The Emergence & the Evolution of Consciousness – Hierarchical Construct Theory

Author: Mark Pharoah | *Mind-Phronesis@Live.Com* | April 6Th, 2013 - *First published online at http://www.markpharoah.net/reductiveexplanation.html, 2007.*

ABSTRACT: *This philosophy article provides a reductive explanation of 'phenomenal experience' and in doing so, provides an explanation for the emergence and evolution of human consciousness. The explanation demonstrates compliance with philosophical criteria. It does this by describing and explaining the relationship between a hierarchy of complex constructs. In doing so, it closely relates the development of emergent mind states to the evolution of biological structure and behaviour. The article focuses on those aspects of the reductive explanation that provide insight into unique human characteristics, specifically in relation to social behaviours, emotion, the philosophy of language, and creativity. Finally, the paper indicates that this reductive explanation is a necessary and vital component in artificial consciousness applications and explains that the evolution of human consciousness is incomplete.*

Overview

Consider the following:

Light striking the eye's retina differs from when it strikes other surfaces. Instead of the light energy merely interacting with the surface through absorption and reflection, the specialised and ordered structure of the retinal nerve translates the light impulse into a neural format. Following this conversion, the 'light energy' travels throughout the neural network and may be filtered, eliminated, conjoined with other impulses, or expressed through motor activity etc. With multiple neural mechanisms, the human brain transforms environmental stimulations into neural constructs.

The brain is a high level example of an evolved structure that dissipates various forms of energy in an ordered manner. But the brain is not the only physical structure that has the capacity to control the dissipation of energy. There are lower levels of structural organisation that do this too. Importantly, these lower levels have a relational status with the higher levels. It is through the identification and explanation of this dynamic relationship between lower and higher levels that this paper is able to provide a reductive explanation of phenomenal experience.

There are three objectives to this paper:

i) First, to introduce and outline a dynamic constructs model that I call the 'Hierarchical Construct Theory' (HCT), which provides a reductive explanation of phenomenal experience and an explanation for the evolution of human consciousness;
ii) Secondly, to show how this theory relates to the evolutionary development of biological structure and behaviour; and
iii) Finally, to indicate how a reductive explanation of phenomenal experience offers explanations for some of the defining and most puzzling characteristics of human behaviour.

To begin, there is an appraisal of the philosophy that indicates what requirements are necessary of a coherent reductive explanation of phenomenal experience (section 1). Then there is a brief historical perspective to the science that seeks to explain complex organic constructs (section 2). Section 3 is devoted to an abstract exposition of HCT. Finally, 'Hierarchical Construct Theory' as an explanation of consciousness (HCT) is described in detail (section 4).

1. An appraisal of the philosophy that determines the necessary requirements of a reductive explanation of phenomenal experience

1.1 The philosophy of consciousness and the problem of phenomenal experience

Deciphering the requirements of an explanation of 'consciousness' is a discipline in itself because it is unclear as to what is being referred to when considering the question, 'what is consciousness?'. This is evident when one considers the plethora of attempts to explain consciousness and explore the enigmatic features of phenomenal experience (e.g. Armstrong, 1968, 1984; Carruthers, 1996; Dennett, 1978; Flanagan, 1992; Gennaro, 1996; Kirk, 1994; Lycan, 1987; Nelkin, 1996; Rosenthal, 1986, 1993; Tye, 1995). Chalmers (1995) argues that there is a uniquely 'hard problem' in deciphering consciousness in that any theory must adequately explain the specific characteristics and the textural qualities of phenomenal experience. Some argue that such a problem does not exist, others that a reductive explanation is impossible (Chalmers, 1996, 1999; Chalmers & Jackson, 2001; Jackson, 1982, 1986; Levine, 1983, 1993, 2001; McGinn, 1991; Sturgeon, 1994, 2000). Chalmers (1995) speculates in favour of an explanation that is non-reductive and that requires the discovery of, an as yet, undiscovered psycho-physical entity or fundamental force with its own laws. Alternatively, others argue in favour of a reductive explanation, with claims by several to having already provided one (Carruthers, 2000a; Dennett, 1991; Dretske, 1995; Lycan, 1996).

What then, are the considered requirements of an adequate explanation of phenomenal experience?

a) Carruthers (2000a, also cf. 2004) argues in favour of a *reductive* explanation of phenomenal consciousness that should,

i) explain how phenomenally conscious states have a subjective dimension; how they have feel; why there is something which it is like to undergo them;
ii) why the properties involved in phenomenal consciousness should seem to their subjects to be intrinsic and non-relationally individuated;
iii) why the properties distinctive of phenomenal consciousness can seem to their subjects to be ineffable or indescribable;
iv) why those properties can seem in some way private to their possessors; and
v) how it can seem to subjects that we have infallible knowledge of phenomenally conscious properties.

b) *Chalmers* (1995) proposes that a coherent *non-reductive* theory of consciousness is necessary and that it must satisfy his three evaluative criteria. To paraphrase, these are as follows:

i) Criterion A, the double aspect theory of information principle, requires that information is fundamental to consciousness, and corresponds to physical and to phenomenal features that are isomorphic. (Section 7.3, para 4).
ii) Criterion B, the principle of organisational invariance, states that any two systems with the same functional organisation will have qualitatively identical experiences. Examples of such systems might include computer systems. (Section 7.2, para 1).
iii) Criterion C, the principle of structural coherence, requires that the processes that explain awareness link structurally to the basis of consciousness by determining the relationship between that of which we are aware (and can report upon) and that of which we experience. (Section 7.1, para 11)

Crucial in the assessment of 'Hierarchical Construct Theory', Chalmers (1995) states that a coherent theory should explain the experience about which and with which humans are individually aware and report upon, and provide an appraisal of prevailing physical facts and show how these facts must lead to organisms that possess phenomenal experience.

c) *Dowell* (2007a) considers the arguments that both the analysis of phenomenal experience and reductive explanation is impossible using "type-A" and "type-B" physicalism methods. She does this by reviewing Jackson, Chalmers, and Gertler, on one side of the debate, and Block, Stalnaker, McLaughlin, and Hill on the other. Each offer a rival account of what, in the absence of analysis, would be sufficient to justify reductive explanation. Dowell (2007b) allays the concerns of the differing views by providing an *alternative* illustration of a strategy that she calls a "type-C" physicalism method, which demonstrates, importantly how phenomenal analysis is not necessary for an a priori entailment (e.g. the extrapolation of existing physical principles) to satisfy reductive explanation. This type-C physicalism is therefore, a deductive-nomological account explanation (Hempel, 1965; Carruthers, 2004, section 2.1). The Hierarchical Construct Theory may be interpreted as an example of a type-C method.

1.2 Hierarchical Construct Theory at a glance

Whilst Hierarchical Construct Theory's (HCT) reduction describes the processes that lead to the emergent property of phenomenal experience, there is an argument suggesting that it does not explain first-person individuated consciousnesses. In answer to this objection, Hierarchical Construct Theory explains how the first person must exist as an emergent property, but does not explain the 'actual' perspective that defines any single individual. In this regard, HCT provides an explanation for phenomenal experience without explaining consciousness in the manner that some philosophers may regard it, as a property existing 'outside' or 'beyond' phenomenal experience. In its explanation therefore, HCT implies a two part division in the problem of consciousness:

i) The phenomenal part, which is reductively explained in this paper; and
ii) The noumenal part, which is not discussed further here.

