

TOWARD A NEUROPEDAGOGY OF EMOTION

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

In the
Faculty
of
Education

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SIMON FRASER UNIVERSITY

Summer 2008

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ABSTRACT

With deep historical roots in philosophy, intellect, in the Hellenistic tradition of the Western world, has been the main focus of educational models, research, and methodology; and hence, also the focus in curriculum theory and implementation. Aristotle, Descartes, and Spinoza, have contributed to the metamorphosis of the relationship between cognition and emotion from an irrational renegade controlled by reason to phylogenetic director of embodied brain function as exemplified in Damasio's somatic marker theory.

Drawing primarily on Damasio's work, along with other neurobiological, neurophysiological, and neuropsychological work in this area, I provide evidence and rationale for re-conceptualizing emotion in relation to cognition. In so doing, I formulate a model of affect, the Somatic Appraisal Model of Affect (SAMA), to help justify and inform new directions in educational scholarship and research.

SAMA, in brief, presents affect as a term encompassing three levels of what are commonly called emotions, namely: mood; primary or basic emotions; and secondary emotions or feelings. The essential scientific distinctions among these three types of affect are explicated in SAMA as differing functions of brain/body interaction, whereby changes in somatic and neural states are evoked by both afferent and efferent chemical transitions circulated via both neuronal and humoral pathways. Specific regions of the brain, including the limbic system and especially the amygdalae, but also the prefrontal cortex, are implicated in

various levels of appraisal of incoming sensory stimuli. These appraisals of somatic and neural states assess the emotive importance of incoming stimuli, allowing the “emotional brain” to ascribe affect valences to information that, in turn, influence attention and memory in ways that cognition does not.

SAMA is intended to help promote clarity and coherence among educational scholars and researchers engaged in re-conceptualizing curriculum theory and implementation in terms of the primacy of emotion. SAMA is further intended to contribute to building a dynamic foundation upon which to base a forum for interactive dialogue and research among educators, neuroscientists, and other stakeholders, thus assisting in transforming education accordingly. Not to be confused with “brain-based education,” this thesis provides evidence and rationale toward a transdisciplinary, theoretically-rigorous, and empirically-grounded neuropedagogy of emotion.

Keywords: Affective neuroscience, neuropedagogy, emotion, affect, feelings, brain-based education, neuropsychology, emotion regulation, affect regulation, educational neuroscience, neuroeducation, , emotional competence, emotional intelligence

DEDICATION

To my father, Wilfred Alexander Patten, who taught me the beauty of knowledge and modelled the pursuit of peace, and to my mother, Ruth Muriel Patten (nee Nichols), who showed me the power of emotion.

ACKNOWLEDGEMENTS

I would like to thank my committee members, Dr. Charles Bingham and Dr. Sandra Vamos, for their guidance and support. I would especially like to thank Dr. Stephen Campbell (Sen) for his unwavering belief in me, for the challenges he presented to help me refine my ideas, and for sharing his vast arena of knowledge and his creation of the educational neuroscience laboratory. Without his guidance, wisdom, and encouragement, this journey would not have been as enriching nor as fulfilling.

Lastly, I would like to thank Rob for his emotional support, for his sufferance to fashion our life around this project, and for sharing my journey.

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CHAPTER 1: INTRODUCTION

We live in the resurgence of our emotions, whatever song we sing, whatever story we tell, whatever play we act in our lives. Despite our collective history of denigrating the emotions, modern neuroscience places emotion at the epicentre of what it means to be human. This thesis embarks on a journey from the philosophical regard of emotion as a demon to be overthrown by the knight of reason, to the neuroscientific revelation of emotion as the primal cohort of cognition. If we ascribe emotion the primacy neuroscience asserts, then we must examine its theoretical and neuroscientific underpinnings and the resultant implications for education, with the emotive teacher/learner in mind.

For centuries, philosophers and educators in the Hellenistic tradition have regarded emotions as being in need of habituation and temperance. Concomitantly, emotions have been disconnected from the intellect in various guises. This disconnection has contributed to the dysphoric regard of the emotions in the public education system and, likely to some extent as well, to the rise of modern malaise so prevalent in our twenty-first century society. How is it that we can create a self-propelled vacuum cleaner that saves people from the mundane task of cleaning their homes, but we do not collectively care that millions of other people are homeless? And why is it that hordes of modern day humanity have turned to drugs to create artificial and transient feelings that leave their minds and bodies devastated and ravaged? If emotions are so potent that

people commit horrific crimes of passions and emotions are also so powerful that they can motivate people to sacrifice their lives for ideals critical to humanity, how can we and why do we ignore their importance in educating the human mind?

Emotion has been typified as disparate, dysfunctional, and reactive. This thesis explores the theoretical differences and practical ramifications of defining curriculum and instruction if we were to also regard emotion as compatible, functional, and proactive. An understanding of the neurobiology and neuropsychology of emotion may be the key to the formulation of educational theories, policies, and practices capable of diminishing human pain and improving human existence.

In the last decade, there has been increased recognition of the importance of emotion in human existence and resultant research on the process and function of emotion. This thesis presents what is commonly referred to as emotion as a function of brain/body interaction, as a vital part of a multi-tiered phylogenetic or species pertinent development set of neural mechanisms, evoked by both instinctive processes and learned appraisal systems. Instinctive processes include primary genetically encoded analysis of incoming stimuli, and learned appraisal systems constitute secondary individually encoded evaluation of incoming stimuli.

I begin with a historical synopsis of the relationship between the intellect and emotion, focusing on proponents of a gradual shift in the history of philosophy from the Platonic tradition of emotion as being necessarily subjugated to intellect, to the more modern view of emotion as an essential aspect of human

nature. I acknowledge the prescient views of the likes of Spinoza who contemplated the concept of embodied emotion and proposed the importance of emotion in human functioning. I then engage literature from the neurosciences and neuropsychology that has also served to reverse the traditional priority given to cognition over emotion for educational theory, and present emotion as having not only functional primacy, but also phylogenetic, ontological, physiological, and neurological primacy over cognition. As a matter of scope, this thesis does not consider ontological priorities in the sense of the mind-body problem: rather, the central concerns of this thesis are ways in which emotion is factually and normatively prior to cognition. Further, I wish to emphasize that by speaking of mind and brain/body, I imply no sense of priority to either, but rather they are viewed here as co-dependent and may be used interchangeably.

It is difficult to improve what we do not know. Neuroscience has made important contributions to knowledge of the brain/body interaction in the processes of emotion. More specifically, neuroscience has revealed emotion to be a complex process involving both brain and body, where the brain triggers release of complex neurotransmitters that have the ability to evoke changes in both brain and body states that ultimately influence brain and body functions and ultimately, human existence and well-being.

Psychology, not new to the study of emotion due to its close relation to behaviour, has long studied various aspects of emotion, and neuropsychology has focussed on emotion in relation to brain processes and behaviour. It is the recent synergy of neuroscience and neuropsychology with regard to emotion,

commonly referred to as affective neuroscience (e.g. Davidson & Sutton, 1995), which combines the examination of emotion with respect to theory, process, function, and behaviour that holds much promise for a new discourse of educational reform, not only because both process and function have been examined, but also because they can be combined to create a forum through which to devise and debate theories prescribing educational practice.

Specifically, this thesis addresses many of the common myths associated with the phenomenon of brain-based education where brain-based enthusiasts have extrapolated and over-generalized neuroscientific findings and, without sufficient theory, caution, and expertise, applied these findings to classroom practice. What is needed is a cautious examination of the findings of neuroscience and neuropsychology, and exploration and application of those scientific results to the realm of the teacher/learner's lived experience. The new field of educational neuroscience is tendered as the vehicle to address the application of neuroscientific and neuropsychological constructs to the many facets and functions involved in the mind/body processes, actions, and interactions of teachers and learners. The rehabilitated view of emotion presented by affective neuroscience can and should serve to initiate radical changes in educational theory, specifically, in curriculum theory and implementation. What is initially needed and presented herein is a precis of the collective knowledge of affective neuroscience and the creation of a paradigm of emotion based on that current knowledge. This paradigm will serve as a stage

upon which educators and educational researchers may debate and continue to conceptualize the new future of emotion in education.

It is not my intent here to survey the vast array of burgeoning research on emotion in the field of neuroscience and neuropsychology. Instead, I will briefly present various views and results that are most significant in demarcating and defining my ideas for shaping educational change in proposing a new model of affect, which is based primarily on Antonio Damasio's Somatic Marker Hypothesis (SMH) (Damasio, 2003). This new educational paradigm for emotion, which I am referring to as The Somatic Appraisal Model of Affect (SAMA), presents emotion as deriving primarily from bodily or somatic states, including neuronal arousal, chemical presences, and visceral and muscular activation, and secondarily from cognitive appraisals. Much of the current disagreement surrounding the phenomenon of emotion stems from a lack of a clearly a defined lexicon relating to emotion. For this reason, SAMA clarifies variance in terminology in the literature reviewed, identifies components and facets required to delineate emotion-related research, and explicates the various arenas of appraisal.

The debate of the roles of emotion and cognition cannot be ignored. Herein I present both sides of the debate: that all emotion requires cognition, and its contradiction, that not all types of emotion involve cognition. Emotion is presented as not only distinct from cognition, but also more potentially significant than the intellect. The interface of emotion and cognition is explored and the primacy of emotion is established phylogenetically, ontogenetically,

physiologically, and neurologically. Establishing the primacy of emotion is critical to presenting emotion as a phenomenon worthy of inclusion and infusion in the realm of education.

