The Growth Delusion: why we don't want to believe in Peak Oil and Climate Change

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Abstract

Concern for the environment and a move towards "sustainable development" has assisted progress in a wide range of renewable energy technologies in recent years. The science suggests that a transition from fossil fuels to sustainable sources of energy in a time frame commensurate with the demise of the fossil fuels and prevention of runaway climate change is needed. However, while the movement towards sustainable energy technologies is underway the world does not want to give up the idea of continuing economic growth.

The transition will be difficult to achieve as nowhere within existing economic and political frameworks are the limits to when growth will be curtailed being set. It is possible that the irrational insistence on endless growth as a non negotiable axiom, by a large proportion of the world's population, may in fact be akin to the similarly irrational belief, by a similarly large proportion of the world's population, that a supernatural being controls our existence and destiny. The irrationality of religion has recently been examined by Richard Dawkins (2006) in "The God Delusion". Dawkins' book is used as a starting point to investigate similarities between a belief in God and a belief in continuous growth.

The contention

The contention of this paper is that:

- The twin problems of peak oil and climate change are underpinned by our belief that economic growth can be supported indefinitely by a finite earth.
- This irrational belief is consistent with the evolutionary history of the brain and in particular its modular structure which can allow two or more contradictory views to be held and believed concurrently.
- That the above situation occurs can be illustrated with the widespread example of religious beliefs. Here similarly irrational beliefs are found to be held concurrently with modern scientific ones with little overlap. The similarity between a belief in an all powerful entity and a belief in never ending economic growth is striking and may lead to insights into our present situation with regards to peak oil and climate change.
- Our recent history of extreme free market economics, fostered by corporate and financial interests over the last two or three decades, has reduced the ability of most governments to control, or even think about controlling, economic growth. (This conclusion was reached in Lloyd 2007).

1.0 Introduction

In *The Commons revisited the tragedy continues* (Lloyd 2007), it was argued that the problems of peak oil and climate change were essentially problems of the commons (Hardin 1968). The tragedy of the commons hinges on the proposition that humans act individually, or as nation states, in an entirely self interested manner with short term aspirations and not in the interests of the long term survival of the human race. Heinen and Low (2007) argue much the same thing; they suggest that our evolutionary history has predisposed humans to relate only to proximate rewards and punishments and not long term ultimate costs and benefits. These authors, however, discuss our ability to cope only in terms of our evolutionary history and take little account of the fact that some parts of the brain, at least, can act rationally for some of the time.

If we were able to act purely rationally over the long term, at a global level, then the commons tragedy would in all likelihood disappear and a stable relationship with the earth and its resources could be established. The nagging question, not fully addressed in Lloyd 2007, is whether structural problems in our brain prevent such a solution from occurring? Is the ultimate problem more basic than expressed by the proximate problems posed by global conspiracies, corporate interests and world politics? The present paper attempts to address this nagging question.

It should be obvious that economic growth, involving ever greater use of fixed resources, cannot occur indefinitely in any bounded system (Hubbert 1949, Meadows et al 1972, Catton 1982, Peet 1992, Daly et al 1993, Ehrlich 2002, Meadows et al 2004, Bartlett 2004, Campbell 2005, and many others). Yet continuous economic growth is not seen as a problem by much of society today and those who suggest otherwise are denigrated as aberrant spoilsports (Simon 1980, Kallio 2007 and Bardi 2008). Bardi's essay in particular has recently analysed the reaction to the 1972 Meadows et al paper and supports the conclusion that the opposition comprised a combination of vested interests from corporations, academia (economists), religious and political establishments all aligned against any hint that growth should be limited. Indeed the world has even defined a paradigm called sustainable development that is axiomatically both sustainable and able to grow (IUCN 1980). This arrangement suits both the rich and the poor. The poor need economic development, for without it they are highly likely to perish, given high levels of population growth. The rich need economic development because it allows businesses to grow and make lots of money for the people who control the rich economies. This latter need has been compounded in the last few decades with the almost complete capitulation of world economies to the neo conservative Washington Consensus (see Williamson 1994) and the simultaneous demise of alternative economic systems (Beder 2006, Klein 2007). Unfettered, unrestrained economic growth with minimal government interference is now the axiom of economic sustainable (sic) development. Some evolutionary psychologists are even talking of *Homo economicus* (Wilson et al 2007). While the sheep in Orwell's Animal Farm bleat "four legs good two legs bad" repeatedly, we all bleat growth is good, growth is good.

Peak oil then poses a problem, because economic development is so dependent on, energy resources with a favourable energy returned on energy invested (EROEI), in particular on

an ever increasing flow of crude oil. If sustainable development is a self obvious axiom then peak oil cannot exist and oil must be capable of flowing more or less indefinitely (Simon 1980)! An alternative, less severe, argument accepts that peak oil exists but suggests that substitute products will be found or that the demise in crude oil will occur sufficiently far in the future that it need not be of concern.

In terms of the climate change problem, the scientific community, at least, is pretty much universally convinced that anthropogenic climate change is occurring (IPCC 2007). This agreement suggests that if vested interests can be excluded, peer reviewed scientific research can come to a common conclusion across a wide range of cultures and scientific disciplines. In the climate change situation the concentration of CO_2 in the atmosphere can be accurately measured and so not easily falsified or obscured as are the extent of existing and possible future oil reserves. The link from CO_2 growth to climate change, however, is more problematic and it is here that the detractors concentrate. Growth in CO_2 concentration is a direct result of population and economic growth and thus climate change is another problem that sits uneasily within the never ending growth paradigm.

There is thus a large section of growth oriented big business and financial market organisations which are still trying to deny anthropogenic climate change or argue that it will not affect (or be allowed to affect) the growth axiom. Recently in New Zealand, a consortium of business organisations, farming cooperatives, lobby groups and think tanks have sponsored web sites and are sponsoring an Australian and New Zealand Commission on Global Warming to counter the IPCC reports and wind back any economic incentives to punish CO_2 emitters (Scoop 2008). Similar organisations to the above exist in many other countries, as do organisations dedicated to spread doubt about global resource depletion including peak oil. Exxon has recently admitted funding such organisations and agreed to cut back this support although others suggest that this cut back may not eventuate (Greenpeace 2008).

In terms of energy use Hubbert realised as early as 1949 that the world would need to make the transition from fossil fuels to renewable sources of energy and that this would need to be accomplished before peak oil, as the resources needed for the transition were too great to be provided for by renewable energy alone (Hubbert 1949) . Hubbert provided three scenarios in his 1949 paper, one leading to the continuation of high energy use per capita for the world. This scenario he suggested would occur if the transition was made starting a sufficient time before peak oil so that the fossil fuel resources could provide the embodied energy to fabricate the renewable energy devices. The two other scenarios would be the result if the transition was not so timely. In both of the latter scenarios a collapse in population was postulated. These early non quantitative results of Hubbert were put into a computational model format by Meadows et al 1972 who showed essentially the same result.