In providing a reductive explanation of phenomenal experience, HCT determines that,

i) the phenomenon of consciousness is an evolving emergent property;
ii) the hard problem of consciousness is not the problem of experience;
iii) a full account of consciousness requires a theory that also explains the noumenon of consciousness; and
iv) the materialist, monist, and dualist equally can make claim to HCT – The claimants views will differ with regard their understanding of how the noumenal relates to the phenomenal.

In summary, this reduction provides uniform consistency by showing an evolving constructs-hierarchy that extrapolates from physics principles dismantling all of Velmans' (2001, cf. conclusion) criticisms that reductive physicalism ignores both the first-person phenomenological evidence regarding the nature of consciousness and the third-person evidence about how it relates to a world described by physics. The theory also has bearing on First-order and High-order representational theories in that it formalises a dynamic hierarchical structure that explains physiological and evolutionary relationships. This answers the question posed by Carruthers (2000b) as to how and why transitions in the evolution of human consciousness take place. Furthermore, it indicates opportunities for empirically testing.

2. An historical perspective to the science that seeks to explain complex organic constructs

2.1 The science of thermodynamics and the problem of order from chaos

Schrödinger (1944) makes the observation that the laws of physics "have a lot to do with the natural tendency of things to go over into disorder" and that "it is by avoiding the rapid decay into the inert state of 'equilibrium' that an organism appears so enigmatic." (Chap. 6, para 2 & 6). Superficially, it would seem that living organisms appear to contradict the second law of thermodynamics because life creates structure and order out of chaos. Despite the apparent paradox, Boltzmann (1886/1974) is clear that the evolution of ordered systems does not conflict with thermodynamic principles and Pieper (2000, para 2) clarifies the point by stating, "the synonymous use of the terms entropy and disorder represent a serious misunderstanding of thermodynamics." Thirty years following Schrodinger's observation regarding the enigma of ordered lifeforms, Prigogine (1978), another Nobel laureate, was able to demonstrate in his theory of dissipative structures that self-organisation can evolve spontaneously even within chaotic environments. However, Corning & Kline (1998) give an in depth critique of the applications of the second law of thermodynamics to multileveled structures like biological systems, making a distinction between order and functional organisation. What Corning & Kline allude to is that understanding systems dynamics requires understanding the function of systems structures, which is not possible through the application of thermodynamic laws alone.

2.2 General Systems Theory and the problem of information

Over thirty years before the first journal devoted to complex systems was to publish its first paper, Bertalanffy

succeeded in introducing his General Systems Theory via the British Journal for the Philosophy of Science (1950) and the journal, Human Biology (1951). From these seminal papers are two points of particular relevance to this paper:

i) The laws of thermodynamics apply to closed systemss, but *not to open systemss* – Importantly, the environment with which lifeforms interact, is open.
ii) With complex systems such as living organisms, there is a certain 'self-regulation' or 'self-organisation' that entails feedback or the 'transfer of information'

Adopting Bertalanffy's lead, Kuhn (1974) proposes that all systems tend toward equilibrium through communication (where communication translates as the exchange of information) and transaction (involving the exchange of "matter-energy"), and that a prerequisite for the continuance of a system, by controlled or uncontrolled means, is its ability to maintain a steady and stable state.

Hierarchical Construct Theory develops the thoughts of Kuhn further, explaining how construct stability arises through the transaction of information both by controlled and uncontrolled means and how this transaction is self-regulatory. Additionally, it describes a hierarchy of constructs each with their own unique behaviours.

3. The Background principles underpinning Hierarchical Construct Theory

Newton's Third Law of Motion states: when one body exerts a force on a second body, the second body simultaneously exerts a force equal in magnitude and opposite in direction on the first body.

Consider Newtonian "bodies", for instance, not a spheres in space, but as a metaphor for constructs of any sort. These constructs have dynamic interactive components, but comprise an identifiable and stable whole. They can be referred to, as 'a body'.

When body A and B collide (as of Newton's Third Law), how do they 'know' how to respond?

In other words, what 'tells' body A, that body B with which it has collided is, for example, 5 times greater and consequently that it must respond by rebounding at such and such speed and angle? What information do bodies A and B access such that they can respond according to Newton's law? Their behaviour is not arbitrary. Furthermore, what are the intentions of bodies A and B in behaving as they do?

In view of these questions, the first point I wish to make is that all interaction can be interpreted as some kind of negotiation. In an example of bodies with mass, the consequential behaviour is the summation of negotiated relative mass. The purpose and intention of the negotiation, therefore, is to arrive at an equitable compromise - a state of equilibrium. If one is to say anything of the intention and purpose of bodies during interaction therefore, it is that they *seek equilibrium through negotiated compromise*.

The second point, is that when two independent bodies (or constructs) interact with one another, the ensuing

reaction is always indicative of their expressive differential and consequently, there must be some 'knowing' informative principle at work - an 'endowed physical propensity' that directs their action such that it reflects this differential - for a quantum mechanical extension of this principle c.f. Rovelli's relational quantum mechanics interpretation (1996).

So from this basic interpretation of Newton's Law we have the following:

i) Newtonian "bodies" can be interpreted as a metaphor for any dynamic construct that comprises a coherent identity.
ii) Interaction between constructs is a form of negotiation.
iii) Negotiation leads to a compromise which expresses itself as some kind of stability or equilibrium state that incorporates all parties involved.
iv) Interaction, negotiation, and compromise is an informing constructing principle.

Next we have to ask, how could this possibly relate to consciousness?

As a starting point, let us consider the view that perception, consciousness, and awareness are constructs. I recognise that there are many different interpretations and definitions of these terms - they mean different things to different people. However, as a starting point, consider the characteristics that we identify each of them by as arising from their interaction with environment as coherent constructs.

With this assumption, what we have is a scenario where each construct is comprised of dynamic parts or processes. Each interacts with the environment and through interaction, negotiate and re-establish construct stability through the institution of compromise toward equilibrium. This process endows the constructs with a certain 'information' about their environment - as intimated in the Newtonian, see section above. Roughly speaking, this information is qualitative at all levels of construct, but each construct has a different form of qualitatively informed representational construction (this will become apparent later on).

An abstract exposition of Hierarchical Construct Theory (HCT)

HCT identifies a series of constructs that evolve, and through evolution cause the transcendent emergence of subsequent constructs. Thus the constructs are hierarchically related and dependent on one another for stability. We can examine the nature of the evolutionary process and the emergent transcendent process as follows:

A construct that evolves through environmental interaction, does so without purposeful intent. Thus I call the evolutionary phase, 'passive'. The passive phase enters into an active phase following the incidental emergence of a new transcendent construct. As a coincidence of this active phase, the new transcendent construct a new evolutionary phase that is entirely differentiated from the previous evolutionary phase, but as with the initial construct, the evolution of this new construct lacks purposeful intent, i.e. it evolves passively. And so the cycle of complexity continues, through evolution and emergence, with passive and active phases

continuing up the hierarchy.