Finally, emotion-based constructs and phenomena relevant to educators are presented in regard to SAMA and implications for education are explored from a neuropedagogical perspective, with special application given to the new field of educational neuroscience (Petitto & Dunbar, 2004). Neuropedagogy, an applied educational neuroscientific pedagogy, is proposed. In constructing this neuropedagogy, it is essential to examine the popular construct of emotional intelligence, which is weighed and found wanting. Neuropsychological phenomena significant to pedagogy, such as meta-emotion, emotional contagion, and emotion regulation are explored and their potential applications examined. Providing knowledge of the function of emotions and their influence on self and others, and creating proficiency in managing emotions, holds promise for improving the human lot, and such educational efforts exist. What remains is for the educational community to accept the importance of emotion, to examine these efforts at including education in curriculum, and to improve upon them.

Shifting the sense of priority in education in the Western world from intellect to the emotions is a radical step entailing radical reform. How is it that the primacy of intellect has been so firmly entrenched? In the next chapter, I trace these traditional ethnocentric priorities given to intellect over emotion.

CHAPTER 2: THE METAMORPHOSIS OF EMOTION: AN HISTORICAL VIEW WITH MODERN INTERPRETATIONS

2.1 Historical Status of the Intellect and Emotion and Modern Interpretations

From early, recorded history to modern day, the intellect has been assigned a superior status to emotion. From Aristotle's intellectual pursuit of virtue, Descartes' intellectual and moral virtue shaped by the mind, Spinoza's virtue as disposition governed by critical intellect, to modern day value of intelligence, education has been influenced by the philosophical positioning of the intellect as paramount to emotion. The metamorphosis of emotion from its philosophical portrayal by ancient Greeks as necessary to attaining human fulfillment to modern neuroscientific depiction of emotion as a complex brain/body process essential to human functioning has yet to significantly impact the education system. Aristotle's, Descartes', and Spinoza's contributions are discussed here because they have, in Damasio's words, "prefigured science" (2003, p. 15). It is not my intention to give a detailed analysis of these scholars' philosophies, but merely to address those concepts pertinent to modern neuroscientific theory about emotion, specifically as explicated by Antonio Damasio (1994, 1999, 2003), Joseph Ledoux (1996a), and Daniel Goleman (1995), and as they pertain to formulating SAMA.

2.1.1 Aristotle's Synthesis of the Soul: Rational and Irrational

Aristotle is significant to the historical change in the ideology of emotion. His differentiated view of man's rational/irrational nature and his divergent definitions of virtue were essential to changing the historical derision of emotion. Rejecting Plato's concept of the human soul as the battleground of two distinct enemies, the rational and irrational, Aristotle recognizes the two parts. However, he does not see the rational and the irrational as distinct entities, but rather as constituting parts of the whole. Aristotle views man as comprised of three entities: the rational component, which includes the practical wisdom (*phronesis*) and the intellect (*nous*); the non-rational component, which includes the appetites and emotions; and the physical component. This syzygy of the soul, combining the rational and the irrational, is central to the shift in Aristotle's view of humanity from Platonic emphasis on the ideal to the individual, from emphasis on determining the nature of absolute virtue to becoming a virtuous person. Aristotle shifts the emphasis from the archetypal ideals of his predecessors, the *Forms*, to examine the realities of human experience as part of the polis, wherein the nature of man, as a rational animal, is intellectual, social, and emotional. Aristotle's belief that man's active intellect (the *nous*) gives him the intuitive ability to grasp universal truths from his experience maintains man's aspirations toward the divine, but also marks the germination of man's independence from the gods. Rather than viewing the senses as representing mere shadows of reality, as did Plato, Aristotle regards the senses as essential to collect data to be utilized by the rational mind to determine moral virtue. The intellect is vital to becoming virtuous; it is necessary to choose the right actions and to provoke enacting the

right behaviours in the right context. According to Aristotle, the morally strong (*enkra*tic) person not only knows what ought to be done, but also desires what ought to be done in accordance with his judgment. Thus, his virtuous choices will avoid personal conflict and will promote happiness (*eudaimonia*): the goal of action, the highest good for man. Because *eudaimonia* is not a static state of the soul, but “an active flourishing of the soul in conformity with virtue” (*Nichomachean Ethics*, [NE], trans. Bambrough, 1963, p. 297), man is directly involved in his own habituation. As such, Aristotle’s view of man’s agency, however limited, can be seen as a crack in god-determined fate. Man is no longer seen as a hapless Sophocles acting at the whim of the gods, but as a capable creature who has some power to realize his own fulfilment, and, concomitantly, some responsibility for his own happiness. However, while man has some role in pursuing happiness, Aristotle does maintain that “happiness is a gift from the gods” (*ibid.*, p. 296).

In assigning man the task of becoming virtuous, Aristotle defines moral virtue as a disposition concerning choice, and proposes that deliberate performance of virtuous acts can create a disposition to act virtuously. The end of all action and habituation is happiness (*eudaimonia*), an activity (*energeia*) of the soul. Human happiness, then, consists of activity of the soul in accordance with reason, implying that man has a role in generating his own actualization, his own “successful living” (NE, trans. 1963, p. 295). Furthermore, happiness is available to everyone, claims Aristotle, “through learning and exercise,” but only if the individual is “not totally corrupted as regards virtue” (*ibid.*, p. 296).

In his *Psychology* (PSY), Aristotle espouses that thinking belongs to the soul alone; but emotions or “conditions of the soul” can involve a cognitive element that includes beliefs as well as bodily motions and physiological phenomena, indicating that the pursuit of becoming virtuous presents a synergy of the rational and irrational. He asserts that “knowledge is an activity of the soul and so are perception and belief” (PSY, trans., 1963, p. 244). Aristotle’s claims that many emotions, such as anger, involve moral beliefs about what is right or wrong and judgments about how one ought to behave, reveals, at least implicitly, that he recognizes both the social imbeddedness and cognitive component of affect. He also acknowledges the link between emotion and body: “the affections of the soul, too, seem all to be linked with the body: anger, gentleness, fear, pity, confidence, ...” (ibid., p. 237). He describes these “affections of the soul” or emotions as “forms imbedded in matter” (ibid.). While Aristotle does not see emotions as totally irrational and in need of suppression like many of his predecessors, he believes emotions can involve varying degrees of the rational and irrational. His exhortation in *Politics* (PO), is that “it is natural and expedient for the body to be ruled by the soul, and for the emotional part to be ruled by the mind and by the part that has reason” (trans. 1963, p. 388).

Since Aristotle regards the soul as inseparable from the body and emotions as involving the intellect, training of both the body and intellect could be useful in containing the emotions (PSY, trans. 1963, p. 237). As well, Aristotle presents two types of virtue: *intellectual*, which he asserts, can be promoted by teaching; and *moral*, which is produced by habit (NE, trans. 1963, p. 303).

Aristotle advocates that beliefs, which are involved in many emotions, are potentially rational, and therefore educable. According to Aristotle, the moral value of music and theatre is didactic; they are useful in habituating the emotional being within a social context. Aristotle believes that music directly represents the emotions, that the “rhythms & melodies contain the greatest likeness of the true natures of anger, gentleness, courage, temperance, and their opposites, and of all the other components of character as well” (PO, book IV). He does not regard musical talent as having any worth other than that of representing the emotions in order to aid in judging what is good or bad for the soul (ibid.). Aristotle believes that theatre provokes powerful feelings and allows citizens to experience emotions, to explore these situated emotions in a vicarious manner using intellectual or practical wisdom, and to experience that these emotions were shared by others and thus reflective of the values of the *polis*. Tragedies also displayed extremes of emotion from which the rational mind could deduce the mean. Bertrand Russell (1959) asserts that Athenian tragedies acted as a medium to rid the soul of undesirable emotions and to act as “... a kind of psychiatric inoculation” for the community (p. 97). Thus, music and theatre involved mass habituation of the population that was not only behavioural, but also intellectual.

In sum, Aristotle regards the intellect as the human asset most critical to achieving moral virtue: man, through careful observation, questioning, and analysis of nature, could use his intellect to aspire to his potential, to achieve true happiness. According to Aristotle, a happy man acts in conformity with virtue and

loves goodness; he is not “a mercurial character” (NE, trans. 1963, p. 299), but a man controlled by his intellect. Man’s active intellect, the *nous*, gives him the intuitive ability to grasp universal truths and to pursue happiness, “an activity of the soul” (ibid., p. 301).

To Aristotle, education is the guided dialectical practice of revealing “the authentic reality behind the appearance” (Tarnas, 1991, p. 7), the virtuous act of contemplating truth with the aim of realizing man’s potential in a communal setting. Aristotle’s education system consists of three constituent parts: instructing the rational, habituating the non-rational, and training the body (Reeve, 1998, p. 54). Not only is this education to reveal what virtues are, but to promote their expression in everyday acts.

For Aristotle, emotion is not a virtue, although it is “closely related” (NE, trans. 1963, p. 371). Education conditions people to feel the right emotions “at the right time, about the right things, in relation to the right people, and for the right reason” (ibid., p. 309). Habituation is not only behavioural, or being obedient to rational principles; it is also intellectual, or possessing and exercising rational thought. Because emotions involve beliefs, Aristotle regards them as potentially rational and therefore subject to rational control. In this regard, Aristotle regards music and plays as public venues for purging and normalizing emotion.

