The Neurobiology of Human Consciousness:
Linking Rhetoric, Science, and Graduate Liberal Studies

by

Kerk F. Kee
Department of Communication Studies
University of Texas at Austin

kerk.kee@gmail.com

www.ekerk.com

ABSTRACT

The purpose of this paper is to suggest Consciousness Studies as the fertile ground for linking the fields of Rhetoric, Sciences, and Graduate Liberal Studies. In order to do that, I first present a theoretical model developed in a master’s thesis on the topic of consciousness, which was completed in the Graduate Liberal Studies program at San Diego State University. Drawing widely from research by neurologist Antonio Damasio (2000, 2003), philosopher Daniel Dennett (1991, 2001, 2005), biologist Gerald Edelman (2000, 2004), and psychologist Julian Jaynes (2000), I argue in this theoretical model that the mechanisms of consciousness are both biological (neurons, neuronal groups, neural networks, and developmental selection) and cultural (semantics, language, metaphors, memes, and experiential selection), and the cultural mechanisms build on the biological mechanisms. This theoretical model shows that Consciousness Studies can benefit from research from the neurobiological studies of the brain, and the rhetorical studies of metaphors. Second, I explain the importance of rhetorical studies of metaphors in understanding human consciousness. Third, I note the recent establishments of doctoral programs the field of Graduate Liberal Studies as an indicator of its increased research emphasis. Implications of Consciousness Studies for the liberal arts tradition are also discussed.
INTRODUCTION

Consciousness is one of the most profound topics in the history of knowledge. It is the source of our identity, behaviors, cultures, politics, and civilizations. Without it, we cannot validate our own existence. It has been an enduring topic of debate in philosophy and religions for many centuries (Mishlove, 1993), and has become an important topic of inquiry in science for the past few decades (Churchland, 1986).

Consciousness is a mystery (Blackmore, 2004; Chalmers, 1999; Dennett, 1991; Edelman, 2004, Jaynes, 2000; McGinn, 1999). We experience consciousness at an intimate level. Yet, when asked to explain it, the experience is difficult to explain. David Chalmers (1999) states, “Conscious experience is at once the most familiar thing in the world and the most mysterious. There is nothing we know about more directly than consciousness, but it is extraordinarily hard to reconcile it with everything else we know” (p. 287).

An attempt to define consciousness depends on the assumptions, perspectives, and metaphors one uses to understand it. One can understand consciousness as the ghost in a machine, the algorithm of a computer program, or the product of firing neurons. At the experiential level, consciousness can be defined as “those states of sentience and awareness that typically begin in the morning when we awake from a dreamless sleep and continue throughout the day until we go to sleep again, or fall into a coma or die or otherwise become ‘unconscious’” (Searle, 1997, p. 5). In other words, consciousness is “the subjective, inner life of the mind” (Chalmers, 1999, p. 288). Under some special circumstances, there can be multiple altered states of consciousness, such as hypnotic and trance states, the interaction of emotional states and the experience of consciousness, and the phenomena described as multiple personality (Tart, 1969, 1975, 1999).

Scholars are still grappling with the mystery of consciousness. The mystery is traditionally known as the ‘mind/body problem.’ Churchland (1979) explains that the mind/body problem is the question of “the relation between familiar psychological states on the one hand, and the neurophysiological states of the body and the central nervous system on the other” (Churchland, 1979, p. 107). Philosophers and scientists have not yet solved this problem. However, neurobiologist Christof Koch (2004) believes that we stand at a turning point in the history of science and that the “technology to discover and characterize the subjective mind emerges out of the objective brain is within reach” (p. 314). The first goal of
this manuscript is a humble effort trying to put a few pieces of the puzzles together in the attempt to understand the mechanisms underlying human consciousness. To do this, we have to explore the historical development of the problem, and the argument for an evolutionary perspective.

**BACKGROUND**

The ‘mind/body problem’ has inspired different theories, both lay and scholarly (Mishlove, 1993). Broadly speaking, these theories can be categorized into two camps: the dualist camp that believes there are two kinds of stuff (i.e. the physical stuff and the nonphysical stuff); and the monist camp that asserts there is only one kind of stuff (i.e. the physical stuff) in the world.

**Dualism**

The dualists are also known as the “mysterians,” (Chalmers, 1999, p. 288) because they believe that consciousness is a mystery that cannot be solved by scientific methods. There are two branches of dualism: substance dualism and property dualism. They emphasize different aspects to distinguish the mind and the body.

**SUBSTANCE DUALISM**

Substance dualists believe that the mind is a nonphysical substance (Churchland, 1992). This nonphysical substance is completely different from material substance that makes up the rest of the physical environment. If we examine substance dualism further, we will find two closely related theories: Cartesian dualism and popular dualism. Cartesian dualism was proposed by French philosopher, mathematician, and scientist Rene Descartes in 1641. He suggested that the world consists of two kinds of stuff. They are the extended stuff of the material environment, and the unextended, thinking stuff of the mind. These two substances interact in the pineal gland, which is located at the center of the brain. That is how consciousness, the mind, and the body work together. On the other hand, popular dualism assumes that a person is a “ghost in a machine” (Churchland, 1992, p. 9). The ‘ghost’ or the ‘spirit’ of a person is a spiritual substance that takes up physical space, but this substance is different from physical substance of the environment. Both of these theories believe that the mind is a nonphysical substance beyond scientific investigations.
PROPERTY DUALISM

Property dualists focus on the properties of the mind and body (Churchland, 1992). They contend that a person can be described both in mental and physical terms, but one cannot be reduced to another because they possess different properties. Churchland (1992) explains that property dualists argue, “while there is no substance to be dealt with here beyond the physical brain, the brain has a special set of properties possessed by no other kind of physical object. It is these special properties that are nonphysical: hence the term property dualism” (p. 10). These properties include feeling pain or pleasure, having a sensation of green or blue, thinking of a person or an idea, and desiring a job or a mate. The key distinction of property dualism is that these properties can never be explained by physical science, unless there is a separate “science of mental phenomena” (Churchland, 1992, p. 10).

