*. Thorsons, 2001

G. A. Parker and R. A. Stuart. Animal Behavior as a Strategy Optimizer: evolution of resource assessment strategies and optimal emigration thresholds. *The American Naturalist*, 110, 1976, 976, pp. 1055-1076 [[abstract](#)]

Kevin M. Passino. *Biomimicry for Optimization, Control, and Automation*. Springer, 2005

Helena Pedersen. *Animals in Schools: processes and strategies in human-animal education*. Purdue University Press, 2009

Darrell A. Posey (Editor). *Cultural and Spiritual Values of Biodiversity: a complementary contribution to Global Biodiversity Assessment*. Intermediate Technology, 1999 (for the United Nations Environment Programme)

W. Pyper. Emulating nature: the rise of industrial ecology. *Ecos*, 2006, 129, pp. 22-26

Alan C. Repp and Diane E. D. Deitz. Using an Ecobehavioral Analysis to Determine a Taxonomy for Stereotyped Responding. *Ecobehavioral Analysis and Developmental Disabilities Disorders of Human Learning, Behavior, and Communication*, 1990, pp 122-140 [[abstract](#)]

A. Rayner. *Degrees of Freedom: living in dynamic boundaries*. Imperial College Press, 1997

Bryan Roche and Dermot Barnes. The Behavior of Organisms? *The Psychological Record*, 47, 1997, pp. 597-618 [[text](#)]

Steven M. Rosen:

- *Dreams, Death, Rebirth: a multimedia topological odyssey into alchemy's hidden dimensions*. 2013 [[text](#)]
- *Topologies of the Flesh: a multidimensional exploration of the lifeworld*. Ohio University Press, 2006 [[text](#)]
- *Dimensions of Apeiron: a topological phenomenology of space, time, and individuation*. Editions Rodopi, 2004 [[text](#)]

Louise S. Röska-Hardy and Eva M. Neumann-Held (Eds.). *Learning from Animals?: Examining the Nature of Human Uniqueness*. Psychology Press, 2008

Michael Sappol. *Empires in Bodies: Bodies in Empires* ***

Maxine Sheets-Johnstone. *The Primacy of Movement*. John Benjamins, 2011 [[review](#)]

Paul W. Sherman and John Alcock. *Exploring Animal Behavior: readings from American Scientist*. Sinauer Associates, 2013

Neil Shubin. *The Universe Within: the deep history of the human body*. Random House, 2013

A.E. Stuart, F.F. Hunter and D.C. Currie. Using behavioural characters in phylogeny reconstruction. *Ethology, Ecology and Evolution*, 14, 2002, 2, pp. 129-139 [[abstract](#)]

Rupert Sheldrake:

- *The Science Delusion: freeing the spirit of enquiry*. Coronet, 2012
- *A New Science of Life: the hypothesis of formative causation*. J P Tarcher, 1981
- *A New Science of Life: the hypothesis of morphic resonance*. Park Street Press, 1995
- *Morphic Resonance: the nature of formative causation*. Park Street Press, 2009

Tina M. Sidener, Daniel B. Shabani and James E. Carr. A Review of the Behavioral Evaluation Strategy and Taxonomy (BEST OR) Software Application. *Behavioral Interventions*, 19, 2004, pp. 275-285

B. F. Skinner. *The Behavior of Organisms: an experimental analysis*. Appleton-Century-Croft, 1938 [[summary](#)]

Henryk Skolimowski:

- *The Participatory Mind*. Penguin Arkana, 1994
- *Eco-Philosophy: designing new tactics for living*. Marion Boyers, 1981

J. Maynard Smith and G. R. Price. Logic of animal conflict. *Nature*, 246, 1973, 5427, pp. 15-18

Diane H. Sonnenwald and Mirja Iivonen. An Integrated Human Information Behavior Research Framework for Information Studies. *Library and Information Science Research*, 21, 1999, 4, pp. 429-457 [[text](#)]

Stefan Swanepoel. *Surviving Your Serengeti: 7 Skills to master business and life*. Wiley, 2011

Rene Thom:

- Structural Stability and Morphogenesis: an outline of a general theory of models. W. A. Benjam, 1972
- Semio Physics: A Sketch. Addison Wesley, 1990
- Apologie du Logos. Hachette, 1990

D'Arcy Wentworth Thompson. *On Growth and Form*. Dover, 1917

Monique A. R. Udell and Clive D. L. Wynne. Learning from Animals. *Encyclopedia of the Sciences of Learning*, 2012, pp. 1854-1856

Francisco Varela. *Laying Down a Path in Walking: essays on enactive cognition*. New York, Zone Books/MIT Press, 1997

Francisco Varela, E Thompson, and E Rosch. *The Embodied Mind: cognitive science and human experience*. MIT Press, 1991

J. N. Warfield. *Understanding Complexity: thought and behavior*. AJAR Publishing Company, 2002

John W. Wenzel. Behavioral Homology and Phylogeny. *Annual Review of Ecology and Systematics*, 23, 1992, pp. 361-381 [[abstract](#)]

Ken Yeang. *Ecomimicry: ecological design by imitating ecosystems*. Routledge, 2013

Gary Yukl, Angela Gordon and Tom Taber. A Hierarchical Taxonomy of Leadership Behavior: integrating a half century of behavior research. *Journal of Leadership and Organizational Studies*, 9, 2002, 1, pp. 15-32 [[abstract](#)]



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