Given these prior warnings it is staggering that we have left the world energy situation get so far along the fossil fuel path without taking appropriate measures. The inertia of the world energy and emissions system is now likely to necessitate a collapse in world energy production and an accompanying reduction in world population after a time lag. In the Limits to Growth 30 year update, Meadows et al 2004, again quantified such assertions and suggested that if we started on a transition in 2002, it would be very difficult to avoid some measure of collapse. We are now a further 6 years down the track and peak oil is upon us!

To get some idea of the extent of the problem we don't need the World 3 computer model (Meadows et al 2004) but can do a simple back of the envelope calculation. Taking crystalline silicon photovoltaic systems with a documented energy payback time of around two years as a baseline (NREL 2004), the world would have to devote around 10% of its present energy consumption each year over a 20 year time span into making the devices to replace 50% of the present fossil fuelled energy production capacity. This calculation assumes that the energy cost of the balance of system (storage, improved transmission etc) will take about as much energy again (i.e. a total energy payback time of 4 years). In 20 years time it is highly likely that the world will only have access to half as much oil as at present and so a 10 % decrease will be onerous, on top of that implied by the decline in fossil fuel consumption. This energy consumption would need of course to be accompanied by a similar level of other resource contribution to the construction of renewable energy devices i.e. steel, copper etc. and orders of magnitude increase in specialized resources i.e. silicon. While some renewable energy technologies such as wind turbines or thin film PV can have a much shorter energy payback time (6- 8 months) (AWEA 2002, NREL 2004) the added energy cost of providing storage, balance of system and improved transmission for a distributed system, would mean that a four year system energy pay back time would probably be optimistic. This simple analysis, however, suggests that to find the energy capital for any scenario that allows further growth in world energy use over the 20 year time span would be increasingly improbable, as the amounts of energy needed for energy capital formation and other resources becomes implausible.

This paper suggests that the reason that such a disastrous situation has been enabled is by a collusion of vested interests, leading to a tragedy of the commons (Lloyd 2007) and the the human brain having an evolutionary selected propensity towards favouring economic growth that that has allowed the vested interests to be given free reign.

2.0 A defective mind

Arthur Koester argued in the 1960s that the human brain was a defective organ, not suited for survival in the modern age, as it evolved out of the needs of an entirely different era: our prehistoric origins (Koestler 1967). He made use of McLean's, then recently published, triune theory of the brain, to back his conclusion (McLean 1990).This conclusion was that there existed in humans "*a chronic conflict between rational thought and irrational beliefs*" (Koestler 1978).

Koestler further suggested that an outside observer of the human race would:

> "*come to the conclusion that our race is in some respects an admirable, in the main, however, a very sick biological product; and that the consequences of its mental sickness far outweigh its cultural achievements when the chances of prolonged survival are considered.*" (Koestler 1978)

His main survival concern, writing at the peak of the cold war, was that the spread of nuclear weapons would inevitably lead to their use and civilisation would be doomed. While the possibility of a nuclear holocaust has certainly not gone away, his thinking is also pertinent to the tragedy of the commons, as this problem is also essentially a social dilemma and not a technological one (Hardin 1968). Koestler further noted that:

> "*The most striking indication of the pathology of our species is the contrast between its unique technological achievements and its equally unique incompetence in the conduct of its social affairs*." (Koestler 1978).

Koestler's radical solution to the adverse pathology, however, was a biochemical one, whereby "*benevolent enzymes"* could be supplied to the people of the world to circumvent the paranoid streak in the human brain (Koestler 1978). A mass supplied happy pill in the community water supply! This proposed solution, almost given as a one liner, unfortunately discredited his general argument, as it would be difficult to imagine world governments allowing such an extreme remedy to curtail the aggressive tendencies in their own population, when a possible aggressor may not do the same. Or for corporate executives willingly to take such a pill knowing that it would curtail his or her aggressive takeover and expansion opportunities! Nevertheless the ideas Koestler mooted were not singular.

The researcher who has been most prominent in the early formation of the peak oil thesis, Hubbert 1949, in fact wrote along similar lines to Koestler, but even earlier. Hubbert's main concern was not a nuclear holocaust but depletion of natural resources and population growth causing a collapse of civilisation. He suggested that our future wellbeing would depend on whether we could overcome what he called a "*serious cultural lag"*.

> "*In view of the rapidity with which the transition to our present state has occurred it is not surprising that such a cultural lag should exist and that we should continue to react to the fundamentally simple chemical and biological needs of our social complex with the sacred-cow behaviour patterns of our agrarian and prescientific past."* (Hubbert 1949)

The "*sacred cow behaviour patterns*" (Hubbert) and the "*very sick biological product*" (Koestler) speak of the same disorder, a time disconnect in brain capability that has formed one of the basic premises of the new field of evolutionary psychology[1].

That our brain evolved in an era considerably earlier than the present is not contentious (Heinen and Low 2007). Ornstein and Ehrlich (1989) were among the better known environmentalists, who suggested that the human race may be failing to respond adequately to environmental issues, as the brain was designed to cope with life in the Pleistocene and earlier. Ehrlich (2002), however, did not think evolutionarily psychology could unilaterally show the way forward, as there were not sufficient genes in the human genome to supply the pre-programmed behavior that the evolutionary psychologists demanded.

2.1 The modular mind and cognitive dissonance

Steven Mithen (1996) in "*The prehistory of human mind"* gives good evidence to support the hypothesis that in the early history of hominid development, that is before *Homo sapiens* evolved as a separate species, the mind was composed of modular components, "*a swiss army knife*" he called it, with at least four separate compartments, dedicated to social

[1] The founding exponents of this emerging discipline, Cosmides et al (1992) put the problem into perspective succinctly:

> *"the evolved structure of the human mind is adapted to the way of life of Pleistocene hunter-gatherers, and not necessarily to our modem circumstances."* Cosmides et al (1992).

intelligence, language, technical matters (tool making) and natural history (environment). Mithen suggested it was not until somewhere between 100,000 and 30,000 years ago that the mind started to take on the generalised type of thinking that Pinker (2002) might have criticised as a multipurpose blank slate.
The debate that has occupied various research factions in socio-biology, evolutionary psychology, and brain research over the last few decades is the matter of how the brain is organised and whether it is mostly a blank slate, or mostly a reservoir of hard wired ideas and instincts (Mithen 1996, Pinker 1997, Pinker 2002, Rose 2003, Ridley 2003, and Rose 2007). This debate has often taken on political overtones due to the strong links between human behaviour and ideology. It is noteworthy that the latest work by Rose 2007, although denying the suggestions of modular brain organisation by some of his ideologically opposed contemporary's, actually makes extensive reference to the modular nature of the brain in his discussion of that topic. The left wing ideological opposition to any suggestion of inherent behavioural tendencies in the human species thus appears to be losing ground. It would be odd in fact if humans were the only mammal species on earth that did not have some inherited basic nature.

Even given that the brain is only partially hardwired, the contention is that the hardwiring that exists must take place in a modular format whereby each module could be separately subject to different evolutionary pressures. Otherwise it is hard to see how a complex multipurpose organ could have evolved, as it would be often subject to contradictory evolutionary pressures. The proponents of modularity in the brain vary as to the location and extent of the modules. In some cases the modules are physical, i.e. separate brain substructures (i.e. hippocampus, neocortex etc) and in other cases the modules are purely functional, that is a separate modular unit that could be spread over several physical structures in the brain (Bergeron 2007).