There are three theories of property dualism. The first, and the oldest of all, is the epiphenomenalism. Churchland (1992) explains that the Greek prefix ‘epi-’ means ‘above,’ so the basic argument is that mental phenomena “ride ‘above the fray’” (p. 11). Although mental phenomena are the result of brain activities, mental phenomena does not have causal effects in return, and are “mere epiphenomena” (p. 11). Epiphenomenalists assert that the mind has no control over the body and behaviors. The second theory is interactionist property dualism. As the name implies, these theorists believe that mental phenomena have causal effects in return on the body and behaviors, and these behaviors are caused by human desires and personal choices. The last theory is elemental-property dualism. This theory suggests that mental phenomena are similar to other elemental phenomena, such as electromagnetic forces (Churchland, 1992). Therefore, mental properties are like electromagnetic properties that are elemental in nature, thus cannot be reduced to anything else. Regardless of its diversity, all dualists hold that consciousness and the mind are nonphysical phenomena.

Although dualism is the most popular theory in western history, society, and many world’s religions, most philosophers and scientists today reject this view (Churchland, 1992). Ryle (1949) ridiculed dualism as “the dogma of the Ghost in the Machine.” Blackmore (2004) argues that Cartesian dualism is problematic, because if mental phenomena, such as thoughts, can affect brain cells, then they involve either energy or magic. Since it cannot be magic, thoughts must be physical stuff that uses energy. Damasio (1999) predicts that by 2050, advances in biological sciences will have completely refuted traditional dualism.
**Monism**

The monist view argues that consciousness and mental phenomena can be subject to scientific explanation. Monists are also known as the “reductionists” (Chalmers, 1999, p. 288) and “materialists” (Dennett, 1991, p. 33), because they claim that consciousness can be reduced to materials that observe the laws of physics, chemistry, and biology. Reductionism reduces macro-level phenomena to micro-level phenomena (Churchland, 1996). Although some scholars criticize monism to be a limited perspective (Tart, 2006), science in the past few hundred years has been spectacularly successful (Crick, 1995), especially in the last three centuries (Churchland, 1996). This record of success makes the monist view a compelling perspective.

Monist research on consciousness and the mind can generally be categorized into two groups: artificial intelligence and neurobiology. Some monists hold that the brain is like a computer. Therefore, consciousness and the mind are products of algorithms in the brain. This is the foundation of artificial intelligence. Other monists contend that the brain is the product of evolution and the neurobiology of the brain (Churchland, 1995). Therefore, consciousness and the mind can be explained by the firing of a complex network of neurons (Crick, 1995; Damasio, 2000; Edelman, 2004; Koch, 2004). Regardless of the positions, monists maintain that there is only one kind of stuff, the material stuff. There is no spook (Edelman, 2004) and no spirit (Dennett, 2005) beyond physical material. Therefore, monists maintain that consciousness can be examined by scientific experiments and analyses.

**Artificial Intelligence**

Artificial intelligence (AI) is a branch of cognitive psychology, and AI researchers employ the metaphor of ‘brain-as-computer.’ They engage in “the endeavor to understand mind (thinking, intellect) in terms of its design (how it is built, how it works)” (Haugeland, 1997). In other words, the guiding question is: “How do we design digital artifacts and computer programs that behave and respond intelligently?” (Joseph & Poole, 2004). Initially, artificial intelligence researchers were successful in developing mathematical problem solving and expert systems. However, the metaphor of brain-as-computer is somewhat limiting in modeling biological intelligence. Under the limiting metaphor, classic AI researchers ignored insights from neuroscience. This approach then received criticism and
skepticism from researchers interested in modeling the nervous system (Joseph & Poole, 2004; Rumelhart, 1997).

**NEUROBIOLOGY**

Searle (1997) states, “consciousness is a natural, biological phenomenon. It is as much a part of our biological life as digestion, growth, or photosynthesis” (p. xiii). The possibility of a neurobiological explanation of consciousness is a still topic of debate in both the public and academic realms (Churchland & Churchland, 1998). However, advances in neuroscience make it possible to theorize how the brain represents, learns, and produces behaviors based on the basic principles of whole brain function.

There are two important concepts in biology that are key to the neurobiological study of consciousness. The first concept is the operation of natural selection. Every organism, cell, and complex biological molecules are subject to a long continued operation of natural selection, which stretches back to several billions years ago (Crick, 1988). Dobzhansky stated, “nothing in biology makes sense except in the light of evolution” (as cited in Blackmore, 2004, p. 141). Today, the theory of evolution is supported by observing small species that breed rapidly, such as fruit flies, and bacteria in response to antibiotics (Christian, 2004). Evolution is a powerful perspective (Dennett, 1995).

The second concept is mechanisms. Crick (1988) explains, “mechanisms built with chemical components and that are often modified by other, later, mechanisms added to the earlier ones” (p. 138). Therefore, a neurobiological approach to the study of consciousness must acknowledge that consciousness is the product of natural selection in evolution, and it is a mechanism that builds on earlier ones.

About two decades ago, philosopher Patricia Churchland (1986) established the interdisciplinary field of neurophilosophy. She proposed to philosophers of mind the following three tenets: “(1) mental processes are brain processes, (2) the theoretical framework resulting from a co-evolution of neuroscience and psychology is bound to be superior to folk psychology, and (3) it is most unlikely that we can devise an adequate theory of the mind-brain without knowing in great detail about the structure and organization of nervous systems” (p. 482). Today, the field of philosophy of mind can no longer ignore the contribution of neuroscience and neurobiology.
Another strong proponent of the neurobiological approach is biologist Francis Crick (1995). He stressed the point that the study of consciousness is a scientific problem. He authored the book, *The Astonishing Hypothesis*, and the hypothesis states: “all aspects of the brain’s behavior are due to the activities of neurons” (pp. 258-259), therefore, “to understand ourselves we must understand how nerve cells behave and how they interact” (p. xii). He argued that in order to understand consciousness, we have to understand neurons and how they interact together in a parallel fashion, because the “language of the brain is based on neurons” (p, 256). Building on this work, his colleague Christof Koch (2004) argues for a research program to discover the neuronal correlates of consciousness.

**The Research Question for a Theoretical Model of Consciousness**

As stated earlier, a neurobiological approach must acknowledge that consciousness is the product of natural selection in evolution, and it is a biological mechanism that builds on earlier ones. Philosopher Daniel Dennett (1991) argues that a sketch, a model, or a theory of how the brain works “can turn a perplexity into a research program” (p. 41). The purpose of the first part of the manuscript is to synthesize existing theories of consciousness that are based on evolutionary biology, and to sketch a theoretical model of human consciousness. The research question states: “What are the mechanisms underlying the operation of human consciousness?”