The impact of Aristotle’s philosophy is still in evidence. He gives emotions credence as involving the intellect and chooses to school them rather than reject them outrightly as irrational and in need of suppression. He establishes the unifying connections among emotions, brain, and body, an essential step toward

our modern concept of emotion. Aristotle's placing of emotions within a social and political context reflects the emerging multiplicity of man, the role of the state in habituating humans, and the ultimate belief in the virtuous man's ability to be self-regulated. His focus on and ultimate confidence in the intellect continues to shape curriculum today. We do not teach about emotion, evaluate emotion, reward emotion, nor fund emotional activities. The emotions have been relegated to the sidelines for centuries, and the academic disciplines, which showcase the intellect, have been eulogized. It is ironic that Aristotle chooses happiness, which today denotes an emotion, as the highest good, but assigns morality and reason as the vehicles to define happiness and achieve it. Damasio (2003) credits Aristotle with founding virtue "in the reality of a social structure" (p. 171) as the cornerstone of an essential transition to recognize man as a complex, interactive organism, and communal being.

2.1.2 Descartes' emotion as interactionism

No historical review of emotion would be complete without consideration of Descartes' work. While Descartes' bifurcation of reality into distinct mental and physical substances have, perhaps inadvertently, sent philosophers and scientists on a track into centuries of dualism that diverted mankind away from modern unification of mind and body; he did, in fact, propose concepts that foreshadow modern neuroscientists' discoveries about emotion.

The mind (*res cogitans*), according to Descartes in *Meditation II*, (1641), is not the brain (*res extensa*); rather, it lacks spatial location, exists post-mortem, and has its own unique function: it is capable of thought and can generate ideas,

as well as process information from the senses. A mind is “a thing which doubts, understands, conceives, affirms, denies, wills, reforms, which also imagines and feels” (Descartes, 1641/1985, p. 112). In addition, in Meditation VI, (1641), Descartes extols that the mind has a moral function, in “ that it is requisite to knowledge of the truth” (ibid., pp. 132-133). The human body, says Descartes in Meditation II, (1641), occupies space, is perceivable by the senses, and is capable of change” (ibid., p. 111). Later, in *Meditation VI*, (1641), he describes the body as a “machine so built up and composed of nerves, muscles, veins, blood, and skin, that though there were no mind at all, it would not cease to have the same motions as present” (ibid., p. 133), with the exception of motions that are willed or directed by the mind. In addition, Descartes holds that the faculty of feeling “must be attached to some corporeal or extended and not to an intelligent substance” (ibid., p. 131). His doctrine attaches emotion not to the mind, but to the human body, and alleges that emotions are perceptions of the mind that arise from “external impulses, conveyed by corporeal objects” (ibid.) and not by God; hence the predilection of emotions to be confusing and sometimes deceitful (ibid., p. 133). Theoretically, Descartes divides the human into the mind and body, the spiritual and the corporeal, the intangible and the tangible, the mental and the physical, the eternal and the ephemeral.

While Cartesian dualism has long been a contentious fixture in philosophy, I do not intend to dispute the incorporeality thesis (see Cottingham, 1992), but to address those concepts relating the human mind, or soul, to the body that pertain specifically to emotion. In Descartes' last work, *The Passions of the Soul* (PS)

(1649), he presents his physiology of sensory processes and an extensive discussion of the body/brain interactions that produce appetites and passions. It is on this work of Descartes that I choose to focus, in part because it prefigures critical aspects of emotive brain function proposed by Damasio and other modern neuroscientists, and in part because Damasio, in rejecting some of Descartes' postulates, has apparently neglected to consider some of Descartes' other relevant postulates.

Descartes' theory of emotion regards the mind or soul and the body as independent entities: the mind is private, invisible, and defined by the properties of thought and free will; the body is public, visible, and subject to the mechanical laws of physics. His theory tries to explain the metaphysical distinction between these two substances and how they interact. Unlike Aristotle, Descartes does not attribute emotions to the soul: in *The Passions of the Soul*, Article 17, he states "there is nothing in us which we must attribute to the soul, except our thoughts." Descartes envisions two sorts of thoughts pertaining to the soul: actions, or desires of the soul, such as for God or to go for a walk; and passions, perceptions, or forms of knowledge that are one of two kinds, those whose origin lies in the soul, and those whose origin lies in the body. Descartes argues that emotions reside in the body because "we experience [emotions] as being in us" (PS art. 3); in other words, we experience bodily changes that reflect the emotions. Emotions, according to Descartes, are part of a larger group of human phenomena he calls the passions. He delineates three kinds of passion or "ideas that are caused by the body" (Rorty, 1992, p. 373): sensations, appetites, and

emotions. Sensations refer to perceptions attributed to external causes and involve the external sense organs, nerves, and the brain. Appetites refer to bodily sensations attributed to the body, such as pain and thirst, and other such instinctive phenomena. Emotions, or passions proper, are attributed indirectly to the soul, which has awareness of the emotions only after they have been caused by objects acting on the body and the body has sent this perception to the brain, where it connects with the soul in the pineal gland. Emotions, then, are feelings of physical agitation and excitement experienced in the body and registered in the soul. Descartes laments that “of all the kinds of thought which the soul may have, there are none that agitate and disturb it so strongly as the passions” (PS, art. 27). He also asserts that “the passions are to be numbered among the perceptions which the close alliance between the soul and the body renders confused and obscure” (ibid.), suggesting that the body, which receives the unfiltered “not-so-very-fine” air and the “not-so-very-fine” blood (PS, art. 7-10), is the source of “mere shadows and pictures” (PS, art. 28), vague perceptions lacking the clarity of the perceptions originating in the soul. Because most passions originate in the body or are the body’s perceptions of outside objects, they are therefore suspect and not to be relied upon. It follows that “being strongly agitated” (PS, art. 28) by emotion is a negative experience, since emotion is generally contaminated by its originating in or being processed by the body.

Descartes attempts to explain the connection between the human body and the mind or soul by proposing a link between the mind and the brain, namely

the pineal gland. He argues that the effect of external objects on the sense organs creates changes in the body, which can then be transmitted to the brain via the pineal gland, and hence cause sensations to the soul. The body sends these sensory perceptions or sensations through “the nerves, which are like little threads or tubes coming from the brain and containing, like the brain itself, a certain very fine air or wind which is called the ‘animal spirits’” (PS, art. 7). Conversely, the soul can will the pineal gland and direct these ‘animal spirits’ by hydraulic transmission through the nerves to create mechanical changes in the body. Descartes describes these ‘animal spirits’ as “the most active and fine parts” (PS, art. 7) of the blood that is heated and sent by the heart to the brain and thence to other parts of the body. This two-way psychophysical interaction termed Cartesian interactionism, while mechanistic, rightly proposes an interchange of function between the brain and body, and is represented by modern neuroscientific biological transmission of neuropeptides in the blood stream and nervous system.

In summary, Descartes regarded the intellect, the mind, as distinct from the body: the mind is intangible; the body is tangible. Unlike Aristotle, he attributed the emotions primarily to the body, differentiating them from thoughts, which are the sole attribute of the mind. Because the mind has awareness of emotions through the body, emotions have an indirect connection to the mind, in the pineal gland, which acts as an interface between the mind and body. Descartes regards the body as an imprecise instrument for registering the passions, of which emotions are a subgroup, and therefore the body’s

perceptions are not to be trusted. Emotions, too, are then suspect since they originate in the body proper. In *The Passions of the Soul* (PS) (1649), Descartes classifies emotions which originate in the body as lesser and stronger passions, and declares that the will cannot control the stronger emotions such as anger “while this commotion is in its full strength” (PS art. 46), but that man must try not to allow the body to “yield to its effects” (PS art. 46). Descartes differentiated between an emotion which originates in the body and “intellectual” emotion which is evinced from a belief, does not have a “proximate cause” (PS art 25), and originates in the mind. He claims we have the will to control these “emotions of the soul” (PS art. 28), by considering their sources and the rationale behind them. Descartes considers it the job of the intellect to assess and ameliorate the emotions.

Descartes believed in man’s ability to deduce truths using his “native intelligence” (Garber, 2000, p. 129). The aim of Cartesian education was to provide the opportunity to “acquire the habit of intuiting the truth” (Descartes, 1649/1988). Education did not involve the transference of knowledge, but the cultivation of the mind. Descartes rejected the dialectic tradition of teaching logic, arguing that while some of its precepts were generally true, others were sources of confusion and corruption in the refinement of the mind necessary to find truth. While Descartes saved the realms of education from the rigid teaching of traditional logic, he also relegated emotions connected to the body to the realm of the unreliable.