This can be further explained as follows:

Interaction with the environment disrupts construct stability. This disruption leads to a negotiated realignment of stability with one of two distinct possible outcomes: Either it leads to disordered or ordered reaction. When disordered the realignment of stability is not consistent with a construct's structural function and the construct acquiesces to a new reactive equilibrium. When ordered the realignment of stability is consistent with a construct's structural function and the construct dictates the stabilising reactive outcome.

The realignment of stability may lead to two distinct consequences:

a) Construct behaviours, be they ordered or disordered, arise from dynamic reactive structural re-evaluations. These re-evaluations always result in an equilibrium, which may comprise a unified stable state.
b) Construct behaviours are indicative of the displacement or conversion of energy from one state to another. When the conversion of energy is ordered, that process is instructive because the construct becomes more informed by the interactive process. Therefore, one can define such energy conversion specifically as, the 'growth of information'. When the conversion of energy is disordered, that process does not constitute the growth of information. If one is of the view that information describes some form of coherence between a construct and its environment, then HCT explains an evolving construct-to-environment 'information relationship hierarchy'.

The evolutionary passive phase

When a construct does not maintain its structural coherence during environmental interaction, the disordered reactive outcome can lead to uncontrolled structural alterations through the forced reacquisition of stability. When this happens, there is always the *potential* for new structural alterations to possess greater environmental resilience than their predecessor. This potential of improving environmental resilience ensures that over many cycles of environmental interaction, a construct will 'accidentally' evolve more resilient forms, leading to increasingly complex structures with increasingly complex characteristics.

The emergent phase

A hierarchy arises if, during the evolutionary cycle of a construct, a unique construct coincidentally evolves with novel properties. These novel properties have the unique characteristic of *controlling* evolution during interactions where they were previously *uncontrolled*. This creates a new construct category, with its own unique dynamic adaptive potential. This unique construct possesses its own unique evolutionary paradigm.

4. The Evolution of Human Consciousness

4.1 The evolving relationship between the qualitative information that constructs have about environment

By way of introduction we can now say the following:

#1 construct passively embraces the qualitative relevancy of structure as a means of possessing temporal stability in the course of interacting with environment.

What this means is that a structure of construct #1 is informed of its particular formative environment by virtue of its possession of material structural stability. This material stability is acquired passively.

The passive phase entails the evolution of material structures like atoms and compounds, stars, star systems and galaxies.

The emergent transcendent phase commences when, by incidental coincidence, the passive evolutionary phase leads to a complex material structure that possesses the unique characteristic of being able to replicate.

Replication is the unique capability that identifies the #2 construct. A replicating #2 construct transcends the life of its individual material entities by virtue of its replicates over generations. Thus the evolution of stable structure ceases to be passive and becomes actively engaged and controlled because the material replicative construct transcends the life of its individual material incarnate structures.

Thus, we have with #2 constructs the evolution of increasingly complex physiologies that are responsive to the qualitative relevancy of their environment: When a physiology accurately reflects the environment, it survives and perpetuates to the next generations, when the physiology is inaccurate, the structure dies out. Thus the physiologies become increasingly informed of their environment by virtue of their qualitative relevancy, measured by their survival competence. From #1 material reactivity, we get #2 physiological adaptivity.

The passive phase of replicative #2 constructs entails the evolution of innately acquired physiologically complex living organisms like, cells, plants, some insects, bacteria etc.

The emergent transcendent phase commences when, by incidental coincidence, the passive evolutionary phase leads to a complex structure that possess the unique characteristic of being able to assimilate, evaluate, and prioritise the qualitative relevancy of environmental experience *on a realtime basis*, rather than on a generational hereditary basis, as was the case with #2.

This capability is made possible with the particular bio-chemical physiologies of neurones and their networks. Their unique physiology allows the rapid transmission of qualitatively relevant environmental stimulation over distance. Neural networks endow this #3 construct the ability to transcend generational adaptation of qualitative relevance, with realtime behavioural adaptations to qualitative experience. Thus the evolution of qualitative relevance cease to be a passive consequence of mutation over generations, and becomes actively engaged and controlled by rapid environmental assimilations through sensorineural mechanisms.

The #3 construct passively evolves realtime experiential understandings regarding the qualitative relevance of environmental interaction. As a by-product, this passive process causes learning due the destabilisation of

experiential understanding during environmental interaction and then the re-negotiation of renewed understandings regarding realtime qualitative relevance. In effect, learning entails associating qualitative experience with their environmental cause. The passive phase is characterised further by the communication, through gesture and expression, of individuated qualitative feeling. The survival benefits of experiential evaluation promote the evolution of increasingly complex cognitive functions, and with it the passive unintended acquisition of increasingly sophisticated experiential qualitative understandings.

The passive phase of #3 constructs entails the evolution of understandings regarding the qualitative relevance of realtime experience, whose characteristic behaviours are observed in some insects, in many fish, and all mammals, birds, and reptiles.

The #4 emergent transcendent phase commences when, by incidental coincidence, the passive evolutionary phase of #3 constructs leads to a complex cognitive capability that is able to determine concepts about the value of phenomenal experience. This creates an emerging realisation of, and concept about 'self' and its qualitative relation to reality. As a by-product of this inquisitive introspection, the #4 construct is compelled to communicate conceptually about its phenomenal feelings, which are labelled the conceptual term 'emotions'. The #4 construct has a tendency of evolving increasingly complex conceptual networks which are represented through symbolised phonetics and images. These symbolised concepts are used as a means of expressing an individual's interpretative realisations about phenomenal reality through languages.

By necessity HCT dictates that there is a #5 construct that has not yet evolved. However, extrapolation of HCT indicates that there must be a passively evolving characteristic of the #4 construct that is related to the qualitative value or certain types of judgments regarding the nature of reality. This passive evolution will enter a purposeful and active phase when the #5 construct emerges. The realisation of its potential will take many generations or millennia to evolve.

4.2 A more detailed extrapolation of each hierarchical construct

The main focus now is to consider the hierarchical constructs in turn. I will relate them to a highly controversial definition of percpetion, consciousess and awareness, but a definition that is sound. This will help to satisfying the necessary philosophical criteria stipulated in section 1 above.

4.2.1 Construct #1 - Perception states

A compound atomic structure is an example of a construct whose stability is dependent on its component atomic elements and they in turn are dependent on the stability of more fundamental atomic forces.

It is said of atomic compounds that they *react*. But when speaking of material structures such as atomic elements and compounds, one must first consider that they *interact*. To say that a material construct and its environment interact, rather than react, is to acknowledge that there is a two way process where some form of energy exchange takes place. Consider the following:

The *interaction* between a construct and its environment is a process 'through which' (*per*) a construct's structure 'embraces' (*capere*, to seize or to take hold) and then *reacts* to the interactive experience.