McLean in his triune brain theory (Mclean 1990) postulated three distinct physical components of the brain: the cortex, the limbic system and the R complex, each representing a separate time frame in evolutionary terms and each related to separate tasks. Cosmides et al 1992 on the other hand talks of *"functionally specialized problem-solving machinery"* in the brain. Yet others, such as Fodor 1983, in the *Modularity of Mind,* talk of specific "*task oriented modules*". In his later work Fodor (2001) *"The mind doesn't work that way"* Fodor explains that the modularity probably exists only for the more basic parts of the brain. While the details are still hotly disputed it seems clear, that the brain is not just a large mass of neurons without functional structure and that either physical or processing compartmentalisation occurs, albeit with a good deal of plasticity and redundancy.

The other link in the argument to suggest the brain works in a modular manner was supplied by Howard Gardner, who in 1983 published *"Frames of Mind"*, in which he proposed Multiple Intelligence Theory (Gardner 1983). In this theory, Gardner posited between 7 and 9 different intelligences including music, mathematics and existential. His theory, however, was critical of the entrenched general intelligence theory popular at the time and was dismissed by many psychologists (see for instance Waterhouse 2006) who preferred to work with generalised IQ indices, the measurement of which was developing into a lucrative income stream. Multiple Intelligence Theory, on the other hand, was taken up enthusiastically by educationalists that recognised that real students do think in such a modular format and that such ideas were conducive to teaching (Gardner 2004).

The point of this discussion is not to get overly involved in the debate about detailed brain function but to understand if and how the brain is maladapted with regards to coping with the long term and intensely scientific problems of prevention of ecosystem deterioration (climate change) and maintaining a resource base for future generations (peak oil).
In this regard a recent paper by Kurzban and Aktipis (2007) is relevant; these authors suggest that modular architectures of the brain are tolerant of mutually inconsistent representations. No surprise here, but they continue:

> "*Although rarely pointed out, there are an extraordinarily large number of cases in which it is transparent that inconsistent representations are maintained with no effort to compensate in ways outlined in the initial theory (belief change, minimizing importance of discrepant representations, and so on).*"

The most obvious examples given by these authors being:

> *"religious ideas, where beliefs thoroughly inconsistent with ontological commitments are deeply held. Indeed, it has been argued that it is precisely this discrepancy that causes these beliefs to be generated and transmitted."*

That is modular brain architectures are tolerant of cognitive dissonant situations where the mind can hold contradictory worldviews and beliefs that are at odds with behavior. This line of thinking especially with regard to religion will be continued in the next section and will be central to the argument presented in this paper.

Cognitive dissonance has been the subject of one of the most intensive studies in the history of psychology (Eagan et al 2007). These researchers suggest that:

> "*some of the mechanisms that drive cognitive-dissonance-reduction processes in human adults may emerge as a result of developmentally and evolutionarily constrained systems that are consistent across cultures, ages, and even species*."

The cognitive dissonance need not be resolved by the formal mechanism of denial but both views believed to be true and both held concurrently. George Orwell called this "*doublethink*" in his popular novel "1984".

Some degree of cognitive dissonance may in fact be beneficial to survival, Rose (2007), describes the case of soldiers badly injured in warfare who often manage to block out the pain of their injuries, as such a realization would hinder their immediate survival. Denial of adverse situations that could cause a paralysis of action could clearly be of short term advantage. However, when the adverse situation is a symptom of a long term problem, the denial could obviously prevent mitigation of that problem. In such circumstances cognitive dissonance may be of use for short term survival but catastrophic over the long term.

The conclusion here is that by ring-fencing the need for economic growth in one part of the brain, the species *Homo sapiens* is ill prepared to cope with long term real world resource and pollution problems that have economic growth as their underlying cause. Simultaneously cognitive dissonance, as exhibited in the widespread occurrence of religious beliefs, can allow for the accommodation of contradictory world views, whereby for instance, both never ending growth and sustainability can be thought to be concurrently

possible. And the denial means that no action need be taken to mitigate the long term problems.

3.0 God and Growth

In the "*The God Delusion*", Dawkins (2006) documents in detail his conjecture that religious thinking is flawed from an evolutionary point of view. His definition of the God hypothesis is that:

> "*there exists a supernatural intelligence who deliberately designed and created the universe and everything in it, including us"*

But he argues:

> "*any creative intelligence of sufficient complexity to design anything comes into existence only as the end product of an extended process of gradual evolution.*"

Dawkins suggests therefore, that a belief in God in this sense is the product of a deluded (flawed) mind as scientific evidence contradicts such a proposal. There is in fact considerable similarity between Dawkins 2006 and the prologue in Koestler 1978, each giving the same examples of the insanity of human behaviour (propensity to wage warfare, same specie homicides, child human sacrifice etc.). That the God delusion can be accepted while in other pursuits rational thinking and relatively harmonious society prevails can only be understood if we accept a modular organisation of the brain. The delusion in Dawkins' case; that is, the belief in a non-evolved supernatural intelligence, can then be placed in a ring-fenced module that has minimal crossover to other parts of the brain, which is involved in tasks such as rational thinking.

We might conclude from Dawkins' analysis that if a large proportion of people on earth can be deluded into accepting the stupendous leaps of reason and denial of physical causality suggested by the various existing religions, then a belief in never ending economic growth is a doddle. And it would stand to reason that people with such a faith in growth would think that those who think otherwise are heretics and blasphemers, much as religious people think of atheists.

3.1 Why religion is so universal and successful

Dawkins (2006) suggests the following criteria that have made religious belief so successful and predominant in most of human society:

- Evolutionary predisposition
- Indoctrination at an early age
- Exclusivity

The main criteria to be discussed here will be the first one, that is the evolutionary disposition towards religion, and then a parallel set of arguments will be proposed to suggest why a belief in growth is similarly so predominant. As part of the evolutionary argument Dawkins introduces the concept of the "meme" (see later). This concept he considers is another way, apart from genes, that ideas in particular can be sustained in the human species.

3.2 Evolutionary predisposition towards religion

Evolutionists believe that physical or behavioural traits (phenotypes) will only evolve if they give rise to some long term evolutionary advantage to the genotype. This is especially true of attributes or traits that are "expensive" to the phenotype in terms of energy or resources. The often quoted examples include the peacock's tail and the bower bird's bower but there are plenty of others. Religion can be very expensive in terms of both energy and resources, for example, time devoted to worship, building cathedrals, and accessing resources for supporting the clergy etc. Dawkins, however, does not mention that much of such visibly extravagant expenses have been realised in relatively recent years and over a time period within which it could not have been influenced by human evolution i.e. cathedrals. Hunter gatherer and early agricultural ceremonies and sacrificial rituals could, however, have had the same loading on the phenotype. Diamond (2004) documents the famous such case concerning Easter Island where the building of religious monuments, with the concurrent strain on the islands finite resources, eventually caused the civilisation to spectacularly collapse.