2.1.2.1 Damasio's View of Descartes

In his book, *Descartes' Error: Emotion, Reason, and the Human Brain* (DE) (1994), Damasio takes umbrage with Descartes' "clockwork mechanics as a model for life processes" (p. 248) and his notion of 'animal spirits', but he is truly critical of Descartes' "abyssal separation between body and mind.... [s]pecifically: the separation of the most refined operations of mind from the structure and operation of a biological organism" (pp. 249,250). Damasio explains his choice to focus on Descartes because "Descartes' error remains influential" (ibid., p. 250). Damasio points to Descartes for prompting the metaphor of the mind as a software program that underlies the pursuit of some cognitive scientists who focus on artificial intelligence and the practice of some neuroscientists who examine the mind solely in terms of brain function, both premises he soundly denounces. Damasio fittingly suggests that Descartes' "idea of a disembodied mind" (ibid., p. 251) appears to have influenced the way that Western medical practitioners approach the treatment of disease as a simple mechanistic body malfunction, rather than as a physiological/psychological interconnected system failure. Damasio rejects Descartes' "*Je pense donc je suis*" (ibid., p. 248) and argues that it is the opposite: we exist and then we think, "and we think only inasmuch as we are, since thinking is indeed caused by the structures and operations of being" (ibid.) Understanding the humanity of being, Damasio asserts, not only requires comprehending the human mind from an "organismic perspective," moving from the "non-physical cogitum" to the realm of biology, but also integrating body and brain functions as they relate to the physical and social environments (ibid., p. 252). Damasio (2003) does not

venture far into the tangential sphere of the soul as spirit; but he does recognize the possibility of its existence (pp. 284-286). He acknowledges he is not a philosopher and that it is not his place “to move the spirit from its nowhere pedestal to a somewhere place” (Damasio, 1994, p. 252).

While Damasio (2003) recognizes that Descartes is “ahead of his peers in the way he conceived of complicated mechanisms for operations of the body” (p. 187) and acknowledges that Descartes was influential in breaking with scholastic tradition by creating an interface for “physical-inorganic and living organic” (*ibid.*, p. 188) processes that linked mind and body as being mutually influential, he laments that Descartes could not explain how the bodily and mental manifestations of substance interacted, except to indicate the role of the pineal gland. Damasio also argues that because Descartes did not give the mind physical properties, this precluded a feasible explanation of how the interaction occurred (*ibid.*). Descartes’ concept of the mind as lacking spatial extension and material substance contrasts with Damasio’s assumption that the mind “arises from or in a brain situated within a body-proper with which it interacts; that due to the mediation of the brain, the mind is grounded in the body proper” (*ibid.*, p. 191).

Damasio’s work reveals his keen interest in Descartes and the latter’s importance to the evolution of the concept of emotion. However, while Damasio refers to philosophical differences and physiological errors in Descartes’ theory of emotion, he does not detail the similarities that persist from Descartes’ prescient writing relating to the function and process of emotion.

2.1.2.2 Descartes as Prescient Scientist

While Descartes erred in his concept of distinct mind and body, he regarded emotion as worthy of exploration and ventured to examine emotion as function, and to some degree as process. While there are concepts in his theory that are dismissible and even amusing, such as his idea that the pineal gland leans “first to one side and then to another” (PS art. 41) in order to drive the spirits to various parts of the brain in search of a memory, there are other concepts that pre-date science and foreshadow modern scientific findings. It is those concepts that I wish to elucidate and relate to Damasio’s neuroscientific work.

Although Descartes’ concept of the pineal gland incorrectly assigns the role of orchestrating interactions between the mind or soul and body, he also maintains that the “soul is really joined to the whole body, and that we cannot properly say that it exists in any one part of the body to the exclusion of others” (PS art. 30). In the next article he states that “nevertheless there is a certain part of the body where it [the soul] exercises its functions more particularly than in all the others” (PS art 31). Here he, yet again, refers to the pineal gland, that he identifies as “the innermost part of the brain” which he postulates “may alter very greatly the course of these spirits (ibid.). Further, he postulates the pineal gland as “the principal seat of the soul” (PS art. 32) because it is the only part of the brain that is singular. He reasons that it is necessary there be a single spot where the duality of the body, especially relating to the senses, such as two eyes, two ears, two nostrils, could “come together in a single image or

impression before reaching the soul" (ibid.) While Descartes is obviously in error about the role of the pineal gland, I cannot help but wonder if he did not presciently foreshadow the function of the amygdalae, also located deep within the brain, specifically in the limbic system. Although the amygdalae (I will use the Latin plural) exist as a pair, they have been referred to as a filter which assesses the emotional content of sensory information (Damasio, 2003, p. 58; Goleman, 1995, p. 17,22; Ledoux, 1996a, pp. 289, 290) and are capable of overriding the neocortex or thinking part of the brain (Damasio, 1999, p. 179; Damasio, 2003, p. 60; Goleman, 1995, p. 15; Ledoux, 1996a, pp. 155,168-169, 289-290). This subjugation of cortical function by the amygdalae happens because sensory signals enter the brain directly via the spinal cord to the thalamus, and then, across a single synapse, to the amygdalae. The amygdalae are then capable of activating networks that provoke specific reactions, such as fleeing or freezing, facial expressions, sweating, piloerection, and changes in blood pressure and heart rate (Ledoux, 1996a, p. 291) before the neocortex can respond. Goleman (1995) calls this "neural takeover" of the cortex an "emotional hijacking" (p. 14).

Descartes may also have been prescient in determining that there are two routes in the body concerned with emotion: the bloodstream which carries chemical molecules that act on cell receptors in body tissue; and neural pathways that carry electrochemical signals which act on other neurons, muscles, and/or organs (Damasio, 1999, p. 66). In *The Passions of the Soul*, Article 34, Descartes explains that from the pineal gland, the soul "radiates through the rest of the body by means of the animal spirits, the nerves, and even

the blood, which can take on the impressions of the spirits and carry them through the arteries.” In effect, Descartes claims the brain can move spirits via the pineal gland to the soul just as the soul can influence the pineal gland to move spirits to the body via both neural and humoral pathways. Given that Descartes’ knowledge of the functions of the human body are limited by the times in which he lived, it seems uncanny that his theory mirrors modern neuroscientific findings that the body and brain do indeed communicate with each other and convey emotive-based neurological and physical actions and reactions via neurotransmitters along these same pathways.

Descartes also correctly argues that emotions do not originate in the heart (PS art. 33), contrasting Aristotle's view that the heart is the primary seat of emotions and sensations. His argument states that the soul does not receive its passion in the heart; one only feels emotions in the heart because “there is a small nerve which descends to it from the brain” (ibid.). Descartes acknowledges that he does not know the “corporeal principle” that makes the animal spirits and nerves produce movements and sensations; however, he proposes that narrowing of the arteries that proceed directly from the heart cause “only the most active and finest parts” of the blood, namely the “animal spirits” to pass on to the brain (PS art. 10). Neuroscientists now know that the amygdalae assess all sensory input and are capable of activating the production of chemical neurotransmitters which do indeed affect the heart, either by speeding it up or slowing it down (Damasio, 1994, p. 135). What is also known is that a filter keeps certain molecules from penetrating the brain through the use of a “so-called

blood-brain barrier, a biological filter that envelops virtually all the blood vessels that carry nutrients to the brain tissue and is quite selective” (Ledoux, 1999, p. 151). However, a few brain regions lack this “blood-brain barrier” and “admit large molecules that, elsewhere in the brain, are kept from influencing the neural tissue directly” (ibid.). These larger molecules, such as oxytocin, act on the brain, directly exciting neurons and inciting a variety of behaviours and functions, such as sex and childbirth (ibid.).

Descartes' account of fear in *The Passions of the Soul* Article 36, predicates current neuroscientific depiction of this emotion with a surprising degree of similarity. For example, Descartes states that if a “shape that is strange or terrifying” closely related to a previously harmful thing is perceived by the body, the reaction will depend on both the temperament and constitution of the person and his/her prior experience. He states that “certain factors dispose [his/her] brain” to send messages via “animal spirits” to the nerves “to turn the back and move the legs in order to flee” and other spirits are sent to the heart or to “agitate other parts of the body” (PS art. 36). What is most interesting is Descartes' idea that “spirits are sent to the brain which are adapted for maintaining and strengthening the passion of fear” and that the pineal gland provokes “a particular movement which is ordained by nature to make the soul feel this passion” (ibid.). In fact, Ledoux (1996) clearly states that “[t]he amygdala is, in essence, involved in the appraisal of emotional meaning. It is where the trigger stimuli do their triggering” p. 169; see also Damasio, 2003, pp. 58-60). Indeed, Ledoux (1996) goes on to call the amygdalae “the hub in the wheel of

fear” (p. 170), the hub which sends out signals for behavioural, autonomic, and endocrine responses via the neural and humoral pathways. The amygdala “connects percepts of emotional stimuli...with a variety of neural systems involved in acquisition of, response to, and knowledge about such stimuli” (Adolphs & Damasio, 2000, p. 202). These responses include changing blood pressure and heart rate, sweating, and releasing stress hormones like adrenaline (ibid., p. 291). Ledoux’s research has shown that the amygdalae are able to activate arousal systems directly and are also the recipients of arousal system axons, so they are capable of stimulating and maintaining a state of arousal in what he calls “self-perpetuating...cycles of emotional reactivity” (ibid., p. 290). The amygdalae are capable of maintaining an emotional state, such as fear, until the stimulus wanes, or until assessed otherwise by the cortex. In addition, Ledoux states that the amygdalae “can influence ongoing perceptions, mental imagery, attention, short-term memory, working memory, and long-term memory” (ibid., p. 285). Damasio would agree with Descartes’ assertion that certain conditions in the body signal conscious recognition of emotion (PS art. 38): he writes, “feelings are solely the perception of a certain body state representing an emotion” (Damasio, 2003, p. 89). Descartes asserts that “the body may be moved to take flight by the mere disposition of the organs, without any contribution from the soul” (PS Art 38), which reveals a remarkable similarity to Damasio’s somatic marker hypothesis, which will be detailed later in this paper. Simply put, the somatic marker hypothesis (SMH) claims that collections of specific states of various parts of the body, including such conditions as muscle

tension and heart rate, are marked and remembered so that re-emergence of those same states will trigger an associated emotion in the brain.