In this statement, the use of the term interaction, allows for the proposition that a construct 'embraces' or 'takes hold' of its experiences *before* the institution of reaction. Thus one can continue with the following:

When a construct experiences and then reacts, its 'interactive' behaviour is demonstrating environmentally *per-ceptive* characteristics.

This is an unconventional definition of perception because it applies equally to inanimate constructs structures as it does to those experiences gathered by the specialised sensory organs of living organisms. The concept of mutual interaction between material constructs and environment allows for the notion of the constructs embracing and becoming informed by experience.

4.2.2 The distinction between passive and active perception states

Passive perception – When a construct, such as an atomic compound, interacts with its environment it might maintain its structural form by reacting in a manner that is consistent with its function or it might react in a disordered manner. When disordered, the resultant reaction may permanently compromise the material structure and lead to reactive dysfunction or to uncontrolled structural alteration. These structural alterations may create new elements or compounds that have greater survival resilience. This possibility ensures the evolution of increasingly complex compounds as an accidental consequence of 'disordered' environmental interaction.

This disordered evolutionary process is indicative of an environmental perception that is passive because the perception (the means by which matter embraces interactive experience) happens unintentionally or fortuitously. However, there is a unique construct that emerges from increasingly complexity that is actively perceptive.

Active perception: A new construct - Unlike other constructs that merely react, the ability to replicate affords replicative constructs a unique characteristic and status because replication controls the reactionary development of the construct during environmental interaction *through successive generations*, even after the parent structure dissipates and ceases to exist.

A replicating construct encapsulates its perceptions *actively* by controlling the progressive evolution of its representative structures. Environmental interactions do not just happen and then end as is the case with passively perceptive constructs. Instead, environmental interactions have an impact on a replicating constructs, transcending any individual structure's lifespan, through its successive generations. The replicating construct is structurally *adaptive*, whilst non-replicating matter is merely *reactive*.

4.2.3 Actively perceptive constructs seek stable structural adaptation

Whilst the requirements of a passively perceptive construct is merely to seek structural stability during environmental interaction, the structure of an individual replicating construct represents a snapshot in time of an evolving state whose requirements are to acquire and maintain a stable reactive adaptation. Consequently, the interaction of a replicating construct represents a new stable adaptation of that particular construct as it evolves over generations.

4.3.1 Construct #2 - Consciousness states

In the following section, an examination of the unique characteristics of constructs-construct category 2 begins with an exploration of the concept of information as it relates to complex organic structures. In doing so, the intention is to demonstrate how Hierarchical Construct Theory complies firstly with Carruthers' requirements of an adequate explanation of the phenomenon of consciousness (cf. 1.1.a) i) and iii) above), specifically regarding the subjective dimension of "phenomenal states" and their ineffable nature, secondly with Chalmers' criterion A double aspect theory of information principle (cf. 1.1.b) i)), which requires that information is fundamental to consciousness and corresponds to physical and to phenomenal features that are isomorphic, and finally with Chalmers' criterion B principle of organisational invariance (cf. 1.1.b) ii)), which states that any two constructs with the same functional organisation will have qualitatively identical experience:

4.3.2 The concept of information as it relates to complex organic structures

The unique replicative characteristic of *actively* perceptive constructs generates a potential survival advantage. The advantage, is that replicating constructs can *adapt*, whilst non-replicating constructs merely *react.* The advantage is a potential, because adaptation can be realised only through physiological evolution. The realisation of that potential is what leads to the evolution of increasingly complex replicating structural adaptations.

Consider the following statement:

A complex organic construct's structure is the physiological embodiment of its 'knowledge of the environment'.

Clearly, in the context of this statement, knowledge is not of the kind that one might typically associate with such things as reasoning or thinking. Rather, it is by virtue of the complex structures and behaviours *themselves*, that organic constructs demonstrate that they possess a certain knowledge of the environment:

For example, the complex nature of creating sugars from light, water, and carbon dioxide indicate that the evolved biochemical structures of plants exhibit the knowledge that enables photosynthesis to take place.

As here, Dennett (1995a) also argues that adaptation is a form of knowledge. He suggests that any functioning structure carries implicit information about the environment in which the function operates. Dennett does not then conclude,

It is with (*con,* with) its biochemical structure that a biological construct possesses knowledge (*scire*, to know). Alternatively; biological replicative constructs are *con-scious.*

This definition is emphatically not a call to panpsychism. Before the definition is expanded satisfactorily, to cater for those mental characteristics more commonly associated with 'consciousness', we need to clarify the definition, and note the important step that has just been taken thus far with this initial definition.

A construct is passively conscious when its component parts are the intrinsic interdependent elements that define the construct's structure and when the construct's behaviours arise from the structure's adaptation to environmental conditions.

This clarification creates the necessary division between organisms that do possess consciousness, and constructs and structures that do not. For example, those that do not possess consciousness include,

i) Artefacts, such as thermostats (Chalmers, 1994), buckets of water (Searle, 1983), or computers.
ii) Aggregations of atomic elements and/or compounds, of which crystals or rocks are examples.
iii)Constructs that cannot replicate and consequently cannot behaviourally adapt, of which solar, economic, or social systems would be examples.

Certain artefacts are artificially organised constructs designed to give the *appearance* of or to *mimic* the behave of coherent uniform constructs. But a thermostat or bucket of water is no more a construct than, for example, a person and the house in which they live. Both house and person may be interpreted as constituting a single interactive structure: when the person is in the house, that individual's environmental parameters are controlled and restricted by the house. However, combining the two does not constitute a uniform construct because they are not interdependent parts of a functional whole. Computer software likewise is constructed by combining non-relational elements to create organised syntactic actions, but these characteristics are present in the absence of a functional construct. Searle (1980) makes a related point with his 'Chinese Room Argument' thought experiment, where he argues that a computers syntactic operations do not lead to semantic interpretations on the part of the computer.

The intention so far, has been to describe a relationship between constructs and knowledge thereby providing only a preliminary account of how information relates to our initial and narrow definition of consciousness. This relationship is necessary for the theory to comply with the first part of Chalmers' double aspect theory of information principle, which is that information is fundamental to consciousness (c.f. 1.1.b) i) above – Criterion A). The second part of Chalmers' double aspect theory of information principle states that information corresponds to physical and to phenomenal features that are isomorphic. It is to this second part of the principle that attention turns in the following section and which broadens and clarifies the previous definition of consciousness:

4.3.3 Information growth and the distinction between passive and active consciousness states

As stated previously, when a construct interacts with the environment it will either maintain stability and demonstrate its structural function by behaving in an ordered manner, that is, in a manner consistent with that construct's structural function, or the construct's dynamic will reacquire stability in a disordered manner whereby the construct's structure and integrity is compromised. One can explore this dichotomy in relation to consciousness as follows:

Passive state - Mutation ensures that a replicating construct's physiology adapts to the environment over time because it creates the potential of improved survival resilience (as of #1, above). However, it is not its replicating structure but environmental selection, that determines the nature of the knowledge that a constructs structure *acquires* over generations. A replicating organic structure does not have the capability to dictate the means by which it acquires complex environmental knowledge. Thus, when reaffirming the previous definition of consciousness, i.e. that it is with (*con,* with) its biochemical structure that a biological construct expresses its knowledge (*scire*, to know), we see with clarity that the conscious state is passive for a replicating organism, because its structures acquire knowledge unintentionally over evolving generations.