“A theory is a verifiable conceptual system of interrelated propositions explaining conditionship among a set of phenomena” (Spitzberg, 2001, p. 354). The theoretical model developed in this manuscript will be a system of interrelated propositions explaining the operation of human consciousness. This system of propositions can be generalized to the human species across cultures and societies, because the neurobiology is the same across races. Furthermore, propositions may be implicit, as in narrative description of a process or a diagrammatic model (Spitzberg, 2001). The analysis will also include a diagrammatic model with a narrative description of the operation of human consciousness. Finally, the essence of a theory is to explain the phenomenon of interest (Spitzberg, 2001). The phenomenon of interest in this manuscript is the operation of human consciousness.
A theoretical model of consciousness must fulfill several criteria. First, such a theory must be both empirical and philosophical, bridging science and philosophy (Dennett, 1991). Second, such a theory must build on the neural bases for consciousness, and show how it could have arisen during evolution, and how it develops in certain animals (Edelman, 2004). Third, such a theory should include the sense of self, the brain, the entire body, supplemented by cognitive and social theories (Damasio, as cited in Horgan, 1999, p. 299). Fourth, such a theory should be “a simple and elegant set of fundamental laws, analogous to the fundamental laws of physics…” (Chalmers, 1999, p. 294). Finally, such a theory should prove to be “the most reasonable theory on the evidence, to have the greatest explanatory power, predictive power, coherence, and simplicity” (Churchland, 1992, p. 7).

**Significance of a Theoretical Model of Consciousness**

The purpose of the study is to develop a theoretical model for the mechanisms underlying human consciousness. This study is significant at three levels: the personal, humanistic, and scientific. At the personal level, consciousness is the essence of our being. It is where our concept of self emerges (Damasio, 2000), and where our identity resides (Edelman, 2004). Consciousness is the source of our thoughts, feelings, and desires that direct our behaviors and choices (Damasio, 2003; Jaynes, 2000). A theory of consciousness has important implications for ourselves (Chalmers, 1999). Without consciousness, we do not know that we exist at the personal level.

Second, this study is significant to our humanity. Civilization is the physical manifestation of human thoughts, ideas, and plans conceived in consciousness. Therefore, consciousness is the foundation of our society, economy, politics, cultures, education, technology, and overall humanity. Without consciousness, we would not have the civilization we have today.

Third, and perhaps the most important for an academic thesis, this study is significant at the scientific level. The human brain is the most complicated material object ever known (Edelman, 2004). John Searle (1997) states, “The most important problem in the biological sciences… is this: How exactly do neurobiological processes in the brain cause consciousness?” (p. 3).

Searle’s claim is further supported by a collection of quotes in reference to consciousness and the mind. These quotes include: “the major unsolved problem in biology”
Neurobiology of Consciousness (Crick, 2004, p. xiii), “the most intriguing in all of science” (Chalmers, 1999, p. 287), and “the last surviving mystery” (Dennett, 1991, p. 21). Horgan (1996) states, “Mind, not space, is science’s final frontier” (p. 159). Based on these arguments, it is apparent that the research question at hand is significant.

The theoretical model the present study develops brings together four major theories in the field of consciousness studies. These theories are all based on evolutionary biology. Each theory is unique and multidisciplinary. By bringing these four theories together, we are able to draw from a huge range of disciplinary knowledge, and paint a fuller picture of the operation of human consciousness.

This attempt is unique because such syntheses are rarely done. The field of Consciousness Studies is relatively young. Due to its short history, there are not many fully developed theories yet, and there is no consensus on which theory is correct. Most scholars focus on developing their own theories. Synthetic attempt can be fruitful at this point. The following section will present the 19 propositions explaining the present theoretical model of consciousness. The first portion of the propositions emphasizes the biological mechanisms of consciousness, while the second portion on the cultural mechanism of consciousness.

PROPOSITIONS

Proposition 1: There are two sources of input to the multitrack process: internal inputs from the internal self, and external stimuli from the external environment.

The concept of ‘multitrack’ process was first proposed by Dennett (1991) in his Multiple-Drafts model of consciousness. According to him, at any given waking moment, various additions, incorporations, emandations, and overwritings of content can occur simultaneously, semi-independently, and randomly at various locations in the brain. This multitrack process occurs over hundreds of milliseconds. At every millisecond, various contents are at different stages of editions. These contents are the various drafts in the multitract process. These various editions of contents create narrative fragments in the brain. Narrative fragments contribute to the narrative stream (to be discussed in Proposition 7).

The first source of input to the multitrack process is the internal inputs from ‘self.’ Major theorists discuss this source slightly differently. Edelman (2004) calls it the internal states. He explains that ‘self’ signals come from four primary systems in the body and the brain: autonomic system (i.e. system that does not depend on conscious control), homeostatic
system (i.e. the system that compensates for changes in a balanced fashion), kinesthetic system (i.e. the system related to muscles and joints), and proprioceptive system (i.e. the system related to balance). The first two systems regulate vital organs and interactions of physiological functions. Some of these functions include breathing, eating, and hormonal changes. Some of the signals from such ‘self’ systems begin even before birth. All of these systems operate and sustain the life of the animal. They provide a central referential set of signals and perceptual categories. Internal states make up an important portion of input signals to the brain. They are self-generated, and are different from the signals coming in through the senses.

On the other hand, Damasio (2000) believes that consciousness emerged out of homeostasis. His conception of homeostatic regulations expands Edelman’s notion of homeostasis to consider metabolic regulations, basic reflexes, immune responses, pain and pleasure, drives and motivation, background emotions, primary emotions, social emotions, and feelings as the key components of homeostasis. According to him, homeostasis refers to the “coordinated and largely automated physiological reactions required to maintain steady internal states in a living organism. Homeostasis describes the automatic regulation of temperature, oxygen concentration, or pH in your body” (pp. 39-40). These automatic regulations do not require reasoning, and the purpose is to solve the basic problems of life (Damasio, 2003). These problems include finding energy sources and processing energy to sustain the life of the organism, maintaining interior chemical balance and protecting the organism from external agents of disease, and building and repairing the structure of the organism. The process of homeostatic regulation evolved from simple to complex. Regardless of the differences, Edelman and Damasio suggest that internal inputs are biological in nature.