While the peacocks' tail and the bower obviously gives advantage to the individual birds offering the display, in general an evolved trait need not necessarily advantage individuals to be selected for. The other possibilities Dawkins' suggests are group selection and parasitic selection, whereby the trait may advantage a group of individuals or indeed a parasitic organism e.g. the propensity of humans to contact colds and flu gives advantage to the DNA in the bacterial or viral organisms concerned. In terms of group selection the possibility that a group that is held together by a strong religious belief may be more likely to succeed than a group with no binding philosophy has been expressed by others (Wilson 2002) but is according to Dawkins still controversial (Dawkins 2006) . Dawkins' surprisingly did not discuss the possibility that the parasitic organisms could be the cohort of religious leaders, as the survival advantage to them, would be very large.

In addition the trait that is selected for may be the unintended side effect of some other evolutionary trend. The example Dawkins gives in this regard is the evolved trait of moths navigating by using distant celestial objects, causing them to apparently have the trait of committing suicide if they are exposed to a fixed nearby sources of light, such as a candle. In terms of religion, Dawkins favours this last mechanism and gives the specific hypothesis that a trait may have developed that predisposed children to obey authority (i.e. if they did not they would have a reduced chance of survival). This trait then would have the unintended side effect that biases humans towards being compliant and following a leader (a religious leader presumably). The script in Monty Python's parody of religion "*The Life of Brian*" comes to mind here, with the crowd of Brian's followers, all multitudes of them chanting in unison to his prompt: "*We must all think independently*".

3.2.1 Religion and Memes

Finally Dawkins proposes that the object of the selection process may not even be an organism but a reproducing idea or meme.

Memes are a Dawkins' invention (see *The Selfish Gene* Dawkins (1976) or Susan Blackmore (1999) "*The Meme Machin*e" and are 'ideas' (units of cultural information) that can act as reproducing agents; examples of memes Dawkins gives are *tunes, catch-phrases, beliefs, clothes, fashions, ways of making pots, or of building arches.*
Dawkins suggests:

> "*The fact that religion is ubiquitous probable means that it has worked to the benefit of something, but it may not be us or our genes. It may be to the benefit of only the religious ideas themselves, to an extent that they behave in a somewhat gene like way as replicators.*"

The sorts of replicators or memes that Dawkins suggested in the "*The God Delusion*" that may have been useful in furthering a propensity towards religious beliefs included the following:

- Heaven- promise of surviving death
- Hell - heretics and disbelievers punished
- Faith as a virtue in itself
- Music art nature as a reflection of god

The main two discussed in the "*God Delusion*" were the carrot (heaven) and the stick (hell) with purgatory in between as a halfway house.

Heaven is a powerful meme because of its connection with the possibility of surviving death. It is known that most people exhibit thought processes consistent with the theory of mind or ToM (Whiten 1991). The theory of mind is closely related to self consciousness and expresses the idea that our mind can conceive of and project the thinking of the minds of other people. It is relatively easy to see how the ToM evolved, as this attribute has considerable survival advantages in relation to the success in managing complex human social relationships. Autistic people, who have a reduced or absent ToM, have difficulty in managing social situations and understanding the motives of their fellow travelers. The next step from ToM is "dualism", which is the idea that mind can exist separately from people, the brain and indeed from any material form. Dualism has been a part of western philosophy since at least the golden age of Greek philosophy. In particular children are thought to be natural dualists (Dawkins 2006, Bloom 2007). If one is a dualist that accepts minds are capable of existing outside the body, it is then but a small step to imagine minds surviving death. Bering 2006 documents surveys showing that around 95% of all Americans believe in life after death. He further postulates that an organized cognitive system (a module) that holds beliefs such as, immortality, intelligent design and symbolic attribution to natural events, evolved through natural selection. It can thus be seen that once ToM evolved the other two steps, that is dualism and life after death, could have followed "accidentally". An organization then which posits a pleasant place for all the disembodied minds to inhabit after death would become very attractive and it is likely that such an idea would be likely to survive and be reproduced as a meme. Likewise a nasty place which might be the final resting place of minds previously belonging to a body that went against the teaching of the organization, would act as a strong stick. In this vein, life after death must be the archetypical cognitive dissonance.

3.3 Indoctrination and exclusivity

The indoctrination and religious labelling (of children in particular) was one of the main themes put forward in *The God Delusion* as the unforgivable abuse attributable to existing religions (Dawkins 2006) . Dawkins went to great lengths to explain that a 5 year old child cannot be called a Christian or a Muslim any more than they could be called a neo-marxist or a Keynesian at that age. As suggested elsewhere, children are particularly susceptible to having their brains imprinted with information and it is no coincidence that most religions target children at a young age (also see later regarding children and consumerism).

Exclusivity, Dawkins suggests, is the domain of the three main monotheistic religions, Judaism, Christianity, and Mohammedanism and as such is fiercely defended by each, with the consequent problems in terms of historical religious conflicts (Dawkins 2006).

In summary, there is considerable evidence from many fronts to suggest that humans are predisposed towards a belief in a religion by real selection pressure, by accidental mechanisms, or from some of the components of religion acting as memes. Dawkins (2006) thinks all may be important although he personally favors the accidental by product mechanism whereby children are selected for because of their relative compliance and this compliance is amenable to religious behavior. The propensity towards compliance could also help to explain why people tend not to be critical of the present dire situation with regards to peak oil and climate change.

4.0 Evolutionary predisposition towards growth

The next question to be asked is what are the parallels between a belief in God and a belief in (economic) growth? The answers will be given following the above analysis of religion given by Dawkins (2006) again with an emphasis on evolutionary reasons. Evolution giving a genetic predisposition in human society towards economic growth can be investigated by looking at propensity to acquire possessions (i.e. economic growth), population growth, and the relation between the two. Obviously to maintain similar standards of living, population growth implies some economic growth. Conventional evolutionary biology suggests that organisms which have a high number of viable offspring will be more likely to succeed than those which have fewer. The seemly rational proposal to limit growth by limiting population growth is one where opposition is provided by the irrational aspects religious thinking.

4.1 Propensity to acquire possessions

The selfish gene, as per the Dawkins' 1976 book of the same name, gives rise he suggests in many cases, to selfish phenotypes, which can be exhibited in humans as the propensity to accumulate wealth and possessions (Dawkins 1976). There is considerable evidence to suggest that contemporary humans prefer present consumption over future consumption and that people in general have an "inherent" high discount rate for the future, albeit with some differences according to sex (Alvard 2007). Possessions, even in early times, may have given an absolute survival advantage; such as, clothing, materials for starting a fire, stone axes for butchering, water containers and weapons. Thus the propensity to accumulate such possessions may be inheritable as it would give a long term evolutionary advantage. In hunter and gatherer societies, however, the practicality of accumulation of possessions must have been severely limited by nomadic lifestyles. For an advantage to occur, however, the increase in possessions would only have to be relative to possible competitors. A small increase in possessions might have lead to a considerable increase in

prestige, power, status and ability to exert control over the clan. The ability to efficiently harvest and transport food, and water in particular must have been of considerable survival advantage in hunter and gatherer times. Successful location of water, and having the brain capacity to remember such locations, would act as a powerful evolutionary feedback device, as life stops very quickly without this source of nourishment.