This disordered evolution of the passively conscious, leads to ever increasingly complex innately acquired structural adaptations, in perpetuity. However, this uncontrolled acquisition of 'innately' acquired structural knowledge leads incidentally, to the creation of a new construct where consciousness becomes an active process:

Active conscious: A new construct - A construct acquires a unique capability to actively and intentionally influence the acquisition of its knowledge when it develops the capability to *assimilate* and *evaluate* realtime environmental conditions. This capability has significant potential advantages over other forms of physiologically evolved knowledge because it enables the evolution of *behavioural* rather than mere *structural* adaptation. The potential advantages have resulted in the evolution of sophisticated neural network mechanisms, which are the most successfully evolved biochemical mechanism capable of spontaneously encoding knowledge about environmental conditions.

4.3.4 On the evolving capability to 'evaluate environmental conditions'

To realise the potential advantages of behavioural adaptability requires #1 structural adaptation through the evolution of,

i) Sensory mechanisms for converting environmental experience into a bio-chemical format.
ii) Interpretative mechanisms for conflating and organising that sensory derived information.
iii) Evaluative mechanisms for prioritising the relevancy of that knowledge for the purposes of motivating action.
iv) Physiological mechanisms for instituting the benefits of these cognitive capabilities.

The extent to which sensory, interpretative, and evaluative mechanisms evolve, determines the sophistication of an organism's behavioural adaptability and determines its ability to respond effectively to the 'good' and the

'bad' of environmental experience, whilst the potential benefits of these capabilities enables the evolution of advanced and spontaneously adaptable social interactions.

4.3.5 On the 'good' and the 'bad' of environmental experience

Neurally encoded knowledge has a distinctive characteristic that sets it apart from innately acquired physiological knowledge. Specifically, actively conscious constructs uniquely develop an *understanding* of the qualitative relevance of experience. The understanding is defined by the relationship between a spontaneously acquired environmental knowledge and an interpretation of the *quality* of that experience. Some experiences are good whilst others are bad.

It is through an association between its fluctuating stable neural knowledge and the aesthetic quality of its experiences, that an individual organism acquires a *stable understanding* of the environment. As the stability of understanding fluctuates with experience, an animal is compelled to 'learn' to balance its evolved aesthetic preferences.

4.3.6 HCT explains the requirement for a stable understanding

A key characteristic of any construct is that its dynamic and interdependent parts must be able to maintain stability for the construct to exist. Applying this principle to #2; neurally encoded understanding about the environment, represents a singular stable construct state. Environmental conditions have a continually destabilising effect on neurally encoded phenomenal understanding. Thus, there is a constant realignment of the stability of the understanding that neural structures encode in response to environmental interaction. As a consequence of this dynamic process, actively conscious constructs are continually seeking an all-inclusive behavioural adaptation.

4.3.7 HCT and the subjective and ineffable characteristic of the phenomenon of feeling

A continual realignment of stable understandings ensures that actively conscious organisms experience a unique phenomenon that reflects the essence of experience. This essence of changing knowledge as it relates to the aesthetic 'quality' of experience, creates a qualitative feeling phenomenon.

The term 'phenomenon of feeling', is not that which one might associate with human concepts of 'what it is to have feelings'. Feeling here refers to an effect arising from a process of restabilising neural qualitative representations. In itself, the effect arises as a by-product of the processes of active consciousness and has no contextual status-by-default. Consequently, comparative experiential interpretation is not a process of 'thinking' that can therefore be self-scrutinised with thought. The aesthetic value of experience is determined by the innate intrinsic worth, to a construct, of specific classes of experience. Consequently, qualitative feeling is subjective and ineffable. (c.f. Carruthers, 1.1.a) i to v, and the second part of Chalmers criterion A c.f. 1.1.b) i above).

4.3.8 What HCT indicates of 'feeling' and its correct interpretation

A stable understanding of experience does not give an animal a mind's eye view, inner wisdom, or self-knowing concept.

Consider the nature of communication in an animal that is only actively conscious of experience. In this state, an animal can express itself only by communicating its innate responses to stimuli or by communicating expressions that reflect its feelings regarding experience:

The evolution of the communication of feeling has an advantage in that it can lead to increasingly complex interactive social behaviours and distinctive individual and social stances. But for a #3 animal, there remain no defined realisations as to the significance of any given feeling regarding its expression or interpretation, or any particular insights regarding the relationship between an expression and learnt associations. In the absence of conceptual representation, an animal such as this cannot begin to communicate any form of conceptual understanding or form a view as to what such an expression means 'emotionally'. Consequently, the phenomenal state of being actively conscious of perception does not embody the notion of what it is to be a human that is *aware* of the phenomenon of experience.

The complications of the human perspective regarding feeling are due to the reasoning that arises from a *conceptual* rationale. In this vein, Gunther (2004) argues, "by *introspecting* [italics added] on what we feel, we learn to recognise what emotional attitude we're experiencing." (p. 44) This view is shared by de Sousa (2003) who suggests, "the specific nature of my emotion's formal object is a function of my *appraisal* [italics added] of the situation." (p. 1). Introspection and appraisal (as italicised) are distinct and uniquely human attributes that alter human interpretations of the status of feeling. In support of this, research by Nielsen (1998), and the reassessment of Damasio (1994, 1999), indicates that human creative, reasoning, and problem solving processes utilise the evaluation and assessment of emotions rather than feelings themselves.

4.3.9 HCT and its impact on artificial consciousness applications

HCT indicates that the desire for construct stability generates a self-regulatory macro-intentionality that drives the functional syntactic operations of actively conscious constructs and is the motivation behind the evolution of physiological and organisational mechanisms. Theoretically therefore, a hierarchically based model founded on the principles established by HCT would create the necessary causal mechanisms that would create a self-perpetuating artificial state whose functional organisation would generate syntactic mechanisms with qualitatively identical experiences to conscious animals. (cf. Searle, 1980).

4.4.1 Construct #4 - Awareness states

In the following section, the focus is on extrapolating the construct hierarchy further thereby providing a coherent explanation for unique human characteristics, such as language, complex social order, and creativity.

4.4.2 On the evolution of passive and active awareness

Passively aware state - In the previous consciousness category section, active consciousness enables the

intentional acquisition of knowledge and to the evolution of understanding and behavioural adaptation. This capability has unique potential survival benefits that drive the evolution of sensory, evaluative, and interpretative cognitive mechanisms. Inevitably, cognitive mechanisms evolve in perpetuity, and become increasingly sophisticated in their ability to respond to social and environmental influences.

During the process of re-stabilising understandings, any insights that an actively conscious individual may acquire are unintentional, because there is no systematic interpretation of understanding and no conception of what understandings mean in the context of reality. Such individual animals are *passively* aware of the conscious phenomenon of experience. Kant describes what it is like to experience this passive state in a letter to Herz:

> [If I had the mentality of a sub-human animal, I might have intuitions but] I should not be able to know that I have them, and they would therefore be for me, as a cognitive being, absolutely nothing. They might still… exist in me (a being unconscious of my own existence) as representations…, connected according to an empirical law of association, exercising influence upon feeling and desire, and so always disporting themselves with regularity, without my thereby acquiring the least cognition of anything, not even of these my own states. (Bennett, 1966, p. 104).