The second source of input to the multitrack process is the external inputs from the external physical-behavioral environment outside of the body and brain. They can be an object, a person, or an event. Dennett (1991) explains that sensory inputs from the environment evoke trains of events in the cortex. These trains of events then gradually produce discriminations of greater and greater specificity. For example, when a physical object is presented to a human observer, an onset is created by the visual stimulus (i.e. a physical object), then the location of the object is detected, then the shape of the object, then
the color of the object, then the motion of the object, and finally the recognition of the object by the observer. External inputs can be physical, social, or cultural. As a whole Proposition 1 concludes that there are two sources of input to the multitrack process: internal inputs from the internal self, and external stimuli from the external environment.

**Proposition 2: Both internal and external inputs are filtered through excerption.**

Excerpt refers to our tendency to take an aspect or an image of an object, a person, or an event, frozen in time (Jaynes, 2000). In consciousness, we never completely see anything, interact with anyone, and experience an event. We can only see, or pay attention to a part of the thing, person, or event at any moment. Our knowledge of a thing, a person, or an event, is then a collection of excerptions and possible attentions we can give at various moments.

Jaynes (2000) contends that individual personality and changing situational factors determine what aspect or what image we excerpt. These factors are critical because our consciousness of the world and the people we interact with depend on these factors. He suggests, “How we excerpt other people largely determines the kind of world we feel we are living in” (p. 62). In other words, the external environment of things, people, and events are objective, and our consciousness of this environment depends on a filter shaped by social interactions and personal choices. It is important to note that excerption is not memory. However, memory adheres to the excerptions we made of the external environment. Furthermore, he argues that “consciousness is a metaphor of our actual behavior” (p. 61).

We suspect excerption applies to internal inputs from the biological systems discussed in Proposition 1. In other words, individual personality and changing situational factors determine which aspect of internal biological states one pays attention to. You are constantly breathing, but you may not excerpt this biological process when you are driving in Los Angeles heavy traffic in a hot summer afternoon, talking to a friend on the mobile phone about the documentary *What the Bleep Do We Know?* you just watched, with Elton John singing in the background.

**Proposition 3: Excerpted inputs become distributed contentful states.**

Specialized brain areas (Churchland & Sejnowski, 1992; Dennett, 1991, Edelman, 2005) process external and internal inputs, and yield contentful states. Therefore, contentful
states exist in both space and time in the physical brain. The concept of ‘distributed contentful states’ was first proposed by Dennett (1991) in his Multiple Drafts model. According to him, distributed contentful states contribute to the multitrack editing process discussed in Proposition 1.

**Proposition 4: Distributed contentful states are processed by current perceptual categorization.**

Perceptual categorization is “the selective discrimination of an object or event from other objects or events for adaptive purposes” (Edelman, 1992, p. 87). It allows an animal to partition and categorize input signals coming from the ‘self’ and the environment into sequences or a series of scenes (Edelman, 2004). Edelman (1989, p. 138) explains that the neocortex, cerebellum, hippocampus, and basal ganglia are responsible for the process of perceptual categorization. A key mechanism for perceptual categorization is global mappings, and it is primarily a non-conscious process (Edelman, 1989).

Global mappings are interactions between the sensory and motor systems in the nervous system. A global mapping is “a dynamic structure containing various sensory maps, each with different functionally segregated properties, linked by reentry. These are linked in turn by non-reentrant connections to motor maps and subcortical systems such as the cerebellum and basal ganglia” (Edelman, 2004, p. 49). Global mappings make up of the main basis for perceptual categorization in higher brains (Edelman, 2004). The concept of reentry is discussed in Proposition 10.

**Proposition 5: Contentful states that have been perceptually categorized become perceptual sets.**

Perceptual categorization is the process of partitioning and categorizing input signals coming from the body and the environment into sequences that result in adaptive behaviors (Edelman, 2004). For example, a human takes in the continual, parallel, and multiple visual signals from the garden and categorize them as coherent stable objects (i.e. “trees,” “flowers,” and so forth). A bird might do such a categorization but with different perceptual and motor responses (it might rest on the object we call a tree).

Contentful states feed into the perception categorization process and yield perceptual sets. Perceptual sets are internal information states. They make up our verbal reports of
experience and memory, meaning making or “semantic readiness,” (Dennett, 1991, p. 135) emotional states, and behavioral predispositions. “For instance, a discrimination of a picture of a dog might create a ‘perceptual set’ – making it temporarily easier to see dog (or even just animal) in other pictures – or it might activate a particular semantic domain, making it temporarily more likely that you read the word ‘bark’ as a sound, not a covering for tree trunks” (Dennett, 1991, p. 127). When probed, perceptual sets get elevated to brain-scale state.

**Proposition 6: Perceptual sets are processed by conceptual categorization.**

In order to recognize the common properties and to produce generalization across various complexes of signal and perceptual sets, “the brain must map its own activities, as represented by several global mappings, to create a concept—that is, to make maps of its perceptual maps” (Edelman, 2004, p. 50). This process is called conceptual categorization or concept formation.

Edelman (2004, p. 101) suggests that conceptual categorization takes place primarily in septum, amygdala, and hippocampus. The mechanism of conceptual categorization is non-conscious, however, because the process of forming new concepts requires attention, consciousness is necessary (Edelman, 1989). It is important to note that linguistic metaphors (Lakoff & Johnson, 2003; Jaynes, 2000) and cultural memes (Dawkins, 1989; Dennett, 2004) are essentially concepts. Therefore, metaphors and memes are probably formed in the same brain areas.

Jaynes (2000) defines metaphor as “the use of a term for one thing to describe another because of some kind of similarity between them or between their relations to other things” (p. 48). He suggests, “understanding a thing is to arrive at a metaphor for that thing by substituting something more familiar to us” (p. 52). “The essence of metaphor is understanding and experiencing one kind of thing in terms of another” (Lakoff & Johnson, 2003, p. 5).

According to Dawkins (1989), “Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches” (p. 192). He explains that a meme is an entity that can be transmitted from one brain to another. He further argues that memes are living structures. Therefore, the concept can include examples such as
“architecture, rituals, laws, music, art, and written tradition, as a co-adapted stable set of mutually-assisting memes” (p. 197).