There are other concepts in Descartes' theory on emotion that warrant examination. Descartes posits that the senses send their perceptions to the brain, which in turn transfers these perceptions of emotion to the soul, and that this final stage is where awareness of emotion happens. This corresponds to neuroscientific theory, especially to Damasio's hypothesis that sensory perceptions are processed primarily by the limbic system and it is not until they are processed by the neocortex, or the thinking part of the brain, that they become conscious. In addition, Descartes' concept of an object causing differing passions in different persons because "brains are not all constituted the same way" (PS art. 39) corresponds to Damasio's idea that experience and environment, both social and physical, help to shape our emotional responses and feelings (Damasio, 1999, p. 51, 57; 2003, pp. 48, 54, 171). Descartes states that "[o]ur passions, too, cannot be directly aroused or suppressed by the action of our will, but only indirectly through the representation of things which are usually joined with the passions" (PS art. 45). Descartes also points out that the soul or mind can create a passion or emotion through volition. Scientists agree that we can conjure an emotion by wilfully recalling an associated memory, and that we can act out an emotion at will. After all, actors and actresses, some not by profession, do this all the time. However, Damasio (1994) provides evidence that an emotion-evoked expression differs from a conjured emotion, such as one enacted for a camera (p.141).

Descartes postulates that the soul is not divided, but “at once sensitive and rational, too” (PS art. 47). The conflict arises in the pineal gland where the animal spirits of the body may at times be opposed to the soul. The pineal gland, says Descartes, presents to the soul sensory impressions of objects from the brain, which have no volition; and also presents movements which cause the passions and their accompanying physiological changes which do have volition. Hence, conflict arises between the volition of the passions and the will of the soul. Descartes argues that “the strongest souls belong to those in whom the will by nature can most easily conquer the passions and stop bodily movements which accompany them” (PS art. 48). The weak souls are “constantly carried away by present passions,” rendering the soul “enslaved and miserable” (ibid.). Passions can be habituated by teaching and modelling “firm and determinate judgments bearing upon the knowledge of good and evil” (PS art. 48), so that “[e]ven those who have the weakest souls could acquire absolute mastery over their passions if we employed sufficient ingenuity in training and guiding them” (PS art. 50). Goleman (1995) is not so optimistic. He argues that the design of the brain indicates that we often have no control of when we experience certain emotions, such as anger, but that we can learn to govern how long the emotion will last (1995, p.57). Descartes also implies that understanding emotions leads to better control of emotions when he states that “experience shows that those who are most strongly agitated by their passions are not those who know them best” (PS art. 28).

Descartes may have been wrong about the distinct and separate mind and body, as Damasio claims, but he is rightly credited with examining emotion as a function of the interaction of the two in *The Passions of the Soul* (1649). His prescient ideas in his theory of emotion include the identification of a small centre in the brain capable of orchestrating emotion, the mutual and reciprocal influence of mind and body via the neural and humoral pathways, the personalization of emotion, and the possible habituation of emotions. Although science as a discipline did not exist in Descartes' time, he posited ideas that modern day neuroscience has refined. Admittedly, Descartes cannot explain the connection between the corporeal experience of emotion and the mental experience of emotion. In *Meditations VI*, he concedes, "I could give no reason excepting that nature taught me so; for there is certainly no affinity (that I at least can understand)...between the perception of whatever causes pain and the thought of sadness which arises from this perception" (1642/1985, p. 130). This enigma has found its oracles in neuroscience, through the likes of Antonio Damasio and others.

2.1.3 Spinoza's Theory of Emotion: Mind Over Embodied Emotion

Spinoza, like Aristotle, saw man as having an integrated body and soul. In *The Nature of the Human Mind* (NHM), he presents the human body as "the object of the idea constituting the human mind" (1677/1954, p. 165). By presenting the body and mind as simply two attributes of man rather than two independent substances, Spinoza avoids the problem of interactionism. According to Spinoza, the human mind and body reflect the Nature of God,

except that the human mind and body are finite. The mind is the “idea” of the human body, a part of the infinite intellect of God, a concept redolent of Aristotle’s *nous*. Spinoza proposes a parallelism between body and soul where “nothing can happen in that body which is not perceived by the mind” (ibid., pp. 165, 166), but not the reverse, and relates that the more independent the actions of the body are, “the better adapted will be the mind for distinctly understanding” (ibid., p. 167). However, Spinoza admits that he is not able to explain the exact nature of the human body (ibid.). He acquiesces that he does not understand Nature, and “as to the means whereby the parts are really associated...I am in ignorance” (ibid., p. 162). He attributes this ignorance to his finite mind, which could not fully explain the synchronicity of the mind and body or the cohesive functions of the body since he does not know “the whole of nature” (ibid.).

Spinoza regards emotions, “not as a state, but as a process” (Frijda, 1999, p. 238). In *The Origin and Nature of Emotions* (ONE), Spinoza defines emotion as a “confused idea by which the mind affirms of its body, or any part of it, a greater or less power of existence than before; and this increase of power being given, the mind itself is determined to one particular thought rather than to another” (1677/1954, p. 232). Spinoza denotes two types of emotion: passive emotions which originate outside the body and cause pain and lessen human vitality; and active emotions which originate in man’s own nature and cause pleasure and heighten human vitality—any emotions which result from man’s own nature reflect the Nature of God, and therefore must be positive and flawless.

Spinoza delineates three primary emotions: desire, joy, and sorrow (ONE, 1677/1954, p. 219). Desire is an appetite or impulse or will to have something, whether innate or “conceived through the attribute of thought alone” (ibid., p. 218), or a combination of both. Joy is pleasure, the transition of man to greater perfection, or, as defined in *The Moral Value of Emotions* (MVE), “an emotion by which the body’s power of action is increased or assisted” (1677/1954, p. 273). Conversely, sorrow is pain, or the transition of man to lesser perfection, or “an emotion by which the body’s power of action is lessened or restrained” (ONE, 1677/1954, p. 235). Spinoza goes further to moralize that “joy is not directly evil, but good; sorrow, on the other hand, is directly evil” (MVE, 1677/1954, p. 273). Spinoza defines forty-eight other emotions, such as love and hatred, not all of which have a counterpart (ONE, 1677/1954, p. 225), as subsidiaries of the three primary emotions (ibid., pp. 221-231). Although he defines forty-eight emotions, he states there are infinite possibilities (ibid., p. 224). Love, for example, is defined as “joy with the accompanying idea of an external cause” and hate as “sorrow with the accompanying idea of an external cause” (ibid., pp. 220, 221).

Spinoza does not see emotions as opposed to reason, (ONE, 1677/1954, p. 212). He sees emotions as natural, and therefore having “certain causes through which they are to be understood, and certain properties” (ibid., pp. 212, 213). According to Spinoza, emotions have two forms of expression, action and passion. When a person is the adequate cause of his/her own actions, these are active emotions or actions; and when a person is not the adequate cause of his/her own emotions, these are passions. Some emotions, such as desire and

pleasure, can be either active emotions or passions, depending on intensity and circumstance. Davidson (1999) argues that the degree to which an event can be labelled an action or passion is really not an either or, but exists on a continuum (p. 45). Pain, however, according to Spinoza, is only passion since it has an external cause. Spinoza concedes that “we are disturbed by external causes in a number of ways, and that, like the waves of the sea agitated by contrary winds, we fluctuate in our ignorance of our future and destiny” (ONE, 1677/1954, p. 234), indicating that, in his mind, we are not self-determined. Davidson (1999) believes that Spinoza’s concept of an emotion as an affect experienced in the mind with an outside physical cause does not imply “the idea of an event in the body,” but rather implies that the cause of an emotion is a certain external object (p. 99). Davidson (1999) argues that Spinoza’s “relation between mind and body is not causal *because* [italics in original] it is the relation of identity” (p. 100). If there is no clear distinction between mind and body, then there can be no interaction; the two shall function as one. Spinoza’s choice to ignore the physical manifestations of emotion, such as trembling, sobbing, and laughter, “because they belong to the body alone without any relationship to the mind” (ONE, 1677/1954, p. 235) reinforces Davidson’s argument that Spinoza does not see emotions as including bodily manifestations.

2.1.3.1 Spinoza’s Prescient Psychology of Emotions

In addressing *The Psychology of the Emotions* (POE), Spinoza describes the association of emotions, where man can recall previous events and objects and the emotions experienced with them (1677/1954, p. 236). Ledoux (1996a)

agrees that memories of objects also contain records of emotional reactions to those objects (p.161). Spinoza also proposes that objects which “are somewhat like” (POE, 1677/1954, p. 237) previously experienced objects can elicit the same emotions as the prior experience. Damasio (1994) agrees with this principle of emotional association (p. 136). Spinoza also notes that “the joy or sorrow of one person...differs from the joy or sorrow of another” (POE, 1677/1954, p. 244) and that one object may elicit different emotions in different people (ibid., p. 245). Spinoza adds that one object may elicit different emotions in the same person at different times (ibid.). Damasio (2003) concurs that emotional reactions can vary greatly due to the emotional valence ascribed to the stimuli, the body state at the moment of stimulation, and the knowledge and memory associated with the object (pp. 177, 178). Spinoza’s concept of the body as the arena of emotions sees the mind as the key to understanding and thus, as marshalling these emotions to promote positive actions which more closely mirror the attributes of Truth and God. Spinoza, however, does not appear to depict the mind and body “on equal footing” as Damasio claims (2003, p. 212).