It was not of course until agriculture was invented and humans settled in one place, that the sort of accumulation of material possessions that we are now used to could take place. Also once we settled down in one place there would have been a large part of the brain that was previously used for image processing (memory of food and water locations), which could then be freed up and used for other (general) purposes; the blank slate.

The other evolutionary advantage of having more possessions, mentioned by Dawkins (2006), would be a reproductive advantage; that is the demonstration of cheat proof advertising; showing off wealth and possessions to gain sexual advantage (Dawkins 1976). The need for honest advertising to give a good signal of fitness to prospective mates was known from the time of Thorstein Veblen in his 1899 classic "*Theory on the Leisure Class*" (Veblen 1981) and is described by Boone (2007) in a recent article on the reasons for human propensity towards conspicuous consumption.

For an advantage to occur, the increase in possessions would only have to be relative to possible competitors. Such a relative advantage would not cause problems for resources in the Pleistocene and earlier, as population numbers were small and the absolute quantity of possessions could only be tiny due to the fact that most would have to be carried on the person. In more modern times the relative advantage requirement in this process necessarily means that once wealth and possessions grow absolutely then the competition can get out of control and provide considerable positive feedback towards accelerated economic growth, to fund the accumulation of ever more possessions (Hamilton 2004, Hamilton and Denniss 2005, Fear 2008).

4.1.1 Neuromarketing feedback to promote yet further growth

There is now evidence to suggest that the marketing industry has woken up to the potential of using the modular brain to capitalise on the human proclivity towards accumulation of possessions and put in place a powerful new feedback mechanism. A recent editorial by Rapaille in Forbes magazine "*Marketing to the reptilian brain*" recommends using McLean's triune brain theory for market information:

> "*Only accessible via the subconscious, the reptilian brain is the home of our instincts. It programs us for two major things: survival and reproduction. In a three-way battle between the cortical, the limbic (home of emotion) and the reptilian areas, the reptilian always wins, because survival comes first. When you tap into the reptilian brain, you learn what a product means to a consumer at its most fundamental level."* Rapaille 2006[2]

[2] The article then proceeds to give the example of Chrysler's PT Cruiser as a successful result of such an approach where the product was clearly pitched at a level to titillate the prospective owner's sense of power, accomplishment and ability to attract sexual partners rather than the rational intellectual level of fuel efficiency, safety and practicality. Walter et al. 2005 noted in a recent paper on neuro-economics that:

"Marketing to the Mind: Right Brain Strategies for Advertising and Marketing "by Maddock and. Fulton , suggests similar strategies to the above with the book firmly focused on utilizing the modular brain with eleven target categories-"*person, place, time, and circumstance orientations; territorial, sexual, physical, and spiritual survival; followed by expectation, adaptation, and play"* (Maddock and. Fulton.1998*).*

There is also a link here with religious marketing, which also targets children as noted by Dawkins 2006. Researchers investigating modern marketing techniques on adolescents (Pechmann et al 2005) note:

> *"Our review indicates that adolescents tend to be more impulsive and self-conscious than adults because of the neurobiological changes that occur during this critical developmental period. Thus, adolescents may be especially attracted to risky branded products that, in their view, provide immediate gratification, thrills, and/or social status."*

It is obvious by the sheer volume of the literature that the marketing industry is working overtime to adopt the latest advances in neurobiology and brain imaging to promote even more economic growth[3].

4.1.2 Population growth

Before and during the Pleistocene, when the human race mostly evolved, global resources were not close to becoming a limiting factor, a circumstance which would mean population grow could nearly always prompt a growth in consumption of resources. The very low rates of population growth and the low overall numbers up until a few centuries before the industrial revolution, however, meant that human consumption of resources was not globally significant. Once it was realised that resources would become a limiting factor the question of limiting population arose, with Malthus being among the first to consider this possibility. Many others including Hardin 1968 and Bartlett 2004 have pursued this line of thinking but in some circles such ideas have been very unpopular as the population restraint arguments can be construed to hint at an underlying racism or in the case of Malthus the class structure of society in the UK at that time. That is: it's the fault of the poor and it's the poor countries that are overpopulating the earth, not the rich who generally have lower fecundity.

"*Certainly, sport cars symbolize speed, power and independence. Apart from that, however, we propose that sports cars do signal social dominance.*" As if we did not know!

[3] There is a problem here for free market economics because, according to Walter et al 2005:

> *"Neuroeconomics can broadly be defined as the interdisciplinary enterprise to investigate economic-related behaviour by using neuroscientific methods. Thus, neuroeconomists are interested in the neural correlates of the motivating forces of behaviour and decision-making."*

The problem is that free market economics requires that people make free choices in the marketplace but neuro-economists are now suggesting that the choices can be manipulated by the marketers and linked to pre-programmed parts of the brain. Pre-programmed in fact by neuro-marketing techniques which use the marketing process to tap into the growth predisposition and with brand power "own" key parts of the human brain that are responsible for consumption (Maddock and Fulton 1996). The conclusion that must then be reached is that there cannot be a free market because the marketers brainwash their clientele; which is what everyone, except a minority of economists, knew all along.

The other sector who opposes population control is of course the collection of various religious groups who believe that such a practice would be contrary to their doctrines. Here is another clear example of the modularity of the mind imposing restrictions on how we might solve the world's problems and of the close relation between religion and growth.

While continued population growth alone is obviously unsustainable it is quite clearly the combination of population growth and consumptive (economic) growth that is the relevant factor in terms of the world's finite resources and emissions (Meadows et al 2004).

4.1.3 Relationship between population growth and economic growth

Although there is usually an evolutionary advantage in having a high fertility rate for most animal populations, for human populations there is some doubt, as once past the demographic transition (Kirk 1996) the number of offspring tend to decrease with wealth. Possible reasons for this will be discussed below. In traditional societies, however, the opposite seems to be true. Hopcroft (2006) lists over 30 studies of non-modern societies where a positive relationship between male status and number of surviving offspring is shown. The indicators of status varied between the studies but included hunting ability, wealth, land ownership, religious rank and social status. In the Pleistocene, the more modern indicators such as monetary wealth would not have existed and indicators must have been considerably more rudimentary, including hunting ability, social status, religious rank and possibly acquisition of the types of possessions that could be easily carried. The above mentioned studies, however, relate to relatively normal times: that is periods of history which were relatively stable in terms of population growth and food supply.

Prior to the invention of agriculture/horticulture, overall human population growth was very low, Catton (1982) tables human population growth as a function of major technological breakthroughs and using data from Boughey (1975) he suggests population growth rates of around 0.09% per generation (or 0.005% per annum) before 8000 BC. Hassan 1982 gives a range of between 0.00007% and 0.011% per annum up until the Neolithic transition, consistent with this value. Such low rates are hard to explain, even without modern health care. Boone and Kessler (2007) argue that to keep the rates so low over the long term, human population growth must have been moderated by periodic catastrophic collapses. Such periodic episodes of short collapse, they document, are also found to occur in many animal species (Young 1993, in Boone and Kessler 2007). Additional evidence relating to human populations is also given to demonstrate that population bottlenecks must have occurred on a regular basis in our past, with decreases in population being as high as 90%.