**Proposition 7: Perceptual sets conceptualized create narrative streams.**

The process of conceptual categorization yields concepts that contribute to narrative streams. A narrative stream or sequence is made up of narrative fragments at various stages of editing. Since these narrative fragments undergo continuous editing, there are ‘multiple drafts’ of a single narrative fragment over time. If one probes too early, a ‘rough draft’ with little specificity may be obtained. If one probes too late, a completed draft may have died out or been transmitted to other parts of the brain. Therefore, conscious narratives are not independent of particular probes. When probed at a particular point in time, a single version of the narrative stream (i.e. ‘stream of consciousness’) can be obtained.

It is important to note that since our narrative stream of consciousness is made up of narrative fragments undergoing continuous editing, there are no pre-consciousness and post-consciousness states. Also, there is no final or published draft in the actual stream of consciousness, whether or not the experimenter (or even the subject) can gain access to it.

Furthermore, “the Multiple Drafts model makes ‘writing it down’ in memory criterial for consciousness; that is what it is for the ‘given’ to be ‘taken’ – to be taken one way rather than another. There is no reality of conscious experience independent of the effects of various vehicles of content on subsequent action (and hence, of course, on memory)” (Dennett, 1991, p.132). This is probably one reason why Weick (1995) and E.M. Forster both argue, "How can I know what I think until I see what I say" or why von Foerster (1984) proposes, "Doing = Knowing" (p. 60).

**Proposition 8: Narrative streams that have sequalae are linked to special value-category memory.**

Sequelae refer to modulation of subsequent behavior (Dennett, 2005). Things that have sequelae can have important consequences to our survival, unique and unusual, or both. A vast amount of narrative streams exist at any given time. However, most of these narrative fragments are short-lived, and only modulate current activities. Just because a content-bearing event creates a narrative stream in the brain during the multitrack process, it does not mean that the narrative stream will contribute to consciousness. Only those streams that have
sequelae made it to the brain-scale state and have effects on modulation of subsequent behaviors (Dennett, 2005). After making it to the brain-scale state, these narrative streams are linked to special value-category memory.

Modulation and changes in neural inputs from the value systems affect the dynamic memory system. Value systems are related to “rewards and responses necessary for survival” (Edelman, 2004, p. 25), and they “bias neuronal responses affecting both learning and memory and controlling bodily responses necessary for survival” (Edelman, 2004, p. 25). These systems influence the degree and extent of memory recall and output. Edelman (2004) calls the central memory system a “value-category memory system” (p. 53). He suggests that “the development of all these systems was a necessary evolutionary precursor of conscious activity” (p. 54).

**Proposition 9:** Narrative streams that do not have sequelae die out and vanish.

Narrative streams that do not have sequelae die out and disappear in the multitrack process. If not probed as suggested in Proposition 5, the subject never becomes aware of these contentful states and narrative fragments.

**Proposition 10:** Basic consciousness is generated by reentry linking special value-category memory and current perceptual sets.

Millions of synaptic connections are established within a local brain region, and over long distance among various brain regions during development. These are not a series of linear and sequential transmissions. They are ongoing, recursive, reciprocal, and parallel transmissions of signals among brain areas through multiple pathways simultaneously. According to Edelman (2004), reentry is the interconnected network of ongoing, recursive, reciprocal, and parallel transmissions of signals among brain areas through multiple pathways simultaneously. Reentrant paths make possible the partitioning of the huge array of signals from the environment into objects and events. Reentry also makes possible the synchronization of the activity of neuronal groups in different brain maps. It binds them into neuronal circuits capable of producing temporally coherent output.

Basic consciousness, which is Edelman (2004)’s notion of primary consciousness, is a series of scenes produced by perceptual sets linked to special value-category memory through reentry. This is the fundamental consciousness in all living animals. When the
perceptual set (or perception or scene) of a lion is formed in the brain of a deer, this perception is linked to survival value memory that controls bodily response. Upon recognition of the lion (i.e. danger), the deer takes off and runs away from the lion.

The manuscript thus far has focused on the biological mechanisms of consciousness. The propositions will now explain the significance of cultural mechanisms in human consciousness. These cultural mechanisms include language, metaphors, memes, and other.

**Proposition 11: Human consciousness is generated by reentry linking perceptual and conceptual categorizations, special value-category memory, and brain areas responsible for semantics and language.**

Perceptual categorization produces a series of perceptions and scenes of the ongoing events in the external environment. Conceptual categorization generates linguistic metaphors and cultural memes in order to map the similarities among, and make sense of, the ongoing series of perceptions and scenes. Through reentry, perceptions and concepts are then linked to special value-category memory that promotes survival responses, and brain areas responsible for semantics and language, in order to generate meanings associated with the perceptions and concepts and contribute to an ongoing story told in language. The result of these rapid reentrant connections among these areas is the dynamic human consciousness. So what brain areas are responsible for semantic and linguistic capabilities? The answers include Wernicke’s and Broca’s areas of the cerebral cortex.

Wernicke’s area is located at the back of the superior temporal gyrus. Medical cases show that damage to Wernicke’s area leads to the inability to produce meaningful speech or comprehend it. A patient with Wernicke aphasia (i.e., linguistic impairment) can speak fluently, but the content of the speech is “a strange mixture of clarify and gibberish” (Bear, Conners, & Paradiso, 2001, p. 646). It is also believe that Wernicke’s area functions to relate incoming sounds to their meaning. It specializes in storing memories of the sound that make up words.

Broca’s area is an area located in the left frontal lobe. Medical cases show that damage to Broca’s area leads to difficulties in speech production or motor aphasia. Patients with Broca’s aphasia experience difficulty speaking even though comprehension is relatively intact (Bear, Connors, & Paradiso, 2001). A prominent characteristic of Broca’s aphasia is a “telegraphic style of speech in which mainly *content words* (nouns, verbs, and adjectives
carrying content specific to the sentence) are used” (Bear, Connors, & Paradiso, 2001, p. 643). Another observation of Broca’s area is its close location to the part of motor cortex that controls the mouth and lips. Therefore, it is suspected that Broca’s area and nearby cortex may be specifically involved in making grammatical sentences out of words (Bear, Connors, & Paradiso, 2001).

This proposition shows that the mechanisms underlying human consciousness are both biological and cultural. We call this the bio-cultural operation of human consciousness.