2.2.3.2 Spinoza’s Rejection of Descartes

In his introduction to *The Origin and Nature of Emotions*, Spinoza states that he differs from Descartes who “believed the mind is absolute master over its own actions and tried nevertheless to explain by their first causes emotions, and...show the way by which the mind could obtain absolute power over them” (1677/1954, p. 212). While Descartes definitely believed in man’s self-determination, I am not convinced that he believed unequivocally in man’s ability

to control emotions. While he did state in *The Passions of the Soul* (PS) that the “weakest souls could acquire absolute mastery over all their passions if we employed sufficient ingenuity in training and guiding them” (Descartes, 1649/1988, p. 238), this was an ideal; Descartes believed that if humans could fully understand emotions, then emotions could be controlled. However, even Descartes admitted that his understanding was incomplete, and that the very nature of the passions is “confused and obscure” (PS, 1649/1988, p. 229) because of its relation to the body. Spinoza further dismisses Descartes’ theory of emotion, saying that Descartes proved “nothing but the acuteness of his great intellect” (ONE, 1677/1954, p. 212). I have argued earlier that several aspects of Descartes’ explanation of the brain/body function of emotion are significant and relevant in light of modern neuroscientific hypotheses.

Spinoza, in *Of Human Freedom* (OHF), rejects Descartes’ belief in free will and can “scarcely have believed it possible for one so great” to have proposed the concept that the pineal gland could be moved by ‘animal spirits’ within the brain, “a hypothesis more occult than any occult quality” (1677/1954, p. 348). Spinoza’s reasons for rejecting Descartes’ theory are that Descartes did not explain this union of mind and body “by its proximate cause” (ibid.) and did not explain whether the mind or animal spirits has more power over the pineal gland, a critical hierarchy in Spinoza’s concept of the mind. He also rejects Descartes’ theory on the grounds that the pineal gland does not have sufficient room to move in such a variety of ways and that “all the nerves are not extended to the cavities of the brain” (ibid., p. 349). What Spinoza was denied is the

modern knowledge that axons, the sending unit of neurons, come in many sizes, from those extending the length of the spinal cord to microscopic fibres, and that the axons and dendrites of neurons do indeed extend deeply inside the brain.

Spinoza writes that man has “no absolute authority” over emotion, and that “not a little practice and study are required in order to restrain and govern the emotions” (OHF, 1677/1954, p. 345). He asserts that the power of the mind “is determined by intelligence alone” and that “by knowledge of the mind alone” can man determine “the remedies against the emotions” (ibid., p. 349). He argues that the power of an emotion is determined by the power of its cause, and that if man can understand the cause of an emotion and determine its necessity, possibility, or contingency, he can overcome a bad emotion, defined as any emotion that “hinders the mind from thinking” (ibid., p. 351). Spinoza advises that man, using his reason, is able to “detach an emotion of the mind from an external cause and connect it with other thoughts” (ibid., p. 352), thus creating a “clear and distinct idea” (ibid.) from a confused idea. He states that there is not an emotion upon which man cannot perform this transformation, for “an emotion is an idea of a modification of the body and this idea therefore must involve some clear and distinct conception” (ibid., p. 353). He proposes a method for preventing control by evil emotions. Since man lacks a “perfect knowledge” of emotions, he must “conceive a right rule of life, or sure maxims of life” and memorize these, constantly applying them to incidents around him, “so that [his] imagination may be widely affected by them, and they may always be ready to hand” (ibid., p. 356). This concept of habituating the emotions would coincide

with the proposal that repetition of action can aid in construction of new neural pathways involved in the changing of emotional behaviour, which Goleman (1995) calls “emotional relearning” (p. 207).

2.2.3.3 Damasio's View of Spinoza

As its title would imply, Damasio writes a considerable amount about Spinoza in his book, *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain* (2003). He acknowledges several contributions that Spinoza makes to the understanding of the role of emotion. Damasio notes that Spinoza rightly separated the process of feeling from the process of having an idea about an object. Spinoza is also credited with accurately describing what modern science has posited: that humans have an ability to react emotionally to different objects and events (Frijda, 1999, p. 237), and that this reaction is followed by a feeling related to the experience that gives that experience a positive or negative valence (Damasio, 2003, pp. 130,131), or, in Spinoza’s language, is denoted by pain or pleasure. Damasio also comments on Spinoza’s belief that man can overpower negative emotional stimuli by habituation (ibid., p. 275), utilizing reason to replace negative affect with positive affect. Damasio agrees that this is possible to some extent (ibid., pp. 52, 55-56, 275) by choosing our experiences that condition our responses and avoiding stimuli which trigger undesirable individual responses.

Damasio (2003) is appreciative of Spinoza’s unification of the mind and body in his “changing of the perspective he inherited from Descartes” (p. 209), which preserves the aspect of dualism, but rejects the substance of dualism.

Damasio, however, overstates when he posits that Spinoza depicted a mind and body “fully and mutually mimicking each other in their different manifestations” (ibid.), since Spinoza clearly dismissed the physical manifestations of emotions. Damasio does acknowledge that while Spinoza linked mind and body, he failed to “attempt to explain how the bodily and mental manifestation of substance ever arose” (ibid., p. 209), something Descartes at least endeavoured to explain. However, some of Damasio’s claims regarding Spinoza’s prescient contributions can be considered specious. For example, Damasio says Spinoza “may have intuited the general anatomical and functional arrangement that the body must assume for the mind to occur together with it, or more precisely with and within it” (ibid., p. 210). Nowhere in the passage of Spinoza’s descriptions of body and mind cited by Damasio (ibid., pp. 210, 211) do I find evidence to support Damasio’s claim; on the contrary, Spinoza’s depictions of the body are conventional; to assume otherwise would be misleading. Another example of Damasio’s unsubstantiated assumptions occurs when he cites Spinoza’s description of the body in *Ethics Part II* where Spinoza tells us the body can be physically deformed by other moving bodies and can move and arrange external objects. Damasio claims that in this passage Spinoza “stopped short of saying that the deformation could be conveyed by nerves to the brain, although I would not put it past him to have thought so” (ibid., p. 211). In reading these passages, I feel the need to remind readers that Damasio acknowledges in his first chapter that he is not a philosopher (ibid., p. 8), and I encourage reconsideration of such suggestions.

Damasio postulates that Spinoza's notion that mind and body are attributes of the same substance allowed the unity of substance necessary for proposing interaction between the two. Intrigued by Spinoza's "notion that *the human mind is the idea of the human body* [italics in the original]" (Damasio, 2003, p. 212), Damasio goes too far in concluding that Spinoza "might have intuited the principles behind the natural mechanisms responsible for parallel manifestations of mind and body" (ibid.). Damasio's brain/body interactions are reciprocal: the physical manifestations of emotion can affect emotions in the brain, and the brain can induce bodily representations of emotion. Spinoza clearly rejects the physical expressions of emotions "because they belong to the body alone without any relationship to the mind" (ONE, 1677/1954, p. 235), and he cites the unreliability of the body in his example of the emotion of desire, whereby the body desires a certain food, but a short while later, after ingesting its fill, when presented with the same food, the body responds with "loathing and disgust" (ibid., pp. 234, 235).

Damasio (2003) believes that Spinoza "was entirely on the mark in his view that joy and its variants lead to greater functional perfection" (p. 285). The key here lies in the word "functional," which is Damasio's interpretation, but it is also possible that Spinoza meant spiritual perfection, or, more closely mirroring the nature of God, rather than referring to body/mind harmony and homeostasis. Damasio has established through use of functional magnetic resonance imaging (fMRI) that neural and body maps "associated with joy signify states of equilibrium" (ibid., p. 137), or optimal physiological functioning, which is

conducive not only to survival, but also to human well-being. Even Damasio states that these feelings of harmony and its contrast, disharmony, are not necessarily related to objects or experiences, but rather related to states of the body (ibid., p. 138, 139).

Damasio (2003) also rejects Spinoza's moral terms of good and evil to judge emotion, preferring to style emotions as "states of greater or lesser physiological balance" (2003, p. 51). Damasio goes so far as to claim that Spinoza's idea that events experienced by the body are represented as ideas in the mind "conjures up" his concept that emotions are represented in the brain as specific combinations of neural, muscular, respiratory, digestive, and pulmonary states called mapping (ibid., p. 87). Damasio suggests that Spinoza "saw brain and mind as closely associated" (ibid., p. 213), and continues that "now we can fill in the brain details and venture to say for him [Spinoza] what he obviously could not" (ibid.). I would resist such extrapolations.