Boone 2007 notes that:

> "*Since the survivors of a population crash form the population base for the next period of growth, it stands to reason that natural selection might favour individuals or lineages with some heritable capacity to survive (or to have offspring that will survive) infrequent crashes at a higher probability than others in a population*"

Boone and Kessler (2007) argue that the ability to survive the bottlenecks must have been a very strong evolutionary filter, as the total numbers in hunter gather clans were small and so the number surviving would have been even smaller. They further suggested that the ability to survive short term catastrophes, caused by a myriad of physical disasters and food

shortages, was strongly dependent on social status, including access to physical resources. In addition they say that the ability to survive such periods may include a reduction in fertility. The reduction in fertility they suggest would allow more expenditure of resources on offspring who would then be able to cope better with the hard times. Hill and Reeve 2004 also agree that the reduction in fertility, common among the wealthy today, may be the result of an evolutionary strategy to produce a small number of offspring that can take advantage of long-term resource accumulation and thus be one of the reasons for the existence of the demographic transition. Boone and Kessler 2007 give contemporary studies to back this claim, including the famous essay by Amartya Sen "*Poverty and Famines*" on the 1943 famine in Bengal, which showed that landlords and other high status professions survived while 40.3% of agricultural labours were "*wiped out*" (Sen 1981 in Boone and Kessler). Other evidence given includes: survival of Pingelap islanders in Micronesia after a typhoon (1775) where out of a population of around 1000 the 20 survivors included the hereditary chiefs and immediate family, survival of high ranking 19th century Hopi (north eastern Arizona) after droughts, the differential survival of Turareg in Saharan west Africa after famines and Polynesians living in Tikopia after a hurricane (Boone and Kessler (2007).

In terms of numbers of offspring, the evidence from normal times suggesting that high fertility is correlated with status and possessions, is at odds with abnormal times where lower fertility but high fitness is correlated with status and possessions. The contradictory evolutionary tendencies could be resolved by a modular brain hypothesis, whereby both tendencies could coexist in different parts of the brain and in different parts of the population, waiting for the appropriate opportunity to come to the fore. In fact there may be other cases where apparently confusing data in evolutionary psychology could be explained by a modular brain.

The above reasoning would also suggest an evolutionary advantage may exist to predispose, at least some, individuals towards investing considerable energy and resources in attaining high social status and possessions. And as wealth is now a strong indicator of social status it is likely that some humans have a strong predisposition towards the means of achieving wealth; that is economic growth. Again this is stating the obvious but if we look how to reverse the paradigm of economic growth, it is important to know where in the brain such tendencies reside and whether they are innate or culturally learnt.

Thus we have several pieces of evidence to suggest that humans have evolved a propensity to accumulate possessions, wealth and achieve high social status and would thus be predisposed to favour economic growth to realise these tendencies. There is also likely to be an overlap between the tendencies towards accepting religion and accepting growth, as high social status would include various degrees of religious status. In fact Galbraith and Galbraith 2007 note that a niche literature has developed in economics which suggests that geographic areas which have a high prevalence of people with religious beliefs also have high levels of economic growth. These authors found, however, that while there appeared to be a positive correlation between religious beliefs and economic activity there was a small negative correlation between time spent in church and economic activity. The suggestion being that belief alone is sufficient for economic success and that time spent actually worshipping was time better spent on making money!

The overlap becomes blatant in some religions in which the worship of wealth plays a conspicuous role (Dawkins 2006). Again we can conclude that if economic growth is

"worshiped" in the same manner as a god it should not be surprising that peak oil is discounted as a heretical theory and those who suggest it, as non-believing "heathens".

4.2 Memes, indoctrination and exclusivity

Economic growth exhibits considerable advantages in comparison with religion in terms of memes aiding the process; whereas a belief in a god can promise heaven in the afterlife, economic growth can promise heaven on earth, during one's own lifetime. The stick in terms of economic growth is not quite as strong in the richer countries as the meme of hell but the stigma of economic failure looms large and economic failure in the poorer countries must come close, in some cases, to hell on earth.

Indoctrination starting at an early age is certainly a well documented strategy to promote consumerism with advertising and media directed at all age groups starting with the preteens. Hamilton 2004 and Hamilton and Denniss, 2005 capture the essence of indoctrination of the young in his books "*Growth Fetish"* and *"Affluenza*", the latter an affliction which he describes as the *"unsustainable addiction to economic growth"*. Beder 2006a has an entire chapter titled "*Fiddling with Kiddy Minds*" in her book "*Free Market Missionaries*" again suggesting the parallel between religion and growth. Schor 2004 looks at the commercialized child where the marketing industry is everywhere; in classrooms, textbooks, on the internet, and in playgrounds, in "*Born to Buy"*. As mentioned earlier, neuromarketing, is starting to look at direct ways to infiltrate children's minds with hopes of getting long term ownership for the market. (Pechmann et al 2005).

Exclusivity in free market growth economics has crept upon us during the last century with concerted corporate moves since the second world war to ensure that free market, growth oriented thinking is axiomatic and that all alternatives are crushed. Beder 2006b in "*Suiting Themselves*" gives details of how this was accomplished using media public relations departments, think tanks, academic appointments and directed funding and grants for research. She suggests that it is now difficult to find a government department, university economics department or even an NGO in any of the major economies, which does not ascribe to economic growth as an axiom. Other researchers such as Klein 2007 in "The *Shock Doctrine*" have investigated the Chicago School of Economics foray onto the world scene over the last few decades and its moves to inculcate its version of the free market economy into a good number of nations in the world. This expose is especially pertinent as it outlines Milton Friedman's preferred method to circumvent established beliefs, formed in our modular brain, by exploiting the confusion and breakdown in modularity caused by extreme psychological shocks. The world had an opportunity to exploit the breakdown in entrenched modular thinking in relation to resource use immediately after the 1970s oil shocks, but the moment escaped, as oil prices dropped to low levels again by the 1980s. Klein 2007 also suggested that by 2006 the free market crusade was winding up, as in many parts of the world, especially South America, governments had woken up to the false promises and extraordinary inequalities caused by this movement. It is, however, perhaps premature to make this judgement, as the momentum for economic growth still appears to be paradigmatic and entrenched in a ring-fenced module (or modules) of our brain.

5.0 Conclusions

The above analysis leads to the conclusion that the propensity of the human race to believe in never ending economic growth does indeed parallel our propensity to have religious

beliefs. And that such a paradigm is ring-fenced from other modules in the brain and in particular from the multipurpose modules that can engage in rational thinking; such as about how we might solve the current problems of peak oil and climate change. The notion of conceptual ideas being ring-fenced in the brain is of course not limited to social constructs, Kuhn 1962 in "*The* Structure *of Scientific Revolutions"* postulated that in science the evolution of our knowledge base proceeds by means of a series of paradigmatic, or ring-fenced, theories that are difficult to change, until a revolution occurs; usually by a catastrophic failure of the paradigm. Friedman's insight to promote economic change after a catastrophic cultural or physical shock uses the same mechanism: that is when the fences are down or broken, then the brain's propensity to keep thoughts and ideas modularised is impaired and new paradigms can be accepted or implemented more easily.