**Proposition 12: Narratization produces an ongoing story in human consciousness.**

Humans are story-telling animals (Fisher, 1984; 1985; 1987), and stories are “communications about personal experience told in everyday discourse” (Browning, 1992, p. 281). In consciousness, there is an ongoing story of our life. According to Jaynes (2000), narratization is the process of generating an ongoing story, and this process may be conscious and unconscious. Narrative streams that made it to the brain-scale state must be integrated into this ongoing story. Narrative streams that do not fit the ongoing story are quickly forgotten. Jaynes (2000) states, “A stray fact is narratized to fit with some other stray fact” (p. 64). An individual’s self-concept determines the theme of the story, thus the actions and choices in response to different situations.

**Proposition 13: Conciliation produces a coherent story in human consciousness.**

Conciliation is the process of bringing “things together as conscious objects just as narratization brings things together as a story” (Jaynes, 2000, p. 65). Jaynes (2000) explains that conciliation is similar to “assimilation” (p. 64) and “compatibilization” (p. 65). Assimilation is a process by which “a slightly ambiguous perceived object is made to conform to some previously learned schema” (p. 64). Jaynes further contends, “… assimilation consciousized is conciliation. A better term for it might be compatibilization” (p. 65). In conciliation, we ‘compatibilize’ excerpts and narratization so they are made to agree with each other. Proposition 13 argues that narratization and conciliation interact to maintain a coherent story.

**Proposition 14: The story produces a socially constructed and nameable self.**
In the most primitive sense, consciousness began when an organism acquired the power of telling a story about its internal states, and objects or events in its environment (Damasio, 2000). In the most evolved form of consciousness in humans, the ongoing story needs an actor/actress and an audience. With the acquisitions of semantics and language (Edelman, 2004), a sense of self emerged and led to the origin of human consciousness (Jaynes, 2000). The emerged socially constructed and nameable self plays these roles, and the different roles are denoted by the analog ‘I’ and the metaphor ‘me.’

Proposition 15: The socially constructed and nameable self is the combination of the analog ‘I’ and the metaphor ‘Me.’

The most important feature of our consciousness is the metaphor we have for ourselves, and Jaynes (2000) calls it the analog ‘I.’ It is an analog because it is a model generated by the very thing it is an analog of. The analog ‘I’ has the ability to move about and do things in the ‘mind-space’ in our imagination. Our ability to make decision is completely based on our ability to create this analog ‘I’ as the imagined self dealing with imagined outcomes in an imagined environment. The analog ‘I’ refers to the actor/actress in the story we have of ourselves.

The analog ‘I,’ when reflected in third person form, is also the metaphor ‘me.’ It is a metaphor because it is “the use of a term for one thing to describe another because of some kind of similarity between them or between their relations to other things” (Jaynes, 2000, p. 48). In the imagined environment, we sometimes catch glimpses of ourselves, and Jaynes (2000) calls this our “autoscopic images” (p. 63). In our imagination, we may see ourselves sitting on a comfortable sofa, holding this manuscript in our hands, and reading every word carefully. This third person view of ourselves is the metaphor ‘me.’ The self can become an audience of the ongoing story, with himself/herself as the central figure in the story. The metaphor ‘me’ is the main character in the story we watch ourselves in.

The concepts of analog ‘I’ and metaphor ‘me’ come from Jaynes (2000). The relationship between the two concepts is unclear, and Jaynes does not address this directly. However, Proposition 15 suggests that the socially constructed and nameable self is the combination of the analog ‘I’ and the metaphor ‘Me.’
Proposition 16: The socially constructed and nameable self exists in the mind-space, produced by spatialization.

Spatialization is the process of organizing things (with spatial quality) and concepts (without spatial quality) in an invented mental space, or ‘mind-space,’ in our own heads, and the heads of others (Jaynes, 2000). This mental space is where every metaphor we generate and everything we can think of exist in our consciousness. When we think of a few physical things, such as a computer, a cat, New York City, and the rainforest of Borneo Island, they have the quality of spatially separated in mind-space.

According to Jaynes (2000), concepts without a material form are made to have physical characteristics and spatial quality in order to exist in consciousness. When we think of the past two thousand years, we are likely to create the metaphor of time and years as concrete objects, then the metaphor of a temporal succession, so we can organize the past two thousand years in some spatial order, perhaps from left to right, in our mind-space. “Consciousness is always a spatialization in which the diachronic is turned into the synchronic, in which what has happened in time is excerpted and seen in side-by-sideness” (Jaynes, 2000, p. 60). This process creates the ‘mind-space’ in consciousness.

As discussed in Proposition 15, when we ponder upon a situation with the ‘self’ as the main figure, the analog ‘I’ and metaphor ‘me’ reside in an imagined space, move about, and make decisions. We can imagine the outcomes of our actions in this mind-space without they actually taking place in the physical-behavioral environment. When we tell the story to another person, we create the details in the mind-space of another person.

Proposition 17: The socially constructed and nameable self has episodic memory.

Episodic memory is our ability to internally rehearse, review, and replay events that grab our attention (Dennett, 2001). Humans can selectively replay and replay and replay an actual or imagined event obsessively multiple times in the brain. Edelman (2004) calls episodic memory “the long-term memory of sequential events, the brain’s ‘narrative’” (p. 99). Episodic memory is unique to humans, and it is what makes learning possible with a single exposure. The self can repeat remembered events in consciousness. Episodic memory makes semantic activity possible. Hippocampus is responsible for memory, including episodic memory.
Proposition 18: The socially constructed and nameable self has feelings.

Damasio (2003) defines feeling as “the perception of a certain state of the body along with the perception of a certain mode of thinking and of thoughts with certain themes” (p. 86). This theme can be the ongoing story in consciousness. Feelings are internal, private, and mental (Damasio, 2003). In consciousness, feelings are only accessible to the ‘self’. Damasio (2000) calls consciousness “the feeling of what happens” (p. 26). That refers to the awareness and perception that something takes place around ‘us,’ and then the concept of ‘self’ emerged.

Proposition 19: Episodic memory and feelings interact in mind space.

We propose that episodic memory and feelings interact in mind space, and this interaction may be the basis for addictions that are mentally based. When something takes place around you, you form a perception of a certain state of the body along with a perception of a certain mode of thinking and thoughts. You then obsessively replay the perceptions in the mind-space. If the feeling is painful, you then seek to avoid the situation that would induce the same painful feelings. If the feelings is pleasurable, you then seek to create the situation that would induce the same pleasurable feelings again. The experience of the pleasurable feelings reinforces the memory. When the memory gets obsessively rekindled, and it causes you to pursue the pleasurable situation again beyond control, it becomes an addiction.