Damasio does not cite Spinoza's metaphor of the worm in the blood in *The Nature of the Human Mind*, which discerns different aspects of the blood as distinct entities, illustrating Spinoza's conjecture that the composition or nature of blood could be changed regarding absence or quantity of particles (1677/1954, p. 162-164) and that "other motions and other relations arise in the blood, springing not from the mutual relations of its parts only, but from the mutual relations between the blood and external causes" (ibid., p. 163, 164). Perhaps this description of the blood is the unwitting precursor to modern scientific knowledge of neurotransmitters that neuroscientists, such as Damasio and Ledoux, have

studied so carefully in delineating current theories of body/brain interaction.

2.2.3.4 Spinoza's Contributions to Modern Concepts of Emotion

Spinoza represents the philosophical recognition of the importance of the affective domain. However, while he attempted to validate emotions, he recognized only their usefulness to the development of the intellect and regarded the physical expressions of emotion as extraneous to the mind. Spinoza presents the body and mind as the two attributes of man, but the mind is still dominant, since it perceives everything that occurs in the body and has power over the emotions (*Ethics*, 1677/1954). Although Spinoza regards emotion as natural, not opposed to reason, and co-existing with the intellect, emotion has the capability of either confusing or enhancing reasoning, depending on whether the emotion is passive or active, evil or good.

While his clinical evaluations of the emotions reflect the early development of cognitive psychology and are not without flaw, his interest in classifying and defining them helped to establish a platform for further investigation. Further, his detailed elucidation of the causes and functions of emotions hint at future scientific hypotheses about brain/body interaction and emotion.

Damasio has identified several of Spinoza's contributions to the evolution of concepts of emotion beyond his unification of body and mind. Spinoza identified the process of emotion as different from the process of perceiving an idea about an object and noted that humans react emotionally to different objects and events and that these are marked by emotion in memory. In addition,

Damasio registers Spinoza's belief that man can use reason to overcome negative affects, leading to a more harmonious life.

Spinoza provided other significant ideas that promoted the development of the theory of emotion. Among them, he posited that emotion is registered in the body and brain as having positive or negative quality and that this valence can colour future perceptions. He proposed that emotion can derive from mind or body impulse and can vary from person to person for the same object. He also noted that the same object may elicit different emotions from the same person at different events. These concepts foreshadow modern neuroscientific hypotheses about the function of emotion.

In *Ethics* (1677/1954), Spinoza's virtue "is a disposition *accompanied by* [italics in original] right reason" (p. 351). The role of education is to utilize this "right reason" to understand the imagination and its interaction with emotions, to ascertain the patterns of interaction which enable us to transform the fictions of our lives into "critical intelligence" (Lloyd, 2000, p. 169). Modern day curriculum is replete with teaching problem solving and critical thinking skills, which are predominantly cognitive activities. Curricula does not yet include a course on utilizing emotional valences or "gut feelings" (Damasio, 2003, p. 148) to signal a decision.

2.2 Modern Curricula: The Divining of the Intellect and the Decline of Virtue

Individually and collectively, Aristotle, Descartes, and Spinoza have left their mark on philosophical and theoretical regard of the roles of the intellect and

emotion in modern educational practice. So too, the ideas of Locke and Hume have reinforced the priority of the intellect in pedagogy. Locke believed the aim of education was to teach people to live by the rule of reason. The education of a gentleman was meant to produce a virtuous person who would “purely follow what reason directs as best” (*Some thoughts concerning education* [STCE], Locke, 1693/2000, Part 33, p. 103) and then lead the rest of society into virtue and order (STCE, Locke, 1693/2000). It is Locke who recommended the teaching order of academic disciplines that included geography, arithmetic, geometry, history, Latin, rhetoric, logic, and natural science (ibid., p. 188,189). These disciplines are represented over three hundred years later in elementary and high school curricula that designate mathematics, a combination of arithmetic and geometry; social studies, a combination of geography and history; language arts, a combination of reading, writing, and literature; the sciences; and a second language as the core subjects, and leave family life, psychology, the fine arts, and the technical arts as electives.

Despite the movement initiated by Hume whereby morality was less divine virtue and more a human moral sense of what is good derived from feelings, the intellect remained pre-eminent in education. Public schools do not implicitly teach morality. There is no Moral Virtues 101. While many parents have argued vociferously that they reserve their right to teach morality to their children, increasingly, the public has motioned that the schools must step in to fill a void where some parents have abdicated this responsibility.

Dewey (1895/2003) marks a dramatic change in sentiment of the role of the school. He sees education as the agent to socialize and to train the child to become useful to society. Dewey recognizes that education must begin with a psychological insight into the child's capacities, interests, and habits (Dworkin, 1959, p. 20), and argues that it is not only the intellect which must be recognized and appropriately engaged in school in order to prepare children for the responsibilities of adult life. Dewey's vision of schooling is simultaneously intellectual, social, and moral, with a view to creating a pluralistic community that was both good and productive. In another departure from the view of education as composed of purely intellectual disciplines, Dewey is a strong proponent of art education. Elementary curricula today includes the fine arts, such as drawing and painting; and music, both choral and band. However, when funding cuts came in the early 1980's in British Columbia, music was the first program cut in many districts, perhaps indicating that it was regarded as an educational frill and not an essential area of education. Fine arts and music endure in high schools as electives, not as courses mandatory for human development.

Despite the addition of electives to the curriculum, the academic disciplines remain the superior core subjects. It is still the sciences, mathematics, history, geography, literature, and languages that are valued sufficiently to spend valuable tax dollars formally assessing in the form of provincial exams. It is the marks primarily from these courses which act as gatekeepers of scholarships and entrance into post-secondary institutions. Additional funding is given to select school districts that propose programs whose goals are to improve

performance in the academic disciplines. The Fraser Institute of British Columbia uses scores from provincial exams to rank schools; they do not consider student marks in electives, nor do they consider performance rankings of bands, or choirs, or racing cars, or chef trainees, or clothing designers, all of which are involved in national adjudicated competitions. Nel Noddings (2005) comments that liberal education, defined as a set of traditional disciplines, “puts too much emphasis on a narrow form of rationality and abstract reasoning as the hallmarks of a fully human life” (p. 43) and is an outmoded and dangerous model of education for today’s young because it neglects, among other things, feelings and moral activity.

While it is no longer regarded as the ultimate asset to attaining virtue or goodness, the intellect is still supreme in our school system. We have perpetuated the negativity of emotion. Psychology or health education has not become a mandatory course in elementary or high school. We continue to expel students who are too angry, too stoned, too disinterested and we reward those who fit the old, mouldy mold of the self-controlled intellectual. We no longer regard reason as the tool to becoming a virtuous person; in fact, virtue has apparently been lost as *the disposition* to which we openly and avidly aspire. We do not tell children that the aim of education is to make them better persons, but we do repeatedly tell children and parents that students who pursue higher post-secondary education get jobs that pay more money than those who do not obtain further education. Perhaps we have simply replaced morality with money, the new “virtue.” Perhaps advertising, lifestyles of the rich and famous, and

expensive body makeovers have sent the message that money *does* buy happiness.

By denigrating the value of emotion in favour of the intellect, perhaps we have also denigrated the virtue of happiness. By removing being a virtuous person from educational goals, perhaps we have inadvertently left young people to define their own virtue and morality. Rather than focussing on how our emotions define us and connect us to our fellow man, we have left youth to define goodness as an egocentric and instantaneous satisfaction. The virtue of happiness, the virtue of goodness, have been attenuated to a type of personal gratification, an emotional feeling which can be supplied irregularly by natural human experience or on demand by drugs. Since this feeling of well-being is not necessarily naturally forthcoming, despite effort and planning, many choose its synthetic version, drug induced pleasure. The news announces that there are increases in depression, suicide, violence, crime, risk-taking behaviour such as street-racing, and drug use among youth today. Given the increases in these behaviours, we cannot say that our education system is serving the needs of today's youth. We have nothing that is a panacea. I do not propose one. What I hope to do is provide a new focus for discourse that may provoke the beginning of educational reform. I wish to shift our pedagogical focus from the intellect to emotion. I propose a paradigm shift as the source of new beginnings: that we no longer regard emotion as a detriment, as a folly, nor as a somewhat confusing accessory to learning, but as the epicenter of what it means to be human.

Neuroscience and neuropsychology provide the scientific underpinnings for assigning emotion a critical role in education.

CHAPTER 3: THE NEW FRONTIER: NEUROSCIENCE AND NEUROPSYCHOLOGY

3.1 Neuroscience as the New Frontier: Emotion as Process and Function of the Mind

In the last two decades, there has been a significant shift of the cynosure in cognitive science, fostering the development of its derivative, neuroscience (Goleman, 1995, p. xi). Many disciplines have changed their focus from examining the many facets of cognition, to the process and function of emotion in relation to cognition. The longstanding dysphoria with emotion, that wild, untameable, amorphous thing, has become instead a fascination with a new frontier of the human mind, the human brain: emotion. With this pivotal mindset has come recognition that emotion is inextricably linked with behaviour, and as such, is an area of study long recognized by psychologists. However, Oatley and Jenkins (1996) comment that emotions “have traditionally been regarded as extras in psychology, not serious mental functions like perception, language, thinking, and learning” (p. 122).

During the 1990's, that traditional view underwent significant change as psychologists began to examine the neuroscience of brain function in regard to behavioural paradigms. A new discipline, neuropsychology, evolved. At the beginning of this millennium, the most significant syzygy occurred: neuroscience and neuropsychology joined to form affective neuroscience (Davidson, 2000),

whose focus for study and research is the processes and function of emotion in relation to behaviour.