However, with ever-increasing cognitive complexity there comes a point in the evolution of animals that are passively aware of the conscious phenomenon of experience, when a unique construct emerges.

Actively aware state: A new transcendent construct – The neural mechanism responsible for creating understanding evolves a unique transcendent construct when it begins to generate ‘interpretations of understanding’. Interpretations of understanding require the identification of relationships regarding the principle and conditional properties of the objective elements that comprise the reality that an individual experiences. When a construct begins to interpret understanding in this way through introspection, it has the capability of developing ‘conceptual realisations’.

With actively consciousness animals, learning and feeling are a derivative of complex processes and experiential associations. However, this complexity does not bestow upon its individuals a realisation as to the significance of these associations. To do so, would be to recognise their *functional* relevance. For example, an animal may learn that prodding a stick into a crack in a tree and wiggling it about reveals a grub that satisfies its hunger. However, this does not indicate the possession of a conceptual realisation regarding sticks and satisfaction. To do this, it must make an association between objects that, in general, can function as tools for a variety of purposes to achieve a myriad of satisfying outcomes. Such a realisation is what leads to the development of generalised, and ultimately creative, *concepts* about tools in general, and about how they might satisfy.

The proposal is that a complex interdependent conceptual architecture evolves from a realisation of objective

functional properties in view of the emergent appreciation and interpretation of an individual's desires, feelings and understandings.

4.4.3 On the emergence of two fundamental concepts

a) As concepts emerge, they do so in correlation with environmental properties that are also formative in the evolution of the distinctive processing and structural characteristics of each construct category. An example of two such properties are the spatial and temporal. Whilst a non-human animal is capable of relating to the contents of objective reality contextually in terms of their position in time and space, it is unable to represent those same objects within a spatiotemporal conceptual architecture.

A spatiotemporal conceptual architecture has profound implications on the way an individual relates to reality. This relationship need not be generated within the confines of verbal language but can be based on any 'principle of relations'. For example, the principle of relations between the sound pitches in time and the pitch intervals of space, enable humans to conceptually interpret melody and harmony in music and then to relate this to the phenomenon of music's experiential effects as a moving landscape of emotive impressions; all without necessarily interpreting the same through verbal description.

As with all concepts, spatiotemporal concepts are founded on a 'principle of relations' that determine an emergent correlative interpretation of the extrinsic properties that comprise reality, but inevitably can never decipher the intrinsic nature of those properties in themselves.

b) Another powerful concept, is the recognition of the phenomenon of reality itself. I say that it is powerful, because it is by recognising the phenomenon of reality that an individual human comes to recognise itself as a being that exists, as part of reality. This recognition leads to an emerging identification of the concept of self and to an active development of an awareness of the conscious state. In the grand scheme of a personal identity, an emerging conceptual architecture generates concepts about phenomena and ultimately to the recognition of phenomenal experience as a 'condition' of the self. Once again this is consistent with Kant (1781/9):

> …the original and necessary consciousness of the identity of oneself is at the same time a consciousness of an equally necessary unity of the synthesis of all phenomena according to concepts, that is, according to rules, which render them not only necessarily reproducible, but assign also to their intuition an object, that is, a concept of something in which they are necessarily united. (p. 108)

Notably, it is impossible for a self-concept to exist without a belief-concept that can account for the subjective, even if that concept maintains the *denial* of the subjective.

4.4.4 Languages are a by-product

Being actively aware of the conscious state has a significant effect on communication. Whilst the

communication of only feeling in actively conscious animals may exploit complex sounds and gestures, the communication of conceptual reality in actively aware humans is an entirely different proposition: The construction of a conceptual realisation is what *compels* a human to formulate any suitable framework that can effectively communicate conceptualised reality. That universally suitable framework for all languages, is a grammar that facilitates the identification and relation between the objects and functions relevant to the conceived reality worldview. Consequently, an individual's languages develop *in response* to its maturing concepts and their descriptive relevance.

Here in lies a coherent and more plausible alternative interpretation of the findings that led Chomsky (1988) to suggestion that language arises through a realisation in the brain of an innate language faculty, or "language acquisition device" that switches on during language development. Hierarchical Construct Theory explains that language and its functional mechanisms are merely a *by-product* of the dynamics arising from being actively aware of consciousness (as defined above). Language *arises* in individuals through the compulsion to persuasively communicate their 'revelatory' conceptual realisations.

Hierarchical Construct Theory qualifies the need for a reevaluation of the conclusions of Savage-Rumbaugh et al. (1993) and Greenfield & Savage-Rumbaugh (1990, p. 540); that the evolutionary root of human language can be found in the "linguistic" abilities of the great apes, and of the proposals of Leakey & Lewin (1992); that the cognitive foundation for human language is present in ape brains. HCT falsifies the theory that physiological characteristics are responsible for the emergence and development of language, offering the alternative view that an evolving construct hierarchy drives the development of physiological evolution in each transcendent category. Reviewing the research in the light of HCT shows a unified and coherent explanation: actively consciousness processes compel apes and immature human infants to communicate only innate responses and attitudes of feeling, whilst actively aware processes, additionally, compel maturing humans to communicate conceptualised reality. The potential benefits of sophisticated social interaction that arise from the expression of conceptualised reality are what drive cognitive and physiological adaptations that expedite the identification of principles of objective function, the manipulation of social and environmental causes, and *facilitate* the development of language processing mechanisms.

4.4.5 Why are phenomenal properties ineffable?

Conceptual processing is incapable of accessing both the processes that create active consciousness of the qualitative relevancy of realtime experience, and the processes that create active perception of the qualitative relevancy of physiological bio-chemical structure. This fact does little to deter individuals from *trying* to conceptualise the phenomenon of their experiences, which include bodily functions, sensations, feelings, and phenomenal consciousness itself. In conclusion to such cogitations, an individual might come to define sensations as, for example, 'introspectively accessible phenomenal experiences that are irreducible' and yet such descriptions provide *no* clue as to what sensations *actually feel like* or what they are. The powers of conceptual thought are impotent in their scope to decipher the causal mechanisms of these processes through introspective analysis alone. Inevitably, despite the familiarity of phenomenal experience and consciousness,

conceptual description remains elusive (Nagel, 1974; Jackson, 1986; Dennet 1995b).