Narratives Description of the Bio-Cultural Model

These 19 propositions describe the Bio-Cultural model of Consciousness (Figure 1 in Appendix A) rooted in evolutionary biology. A list of all 19 propositions can be found in the Appendix B at the end of the manuscript. According to this model, human consciousness can be defined as a bio-cultural operation that involves a narrative streams producing multitrack process that contributes to the modulation of subsequent behaviors dictated by a self (i.e. analog ‘I’ and metaphor ‘me’) that has episodic memory and feelings in mind-space, in order to promote survival with well-being. The multitrack process excerpts inputs from the internal self and the external environment to form perceptions (i.e. present scenes) and concepts (i.e. linguistic metaphors and cultural memes), which are the bases of the dynamic narrative streams. Rapid neurobiological reentrant paths connect current perceptions, concepts,
semantics, language, special value-category memory, and the self with an ongoing story in order to generate dynamic human consciousness.

The bulk of this manuscript has been an attempt to establish the claim that the operation underlying human consciousness is both biological and cultural, through the development of a theoretical model. The focus at this point turns to the significance of rhetorical studies of metaphors, in our attempt to understand human consciousness.

**THE SIGNIFICANT ROLE OF METAPHORS IN CONSCIOUSNESS STUDIES**

Rhetorical studies of metaphors are essential to a fuller understanding of human consciousness. According to Jaynes (2000), language and its capacity to generate metaphors are key to the operation of human consciousness. He argues that language is not simply a means of communication. In fact, language is “an organ of perception” (p. 50). Language is diachronic, and it creates a sense of moving through time. He suggests that through metaphors, language is able to create abstract concepts otherwise not observable in the physical-behavioral environment. Language is a limited stock of terms, but it can describe an infinite set of situations, or even create new situations conceptually. In early times, language grew from concrete referents to abstract concepts by the generation of metaphors. Jaynes calls language “the rampant restless sea of metaphor” (p. 51). He claims, “The most fascinating property of language is its capacity to make metaphors” (p. 48).

**METAPHOR**

Jaynes (2000) defines metaphor as “the use of a term for one thing to describe another because of some kind of similarity between them or between their relations to other things” (p. 48). He uses the example of “the snow blankets the ground” (p. 57) to illustrate metaphor. The term is ‘blanket’ and the thing to be described is ‘how the snow covers the ground’—“the completeness and even thickness with which the ground is covered by snow” (p. 57). The term ‘blanket’ is used because of the similarity between ‘blanketing’ and ‘fully covering with a thick material.’ Therefore, the term ‘blanket’ describes how the snow ‘covers’ the ground: like a blanket does.

Moreover, Jaynes (2000) suggests, “understanding a thing is to arrive at a metaphor for that thing by substituting something more familiar to us” (p. 52). “The essence of metaphor is understanding and experiencing one kind of thing in terms of another” (Lakoff &
Johnson, 2003, p. 5). In the same example, understanding the way the snow covers the ground is to arrive at a metaphor for covering by substituting ‘blanketing,’ which is more familiar to us in our daily experience. We understand the way the snow covers the ground by associating our familiar experience of being covered by a blanket. This association makes understanding possible. Jaynes claims, “… the feeling of familiarity is the feeling of understanding” (p. 52).

As culture and civilization develop, human experience becomes increasingly complex. New language develops to describe new experiences. Metaphor plays the key role in generating new language to describe the increasing complexity of human experience. Jaynes (2000) contends, “… if we ever achieve a language that has the power of expressing everything, then metaphor will no longer be possible” (pp. 51-52).

**METAPHRAND AND METAPHIER**

Jaynes coined the terms ‘metaphrand’ for “the thing to be described” (p. 48), and ‘metaphier’ for “the thing or relation used to elucidate it” (p. 48). Take for example the phrase ‘mind-space.’ It is a metaphor of real space. The mind is internal to us, and space is external in the physical-behavioral environment. The external environment is the metaphier, and the imagined space in the mind is the metaphrand. He explains, “A metaphor is always a known metaphier operating on a less known metaphrand” (pp. 48-49).

**PARAPHRAND AND PARAPHIER**

Furthermore, Jaynes (2000) coined the terms ‘paraphier’ and ‘paraphrand’ to further expand on his discussion of metaphor. Some metaphors are complex, and they have various associations and attributes attached to them. He called these associating attributes ‘paraphiers.’ By employing complex metaphors, the associating paraphiers then project back into the metaphrand. This projection creates various associations and attributes to the metaphrand, and he calls these new associating attributes ‘metaphrands.’

Consider the earlier example of “the snow blankets the ground.” The metaphier is the ‘blanket’ on a bed. This metaphier is used to describe “the completeness and even thickness with which the ground is covered by snow” (p. 57). Therefore, the metaphrand is the completeness and even thickness of the snow. However, there are various associations and attributes of the metaphier used, which is a ‘blanket.’ These associating attributes are
“warmth, protection, and slumber until some period of awakening” (p. 57). They are the paraphiers of the metaphier of ‘blanket.’ These paraphiers project back into the metaphrand of the way the snow covers the ground. This projection creates the idea of “the earth sleeping and protected by the snow cover until its awakening in spring” (p. 57). He called this projection the ‘paraphrands’ of the metaphrand. By employing a complex metaphor, such as ‘blanket,’ it invokes a complex set of interactions among the metaphier, metaphrand, paraphiers, and paraphrands. These associations and attributes are all packed into a single term of ‘blanket.’

The interactions among the metaphier, metaphrands, paraphier, and paraphrands are critical to consciousness. Jaynes (2000) explains,

… consciousness is the work of lexical metaphor. It is spun out of the concrete metaphiers of expression and their paraphiers, projecting paraphrands that exist only in the functional sense. Moreover, it goes on generating itself, each new paraphrand capable of being a metaphrand on its own, resulting in new metaphiers with their paraphiers, and so on. (p. 58).

According to this view, metaphors grow, and perhaps infinitely into the future. Because this kind of consciousness is linguistically and metaphorically based, it is only unique to human beings at this point in evolution. More importantly, without the understanding of language, rhetoric, and metaphors, a neurobiological model of human consciousness is incomplete. Where can all these come together? The answer is the field of Graduate Liberal Studies. This is the theme of this panel.