In the Commons revisited (Lloyd 2007) I argued that free market solutions to the climate change problem cannot work, because it has been the market that has caused the problem in the first place; whereas in this case we have no choice. Here we have an ill adapted brain with a modular structure that needs to solve problems, which have not occurred during the experience of its own evolution. We have no choice, however, but to use the same brain if we want to remedy the situation. Before Galileo's time, problems such as the structure of the universe and how it began, were firmly fixed in, and constrained by, the same modules of the brain that also held (Christian) religious beliefs. Science and the "*sacred cow behavior patterns"* have since been separated to the extent that (mostly) science can function independently of religious doctrine. The spectacular advance of science since this time (the Copernican revolution) is proof that the brain is capable of solving problems that could not have been part of its own evolutionary history. In terms of advances in cosmology we are now able to postulate the physical conditions pertaining to the beginning of the universe to within a fraction of a second of the singular event and in astonishing detail; an event which occurred more than 13 billion years ago.

The advance of science and technology, coupled with the exploitation of the world's finite fossil fuel resources, however, then allowed another related module to come to the fore, the module with a predisposition for never ending growth. To solve the present dilemma we need a radical change in world view, similar to that which occurred when religion (in this case Christianity) and science were (mostly) disconnected after the 1600s; a new Copernican revolution. The analogy is pertinent, as prior to the Copernican revolution Europeans had a very anthropocentric view of the world, with man on earth at the centre of being. It was Koestler, in "*The Sleepwalkers: A History of Man's Changing Vision of the Universe*", who produced one of the first historical accounts of this monumental transition from Copernicus' original idea to Galileo's trial (Koestler 1959).

The subsequent technological developments that this revolution produced have had such a stupendous effect on the physical world, that in more recent times humans have again been deluded into thinking that they are the centre of all being and that the that the planet and the rest of its other inhabitants are inconsequential by comparison (Catton 1982, Peet 1992). For civilization to make another transition, this time to a more sustainable future, we need to conceptually separate human development and science and technology from the need for economic growth and put in place a political structure, led by scientific analysis and rational thinking, to allow it to happen. A new Copernican revolution! The question is: can this transition happen in the short time available; can the ecologists, ecological economists, and possibly ecological psychologists reclaim the world from the free market economists and marketers purveying never ending growth? If we have to wait for the next oil shock to

break down the fences, instead of relying on a rational analysis, it may well be too late to make the transition to a sustainable future, at the levels of energy consumption that some of us are accustomed to.

The irony of the situation will be that if we fail, the causes of the inevitable collapse in human society, (Catton 1982) once peak oil and climate change take hold, will be traced to the modules of the brain related to immediate survival overruling the rational areas of the brain that are capable of handling long term complex scientific arguments. During and after a collapse phase, however, it will be the survival areas of the brain, the R complex, the lizard brain that the marketing people are homing in on, that will be most important in ensuring individual survival. That is together with status, resource accumulation and financial reserves.

It may even be conjectured that areas of the brain such as the R complex, which have been selected for because of their advantages in terms of short term survival value, are apt to predispose us towards collapse, because those are the times that such areas function best. The important thing to note is that selection to survive a crash is not selection to prevent a crash from occurring. In the event of a collapse the resource rich and the ruthless will likely be the ones who have sufficient physical and material insurance to survive, not necessarily the people who saw it coming. It would also be a time that could see a strong resurgence of religious fundamentalism.

6.0 References

Alvard M.S., 2007, "Evolutionary Ecology and Resource Conservation" in Evolutionary Perspectives on Environmental Problems, ed. Penn D J and Mysterud Transaction Publishers, New Jersey.

American Wind Energy Association (AWEA), 2002. The Most Frequently Asked Questions about Wind Energy, Washington, D.C.

Bardi U., 2008 "Cassandra's curse: how "The Limits to Growth" was demonized" Posted by Ugo Bardi on March 9, 2008, The Oil Drum: http://www.theoildrum.com/node/3551

Bartlett, A., 2004. ''The Essential Exponential! For the Future of Our Planet'' by Albert A. Bartlett, with Robert G. Fuller, Vicki L. Plano, Clark, John A. Rogers. Centre for Science, Mathematics and Computer Education, University of Nebraska-Lincoln, Lincoln,

Beder,S., 2006a, "Free Market Missionaries" Earthscan, London.

Beder,S., 2006b "Suiting themselves: how corporations drive the global agenda" Earthscan, London,.

Bergeron V., 2007 "Anatomical and Functional Modularity in Cognitive Science: Shifting the Focus", Philosophical Psychology Vol. 20, No. 2, April 2007, pp. 175–195

Bering J.M., 2006 "The Folk Psychology of Souls" Behavioral and Brain Sciences 29, 453–498

Blackmore S 1999"The Meme Machine", Oxford University Press, Oxford.

Boone J.L., 2007 “The Evolutionary of Magnanimity: When is it Better to Give than receive?” in Evolutionary Perspectives on Environmental Problems, ed. Penn D J and Mysterud Transaction Publishers, New Jersey.

Boone J.L and Kessler K.L., 2007, “More Status or More Children? Social Status, Fertility Reduction and Long term Fitness” in Evolutionary Perspectives on Environmental Problems, ed. Penn D J and Mysterud Transaction Publishers, New Jersey.

Boughey A.S., 1975 “Man and the Environment” 2nd ed. Macmillan, New York.

Boyer P., *2002*, “Religion Explained: The Evolutionary Origins of Religious Thought”, Basic books ISBN-10: 0465006965

Campbell C.J. 2005 “Oil Crisis”, Multiscience, Essex. UK.

Catton W.R., 1982, “Overshoot: The ecological basis of revolutionary change” University of Illinois Press Chicago.

Cosmides L., Tooby, J. and Barkow J.H., 1992, “Introduction: Evolutionary Psychology and Conceptual Integration” in "The Adapted Mind: Evolutionary Psychology and the Generation of Culture, Barkow, Cosmides, & Tooby (eds.), New York: Oxford University Press.

Daley H. E. and Townsend K.N., 1993 “Valuing the Earth : Economics, Ecology, Ethics” MIT Press ISBN 0-262-54068-1

Dawkins R., 1976,“ The Selfish Gene” Oxford University Press,

Dawkins R. 2006, “The God Delusion” Bantam Press, London,.