4.4.6 The relationship between stable concepts of reality, creativity, and social cohesion

One of the key characteristics of constructs is their tendency toward a state of equilibrium during interaction, as of Newton's Third Law of Motion. This tendency toward equilibrium ensures self-regulation which is concerned with the maintenance of dynamic stability at each hierarchical layer. In the case of the construct that generates an awareness of the phenomenon of experience, the requirement for the maintenance of a stable conceptual interpretation has a profound affect on the behaviour of its individuals and their social interaction:

a) Every individual human possesses stable concepts about reality. However, conceptual stability is often challenged by environmental interaction, contemplation, and discussion and, like a colliding Newtonian body, there is resistance to their destabilising effects. Individuals are eager to resist alternative concepts that destabilise their interpretation of reality. Indeed, every individual's 'concept of reality' includes a concept of self (c.f 4.3.3 b)), whose interdependent parts include a multitude of incorporated constructs. Consequently, individuals are extremely protective of their interdependent concepts because they contribute to a stable concept of self and identity. Even when reason shows various concepts to be absurd, individuals will still adamantly protect an irrational concept. This need for a stable concept of reality is the most potent influence in small group discussion, in the introduction of novel concepts, and during attempts at creative contemplation.

b) An individual's concepts necessarily incorporate family, tribal, and social rules, beliefs, and ideals. Beliefs and ideals are in themselves concepts. Their particular potency is driven by the tendency of individuals to subscribe unquestioningly to a community and thereby become advocates of the community's beliefs and ideals. In turn, individuals are compelled to protect the ideals and the beliefs of their affiliated groups because they are formative in the development of their own conceptual world view. Concepts derived from group affiliation can motivate great prejudice and bias. Notably, an individual's concepts are often conflicting with those group concepts to which he/she subscribes. Moralising is often preoccupied with these types of conflict in the actioning of behaviour, but this is a very narrow consideration to the cause of what is 'good'.

c) Different classes and levels of 'conceptual distortions' and divergence strategies inevitably evolve in all individuals to maintain conceptual stability. One could classify these distortions and their ensuing behaviours in terms of the relationship between concepts and the dynamics of anomalies in, and destabilisations to each hierarchical construct category. Understanding the nature of the development of these anomalies is necessary to further advance psychological profiling and treatments, and to improve techniques at resolving group conflict.

Summary

Hierarchical Construct Theory explains how ordered and disordered interaction between constructs and their environments leads to an evolving hierarchy of self-regulatory constructs. Each construct has its own

evolutionary paradigm and characteristic functional behaviours. It is a simple and unified model that explains the dynamic that generates the phenomenon of experience, which humans call consciousness:

Perception

The unintended emergence of active perception began on earth with complex replicating compounds about 3.5 to 4 billion years ago at the commencement of the Cambrian period. It signifies a point when constructs began to intentionally (rather than to unintentionally) evolve informed structural knowledge about the environment, with the potential benefits being realised in a disordered manner through the development of complex organic physiologies. A process of self-regulatory organisation is identifiable in these constructs as they seek to maintain stable structural adaptations. The communicative behaviours of actively perceptive constructs are confined to innate behavioural responses to environmental experience.

Consciousness

From the disordered evolution of perceiving structures emerged a construct that was actively conscious of experience. It began with the unintended evolution of the ability to spontaneously compare realtime environmental experiences in wormlike animals of the phylum Annelida about 540 million years ago fuelling the Cambrian evolutionary explosion. It signifies a point when constructs began to intentionally evolve structural understandings by way of the informative relationship that exists between knowledge about the environment and its experiential effects. The potential benefits were realised in a disordered manner through the development of complex adaptive behaviours within the bounds of evolved complex neural and structural mechanisms. A process of self-regulatory organisation is identifiable in these constructs as they seek to maintain stable behavioural adaptations. As by-products of the process, animals experience a phenomenon of feeling, and learn through its association with environmental causes. The communicative behaviours of actively conscious constructs are confined to verbal utterances and visual displays that portray only feeling.

Awareness

From the disordered evolution of mechanisms that could derive a actively conscious understanding of the qualitative relevancy of realtime experiences, emerged a construct that was actively aware of the conscious phenomenon of qualitative experience. It began with the unintended evolution of higher order conceptual processing in the hominid brain during the late Pliocene, about 2.5 to 3 million years ago. It signifies a point when constructs began to intentionally evolve structural concepts about reality, which involves identifying the information architecture of the principles and conditional properties for the objective elements that comprise reality. The potential benefits were realised in a disordered manner through the development of complex creative behaviours (both negative and positive) within the constraints of evolving complex cognitive and structural mechanisms, fuelling a rapid expansion in brain size. A process of self-regulatory organisation is identifiable in these individual constructs as they seek to maintain a stable concept of reality. As a by-product of the process, humans experience novel insights as they develop a complex conceptual architecture from a realisation of objective properties and functions. The communicative behaviours of actively aware constructs

are driven by a desire to convey realisations about reality using any suitable medium and framework. This is possible through a grammatical structure that need not be linguistic, but that must be able to convey conceptions of reality.

Future construct

Finally, by extrapolation, one can ascertain the nature and mechanisms behind the next evolutionary stage – The future evolutionary stage to which humankind is evolving.

What is that future state?

References

Armstrong, D. (1968) *A Materialist Theory of the Mind,* London: Routledge.

Armstrong, D. (1984) Consciousness and causality, in Armstrong, D. & Malcolm, N. (eds.) *Consciousness and Causality,* (pp. 103-191), Oxford: Blackwell.

Bennett, J. (1966) *Kant's Analytic,* Cambridge: Cambridge University Press.

Bertalanffy, L von. (1950) An Outline of General Construct Theory, *British Journal for the Philosophy of Science,* 1, pp. 139-164. [Also online], http://www.isnature.org/events/2009/Summer/r/Bertalanffy1950-GST_Outline_SELECT.pdf

Bertalanffy, L von. (1951) General construct theory – A new approach to unity of science (Symposium), *Human Biology,* 23, pp. 303-361.

Boltzmann, L. (1974) The second law of thermodynamics, in McGinness, B. (ed.), *Theoretical Physics and Philosophical Problems* (pp. 13-32), NY: D. Reidel. (Original work published 1886).

Carruthers, P. (1996) *Language, Thought and Consciousness: an essay in philosophical psychology,* Cambridge: Cambridge University Press.

Carruthers, P. (2000a) *Phenomenal Consciousness,* Cambridge: Cambridge University Press.

Carruthers, P. (2000b) The evolution of consciousness, in Carruthers, P. & Chamberlain, A. (eds.), *Evolution and the Human Mind,* Cambridge: Cambridge University Press, [Also online], http://www.philosophy.umd.edu/Faculty/pcarruthers/Evolution-of-consciousness.htm [Jan 2012].

Carruthers, P. (2004) Reductive explanation and the 'explanatory gap', *Canadian Journal of Philosophy, 34*, [Also online], http://www.philosophy.umd.edu/Faculty/pcarruthers/Reductive-explanation.htm [24 Jan 2012].

Chalmers, D. (1994) *What is it like to be a thermostat?* [Online at], http://consc.net/notes/lloyd-comments.html

Chalmers, D. (1995) Facing up to the problem of consciousness, *Journal of Consciousness Studies* 2 (3). pp.200-219, [Also online], http://consc.net/papers/facing.html [24 Jan 2012].

Chalmers, D. (1996) *The Conscious Mind,* Oxford: Oxford University Press.

Chalmers, D. (1999) Materialism and the metaphysics of modality, *Philosophy and Phenomenological Research*, 59.