**IMPLICATIONS OF THE BIO-CULTURAL MODEL AND THE FIELD OF GRADUATE LIBERAL STUDIES**

The Graduate Liberal Studies movement started in 1952 at Wesleyan University (O’Callaghan, 2000). Although its initial purpose was to provide broad liberal education for teachers at the graduate level, it has evolved to adapt a more rigorous research emphasis in today’s higher education. After more than half a century of evolution, the audience of Graduate Liberal Studies programs has become more diverse (O’Callaghan, 2000). With the establishments of the Doctor of Philosophy (Ph.D.) Degree at the Graduate Institute of the
At Emory University, and the Doctor of Liberal Studies (D.L.S.) Degree at Georgetown University, there is an increasing need for GLS programs to increase rigorous research requirements of the programs. O’Callaghan (2000), an Associate Dean and a professor of Liberal Studies at Georgetown University states, “The ability to synthesize materials from diverse disciplines is a crucial objective of liberal studies programs… Rather than descriptive or factual alone, knowledge should be integrative, illuminating issues and ideas” (p. 12). Some Graduate Liberal Studies programs label themselves “Master’s of Arts in Liberal Arts & Sciences,” such as the one at San Diego State University, because these programs have an interest in the sciences.

Important implications can be drawn from the Bio-Cultural model at three different levels: disciplinary, public, and intellectual. First, Graduate Liberal Studies can provide a transdisciplinary context for scholars from across disciplines to pursue bigger questions, such as human consciousness, which require cross-disciplinary thinking. In order to truly understand the complex operation of human consciousness, researchers need to draw widely from neurobiology, psychology, philosophy of mind, linguistics, rhetorical studies, and many other disciplines. The significant research topic of human consciousness cannot be fully understood within the confines of any traditional disciplines. A breakthrough is likely to occur in a paradigm shift when an idea is transferred from one discipline to another (Kuhn, 1970).

Second, Graduate Liberal Studies can provide the platform on which public intellectuals can make a difference. According to Alan Lightman at MIT, the definition of a public intellectual is:

Such a person is often trained in a particular discipline, such as linguistics, biology, history, economics, literary criticism, and who is on the faculty of a college or university. When such a person decides to write and speak to a larger audience than their professional colleagues, he or she becomes a “public intellectual.”

The issue of human consciousness is a question that affects every public member of our society. Scholars of Consciousness Studies can play an influential role as public intellectuals in our society. The major consciousness theorists in cited in this model, such as Antonio
Damasio, Daniel Dennett, Gerald Edelman, and others, are influential public intellectuals of our time.

Third, and perhaps most importantly, Graduate Liberal Studies can be the place to revive the possibilities for a new intellectual renaissance. Stephen Roeder (2005), Dean, Professor of Physics and Chemistry, as well as founder and former director of the Master’s of Arts in Liberal Arts & Sciences program at San Diego State University believes that this effort is worthwhile because it can potentially bring the sciences and the humanities together. C. P. Snow (1989, first published in 1959) notes a knowledge divide between the physical scientists and the literary scholars. He calls the two groups of scholars the ‘two cultures.’ With the continuing trend of research specialization and the artificial boundaries of academic departments for the purpose of administrative resource allocations, this knowledge divide will continue to widen. Although the topic of consciousness is traditionally a humanistic issue, scientists today can contribute to the theorizing by bringing another valuable perspective in evolutionary biology as well as specific neurological disciplines. However, objective science alone is not sufficient, because consciousness is in part a subjective experience (James, 1999, first published in 1902).

A specific issue in consciousness studies that involves this complexity is qualia. ‘Qualia’ is the term used to refer to the ‘feel’ of conscious experience, and all conscious experiences can be considered as qualia. However, qualia certainly would not exist if we did not have brains, yet qualia are not scientifically reducible to measurement at this point (S. Roeder, Personal Communication, March 31, 2005). The issue of qualia needs scholars from both of the two cultures. At the macro level, collaboration between scholars in the sciences and the humanities can contribute to the emerging ‘New Humanism’ (Roeder, 2005) and the ‘Third Culture’ (Brockman, 1996).

The manuscript introduces the research question, “What are the mechanisms underlying the operation of human consciousness?” Through the analysis and synthesis of the major theories rooted in evolution, we see that the mechanisms of consciousness are both biological (neurons, neuronal groups, neural networks, and developmental selection) and cultural (semantics, language, metaphors, memes, and experiential selection), and the cultural mechanism builds on the biological mechanism. The present Bio-Cultural model of human consciousness is far from final and complete. However, as we continue to negotiate for a
final theory of human consciousness in the contact zone between the sciences and the humanities, hopefully we can move toward a unity of knowledge (Wilson, 1998) and bridge disciplines in the humanities and the sciences (Gould, 2003).
REFERENCES


APPENDIX A
THE BIO-CULTURAL MODEL OF CONSCIOUSNESS
Figure 1. The bio-cultural model of consciousness.
APPENDIX B
A LIST OF NINETEEN PROPOSITIONS
Proposition 1: There are two sources of input to the multitrack process: internal inputs from the internal self, and external stimuli from the external environment.

Proposition 2: Both internal and external inputs are filtered through excerption.

Proposition 3: Excerpted inputs become distributed contentful states.

Proposition 4: Distributed contentful states are processed by current perceptual categorization.

Proposition 5: Contentful states that have been perceptually categorized become perceptual sets.

Proposition 6: Perceptual sets are processed by conceptual categorization.

Proposition 7: Perceptual sets conceptualized create narrative streams.

Proposition 8: Narrative streams that have sequelae are linked to special value-category memory.

Proposition 9: Narrative streams that do not have sequelae die out and vanish.

Proposition 10: Basic consciousness is generated by reentry linking special value-category memory and current perceptual sets.

Proposition 11: Human consciousness is generated by reentry linking perceptual and conceptual categorizations, special value-category memory, and brain areas responsible for semantics and language.

Proposition 12: Narratization produces an ongoing story in human consciousness.

Proposition 13: Conciliation produces a coherent story in human consciousness.

Proposition 14: The story produces a socially constructed and nameable self.

Proposition 15: The socially constructed and nameable self is the combination of the analog ‘I’ and the metaphor ‘Me.’

Proposition 16: The socially constructed and nameable self exists in the mind-space, produced by spatialization.

Proposition 17: The socially constructed and nameable self has episodic memory.

Proposition 18: The socially constructed and nameable self has feelings.

Proposition 19: Episodic memory and feelings interact in mind space.