Diamond J. 2004 “Collapse: How societies choose to fail or succeed”, Viking Adult USA

Egan, L.C., Santos L.R. and Bloom P., 2007, “The Origins of Cognitive Dissonance”, Psychological Science Volume 18—Number 11

Ehrllich P , 2002 Human Natures, Nature Conservation, and Environmental Ethics, BioScience *Vol. 52 No. 1*

Ernandes M., and GiammancoS., 1998 “MacLean's Triune brain and the origin of the ‘Immense power being’ idea”, Mankind Quarterly*;* Winter 1998; 39, 2;

Fear J., 2008 “Stuff happens Unused things cluttering up our homes”, Research Paper No. 52 Australia Institute casual paper January 2008

Fodor, J. (1983). “The modularity of mind”. Cambridge, MA: MIT Press.

Galbraith C.S., and Galbraith D.M., *An empirical note on entrepreneurial activity, intrinsic religiosity and economic growth*”, Journal of Enterprising Communities: People and Places in the Global Economy Vol. 1 No. 2, 2007 pp. 188-201

Gardner H., 1983. “Frames of mind: The theory of multiple intelligences”. New York: Basic Books.

Gardner H., 2004 “Audiences for the Theory of Multiple Intelligences” Teachers College Record Volume 106, Number 1, January 2004, pp. 212–220

Greenpeace 2008, http://members.greenpeace.org/blog/exxonsecrets

Hamilton C. 2004,"Growth Fetish Pluto Press, London,

Hamilton C. and Denniss R., 2005, "Affluenza- when too much is never enough", Allen and Unwin, Crows Nest, Australia.

Hardin, G., 1968. Tragedy of the commons. Science 162, 1243–1248.

Hassan, F., 1982, "Demographic Archaeology" in Advances in Schiffer, M.B. ed "Archaeological Method and Theory: Selection by Students from Volumes 1 through 4", Academic Press New York.

Heinen J. T. and Low B. S., 2007, "Human Behavioural ecology and Conservation" in Evolutionary Perspectives on Environmental Problems, ed. Penn D J and Mysterud Transaction Publishers, New Jersey.

Hopcroft R. L., 2006, "Sex, status, and reproductive success in the contemporary United States", Evolution and Human Behavior 27 (2006) 104–120

Hubbert M.K.,1949, "Energy from Fossil Fuels" Science, New Series Vol. 109, No 2823 (Feb 1949), 103-109

IPCC 2007 "Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Synthesis Report, http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

IUCN 1980, World Conservation Strategy: Living Resource Conservation for Sustainable Development." UN

Kallio T.J. 2007 "Taboos in Corporate Social Responsibility Discourse" Journal of Business Ethics 74:165–175 _ Springer 2006DOI 10.1007/s10551-006-9227-x

Kirk D., 1996 "Demographic Transition Theory" Population Studies, 50 (1996), 361-387

Klein N., 2007, "The Shock Doctrine: The rise of disaster capitalism" Metropolitan Books NY.

Koestler A., 1959 "The Sleepwalkers, Picador, London

Koestler A 1967 "The Ghost in the Machine", Picador, London

Koestler A. 1978, "Janus: A Summing Up", Picador, London

Kuhn, T. S, 1962, "The Structure of Scientific Revolutions", 1st. ed., Univ. of Chicago Press, Chicago.

Kurzban, R and Athena Aktipis C."Modularity and the Social Mind: Are Psychologists Too Self-ish?", Pers Soc Psychol Rev 2007; 11; 131 DOI: 10.1177/1088868306294906

Lloyd B. (2007) "The Commons revisited the tragedy continues". Energy Policy 35, 5806–5818

MacLean, Paul D., 1990, "The triune brain in evolution: role in paleocerebral functions", Plenum Press, New York.

Maddock R. C. and. Fulton R.L., "Marketing to the Mind: Right Brain Strategies for Advertising and Marketing" Quorum Books, Westport, CN.

Meadows D., Randers J. and Meadows D.,2004, “Limits to growth: the 30 year update” Chelsea Green Vermont.

Meadows D.H. Meadows D.L. and Randers, 1972 J “The limits to growth” Universe Books, New York.

Mithen S., 1996, “The Prehistory of the Mind: A search for the origins of art, religion and science”, Orion Books, London.

The National Renewable Energy Laboratory (NREL)., 2004. PV FAQ’s, NREL Report No. NREL/FS-520-24619, Washington, D.C.

Ornstein R, Ehrlich P. 1989. New World/New Mind: Moving toward Conscious Evolution, Doubleday, New York:.

Peet J. 1992, “Energy and the ecological economics of sustainability”, Island Press, Washington DC

Pechmann, C., Levine L., Loughlin S., and Leslie F. 2005 “Impulsive and Self-Conscious: Adolescents Vulnerability to Advertising and Promotion” Journal of Public Policy & Marketing, Vol. 24 (2) Fall 2005, 202–221

Pinker S., 1997 “How the mind works”, Penguin Putnam, New York

Pinker S., 2002, “The Blank Slate; The Modern Denial of Human Nature”, Penguin Putnam, New York

Previc F.H., 2006 “The role of the extrapersonal brain systems in religious activity”, Consciousness and Cognition 15 500–539

Rapaille, 2006 **“**Marketing to the Reptilian Brain”. Forbes; 03/07/2006, Vol. 178 Issue 1, p44-44

Ridley, M. , 2003, “Nature Via Nurture: Genes, Experience, and What Makes us Human”. Harper Collins

Rose S. 2003 “Lifelines: Beyond the Gene” Oxford University Press, USA

Sen A., 1981, “Poverty and Famines: An Essay on Entitlement and Deprivation”, Clarendon Press Oxford.

Schor J.B., 2004, “Born to Buy: The commercialized Child and the new consumer culture”, Scribner, New York

Scoop, 2008, NZ web based news outlet accessed January 2008, http://www.scoop.co.nz/stories/PO0801/S00246.htm

Simon J. 1980: "Resources, Population, Environment: An Over-supply of False Bad News," Science, 208, June 27, 1980, pp. 1431-1437pp. 1431-1437**.**

Veblen T., 1981 (original 1899) “Theory of the leisure class”, Penguin Books, New York.

Walter H., Abler B., Ciaramidaro A. and Erk S. 2005, “Motivating forces of human actions: Neuroimaging reward and social interaction.” Brain Research Bulletin, Volume 67, Issue 5, 15 November 2005, Pages 368-381.

Waterhouse L., 2006 “Multiple Intelligences, the Mozart Effect, and Emotional Intelligence: A Critical Review” Educational Psychologist, 41(4), 207–225

Whiten A (ed) ,1991, “Natural Theories of Mind: Natural Theories of Mind: Evolution, Development and Simulation of Everyday Mindreading.” Oxford, Blackwell

Williamson J., 1994 (ed) “The political economy of policy reform”, Institute for International Economics Washington DC.

Wilson D.S. 2002 “ Darwin’s Cathedral: Evolution, Religion and the Nature of Society” University of Chicago Press, Chicago.

Wilson M., Daley, M. and Gordon S 2007, “The evolved psychological apparatus of human decision making is one source of environmental problems” in Evolutionary Perspectives on Environmental Problems, ed. Penn D J and Mysterud, Transaction Publishers, New Jersey.

Young, T.P., 1993,”Natural Die-offs of large mammals: implications for conservation.” Conserv. Biol. 8:410-418