Chalmers, D. & Jackson, F. (2001) Conceptual analysis and reductive explanation, *The Philosophical Review*, 110.

Chomsky, N. (1988) *Language and Problems of Knowledge: The Managua Lectures,* Cambridge, MA: MIT Press.

Corning, P.A. & Kline, S.J. (1998) Thermodynamics, Information and Life Revisited, Part I: 'To Be or Entropy' *Constructs Research and Behavioural Science,* 15, pp. 273-295.

Damasio, A. (1994) *Descartes' Error,* NY: G.P. Putnam's Sons.

Damasio, A. (1999) *The Feeling of What Happens: Body and Emotion in the Making of Consciousness,* NY: Harcourt Brace.

Dennett, D. (1978) Towards a cognitive theory of consciousness, in Dennett, D. (ed.), *Brainstorms* (pp. 149-173), Hassocks: Harvester Press.

Dennett, D. (1991) *Consciousness Explained,* London: Penguin Press.

Dennett, D. (1995a) *Darwin's Dangerous Idea: Evolution and the Meanings of Life,* NY: Simon & Schuster.

Dennett, D. (1995b) The Unimagined Preposterousness of Zombies, *Journal of Consciousness Studies,* 2 (4), pp. 322–

326.

de Sousa, R. (2003) Psychological and Evolutionary Approaches, *Emotion,* in Zalta, E. (ed.), *The Stanford Encyclopedia of Philosophy*, Stanford: Stanford University, [Also online], http://plato.stanford.edu/archives/spr2003/entries/emotion/#4 [24 Jan 2012].

Dowell, J.L. (2007a) Serious Metaphysics and the vindication of reductions, *Philosophical Studies* 139 (1) pp. 91-110.

Dowell, J.L. (2007b) A Priori Entailment and Conceptual Analysis: Making Room for Type-C Physicalism. Forthcoming in *Australasian Journal of Philosophy* 86 (1) pp. 93-111.

Dretske, F. (1995) *Naturalizing the Mind,* Cambridge, MA: MIT Press.

Flanagan, O. (1992) *Consciousness Reconsidered,* Cambridge, MA: MIT Press.

Gennaro, R. (1996) *Consciousness and Self-Consciousness,* Amsterdam: John Benjamins Publishing.

Greenfield, P.M. & Savage-Rumbaugh, E.S. (1990) Grammatical combination in Pan paniscus: Processes of learning and invention in the evolution and development of language, in Parker, S.T. & Gibson, K. (eds.), *"Language" and Intelligence in Monkeys and Apes: Comparative Developmental Perspectives* (pp. 540-579), NY: Cambridge University Press.

Gunther, Y.H. (2004) The phenomenology and intentionality of emotion, *Philosophical Studies,* 117 (1-2), pp. 43-55.

Hempel, C. (1965) *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science*, New York: Free Press.

Jackson, F. (1982) *Epiphenomenal qualia,* Philosophical Quarterly, 32.

Jackson, F. (1986) What Mary Didn't Know, *The Journal of Philosophy* 83 (5), pp. 291-95.

Kant, I. (1922) *Critique of Pure Reason,* in Mueller, F, M. (trans.), New York: Macmillan (Original work published 1781/8), [Also online], http://oll.libertyfund.org/?option=com_staticxt&staticfile=show.php%3Ftitle=1442&chapter=97760&layout=html&Itemid=27

Kirk, R. (1994) *Raw Feeling,* Oxford: Clarendon Press.

Kuhn, A. (1974) *The Logic of Social Constructs,* San Francisco: Jossey-Bass.

Leakey, R., & Lewin, R. (1992) *Origins Reconsidered: In Search of What Makes Us Human,* NY: Doubleday.

Levine, J. (1983) *Materialism and qualia: the explanatory gap,* Pacific Philosophical Quarterly, 64.

Levine, J. (1993) On leaving out what it's like, in Davies, M and Humphreys, G (eds.), *Consciousness*, Oxford: Blackwell.

Levine, J. (2001) *Purple Haze: The puzzle of consciousness,* Oxford: Oxford University Press.

Lycan, W. (1987) *Consciousness.* Cambridge, MA: MIT Press.

Lycan, W. (1996) *Consciousness and Experience,* Cambridge, MA: MIT Press.

McGinn, C. (1991) *The Problem of Consciousness,* Oxford: Blackwell.

Nagel, T. (1974) What is it like to be a bat? *Philosophical Review* 83 (4), 435-50.

Nelkin, N. (1996) *Consciousness and the Origins of Thought,* Cambridge: Cambridge University Press.

Nielsen, L. (1998) Modeling creativity: Taking the evidence seriously, in Hameroff, S. R., Kaszniak, A. W. and Scott, A. C. (eds.), *Toward a Science of Consciousness II: The Second Tucson Discussions and Debates* (pp. 717-824), Cambridge, MA: MIT Press.

Pieper, J. (2000) *Entropy, Disorder and Life,* [Online], http://www.talkorigins.org/faqs/thermo/entropy.html [24Jan 2012].

Prigogine, I. (1978) Time, Structure, and Fluctuations, *Science,* 201*,* pp. 777-785. [Also online], http://pchen.ccer.edu.cn/homepage/Time,%20Structure,%20and%20Fluctuations.pdf

Rosenthal, D. (1986) Two concepts of consciousness, *Philosophical Studies,* 49*,* pp. 329-359.

Rosenthal, D. (1993) Thinking that one thinks in Davies, M. & Humphreys, G. (eds.), *Consciousness* (pp. 197-223), Oxford: Blackwell.

Rovelli, (1996), "Relational quantum mechanics", *International Journal of Theoretical Physics*, 35: 1637–1678).

Savage-Rumbaugh, E.S., Murphy, J., Sevcik, R.A., Brakke, K.E., Williams, S.L., & Rumbaugh, D.M. (1993) Language comprehension in ape and child, *Monographs of the Society for Research in Child Development,* 58 (3-4 Serial No. 233).

Schrödinger, E. (1944) *What is Life?* Cambridge: Cambridge University Press, [Also online], http://whatislife.stanford.edu/LoCo_files/What-is-Life.pdf [24 Jan 2012]

Searle, J. (1980) *Minds, brains, and programs,* Behavioral and Brain Sciences, 3 (3), pp. 417-457. [Also online] http://cogprints.org/7150/1/10.1.1.83.5248.pdf

Searle, J. (1983) *Intentionality: An Essay in the Philosophy of Mind*. New York: Cambridge University Press.

Sturgeon, S. (1994) *The epistemic view of subjectivity,* Journal of Philosophy, 91.

Sturgeon, S. (2000) *Matters of Mind: Consciousness, Reason and nature,* London: Routledge.

Tye, M. (1995) *Ten Problems of Consciousness: a representational theory of the phenomenal mind,* Cambridge, MA: MIT Press.

Velmans, M. (2001) A natural account of phenomenal consciousness. *Communication and Cognition* 34, (1/2) pp. 39-60, [Also online], http://www.neuroquantology.com/index.php/journal/article/view/70/70 [24 Jan 2012]