In demonstrating the new perspective on emotion, I have chosen, for a number of reasons, to focus initially on the writings and ideas of three personages: Antonio Damasio, Joseph Ledoux, and Daniel Goleman. Firstly, all three have recognized the importance of combining neuroscience with psychology and use this synergy as a basis for their concepts and proposals. All three regard emotions as a process involving the brain and the body; this is the machinery which affective neuroscience continues to define and elucidate. The role of psychology is to apply this process to human behaviour in order to unravel the mystery of how emotions function in everyday life.

Secondly, while each author has a distinct contribution to make regarding the process and/or function of emotion, there is also overlap that allows integration of their conceptual views of emotion. Finally, but perhaps most significantly, these experts' ideas and hypotheses are central to defining and demarcating my own concept of emotion, and hence, my suggestion for educational reform. I cannot purport to present in any adequate way the multiplicity of concepts represented in Damasio's, Ledoux's, and Goleman's writings, but to simply summarize their ideas as I perceive them which are pertinent to my argument that neuroscience has something to offer to educational philosophers and theorists, and concomitantly, to educator practitioners.

3.1.1 Damasio and Ledoux: Emotion as Neurobiological Body/Brain Process

Damasio and Ledoux give complex accounts of emotion as neurobiological body/brain function. What I present here is an unpretentious combination of their intricate ideas. Damasio acknowledges that he combines neurological findings with neuropsychological research as a basis for hypotheses and ideas (1994, p. xiii; 1999, p. 15) and espouses that “the course most likely to yield interesting explanations” and fruitful research is to integrate knowledge from other disciplines with neurobiology (2003, p. 160). Ledoux states that his book, *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (1996a), “is not about mapping one area of knowledge (the psychology of emotion) onto another (brain function). It is instead about how studies of brain function allow us to understand emotion as a psychological process in new ways” (p. 23).

Goleman, as a psychologist, sees the neurobiological studies of the brain as the key to understanding the machinery of emotion and instrumental in finding a means to alleviating “our collective emotional crisis” (1995, p. x).

Neuroscientists have rejected the idea that specific parts of the brain perform designated singular tasks and assert that brain parts are highly integrated (Murphy, Nimmo-Smith, & Laurence, 2003), and while specific parts such as the amygdalae function as the hub for certain tasks, they do not perform these tasks alone, but serve to orchestrate and coordinate neuronal activity. Damasio, Ledoux, and Goleman focus on the neural and physiological substrates of emotion as a basis for their theories and hypotheses about the role of emotion.

Damasio (2003) commits himself to elucidating the neurobiology of

emotions and feelings as his contribution to the mind/body problem, which he states is “central to the understanding of who we are” (p. 7). He argues that in order to understand the human mind, we must “move from the nonphysical cogitum to the realm of biological tissue” (Damasio, 1999, p. 252), and relate this to the whole person, which exists in the context of both the physical and social environment. The body, according to Damasio (1994), and specifically the brain, are “the indispensable frame of reference for the neural processes that we experience as the mind” (p. xvi). Damasio states that the mind and body are inseparable and integrated via mutually interactive biochemical and neural components, such as the endocrine, immune, and autonomic neural constituents, which produce chemical and electrical transmitters. These neurotransmitters circulate through the humoral and neural pathways of the body and brain. Damasio considers these neural and biochemical processes and circuits which signify brain function in theorizing that emotion, feeling, and biological regulation are integral parts of human reason.

Damasio (2000) defines emotions as “specific and consistent collections of physiological responses triggered by certain brain systems when the organism represents certain objects or situations” (p. 15). He states that a stimulus is received by the brain, where it is then assessed. Messages are then sent via humoral and neural pathways to the body and other parts of the brain. The body undergoes somatosensory changes, such as flushing of the skin and acceleration of the heart rate. Simultaneously, messages are sent to many other

parts of the brain where the stimulus is analyzed and further messages are sent to the body. Damasio and Ledoux agree that emotions cannot be disembodied.

Ledoux, like Damasio, makes a clear distinction between emotions and feelings (Ledoux, 1996a, p. 329). Damasio says that, unlike emotions, feelings are not instinctive; they are conscious and discriminatory because they are based on memory, knowledge, and the sense of the autobiographical self (1999, p. 17; 2003, p. 271).

The basic functions of emotions are preset: they are “bioregulatory devices which are instinctive and autonomic” (Damasio, 2000, p. 15). Like others (Murphy, Nimmo-Smith, & Laurence, 2003, p. 209), Damasio denotes these primary emotions as fear, happiness, sadness, anger, surprise, and disgust (1999, p. 50) and asserts that they are universal emotions because of their appearance in primates and early appearance in human development (1994, p. 85). These primary emotions are “curious adaptations that are part and parcel of the machinery with which organisms regulate survival” (Damasio, 1999, p. 54) and originate in the limbic system.

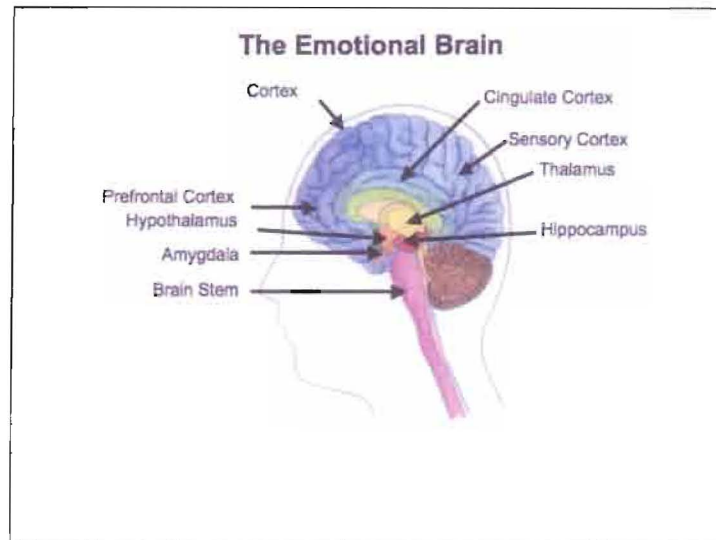


Figure 1: The Emotional Brain

Understanding the underlying brain mechanisms is critical to theorizing about and relating practice to neuropsychological findings. To begin, all sensory input from the body is sent to the amygdalae and the cortex via the thalamus. Ledoux is credited as being the first to discover the significance of the amygdalae (Goleman, 1995, p. 15), two almond-sized structures in the limbic system which act as emotional filters for sensory information, especially fear. Using chemical tracers, Ledoux (1996) discovered that each amygdala is composed of approximately twelve sub-regions (p. 161) Sensory input from the thalamus to the amygdala first goes to the lateral nucleus, which processes the stimuli and decides to what other regions of the amygdala the results will be distributed. The central nucleus of the amygdala, which receives input from the lateral nucleus, is responsible for activating different emotional responses in the body. Based on Ledoux's work, (Damasio, 1994, p. 70), Damasio establishes the amygdala as the key player: it both sends and receives information from many other parts of

the brain (1994, p. 133; 1999, p. 64; 2003, p. 90). If the amygdala assesses this input as having high emotional content, it prioritizes the input and immediately sends neurotransmitters which signal various parts of the brain, (such as the hypothalamus), and body, (such as the heart), to act. Because the basal ganglia and neocortex take longer than the amygdalae to process information, it is possible for the amygdalae, in effect, to short-circuit the brain. Goleman labels this an “emotional hijacking” (1995, p. 26), which I will discuss in more detail later. Simultaneously, the same sensory information is sent to other parts of the brain, such as the basal ganglia and the neocortex, where knowledge and memory are accessed and included in the assessment of sensory input. This combination of input and assessment reaches a level of consciousness and the emotion then becomes a feeling, or what Damasio calls the feeling of emotion, which he defines as “the representation of that transient change in organism state in terms of neural patterns and ensuing images” (1999, p. 282).

Like Damasio, Ledoux identifies the two routes of sensory information. Ledoux (1996a) calls them the “low road,” where the amygdala is the primary respondent; and the “high road,” where the sensory cortex is the primary respondent (pp. 161, 165). Ledoux’s description of amygdalae function is congruent with Damasio’s, but more detailed. Ledoux describes the amygdalae as the hub of a wheel, capable of sending output and receiving input from various parts of the brain, including the low level thalamus and the higher level cortex and hippocampus (ibid., p. 168-170). Ledoux goes further to explore how sensory input incidents are recorded as memory. The amygdalae, Ledoux

asserts, have more neural connections called axons which send information to other parts of the brain than those parts reciprocate, indicating that the amygdalae are more controllers than controlled (ibid., pp. 284, 285).

Ledoux and Damasio also distinguish emotion and feeling through the brain functions of unconscious and conscious thought. Emotions are subjective and outside conscious awareness. Feelings occur when emotions have coupled with memory and knowledge and become conscious as well as individual (Damasio, 1994, p.132). Consciousness is necessary for feelings to exist, although one may not be conscious of the object eliciting the feeling. (Ledoux, 1996a, p. 298; Damasio, 1999, pp. 42, 43).

It is important to note that body or somatic states can be positive or negative. Negative body states slow down the processing of images and limit the diversity of images which can be processed, thus limiting the efficiency of reasoning, but allowing the body to focus on the object causing the negative emotion. Positive body states enhance rapid generation of diverse images, and reasoning is speeded up, but not necessarily efficient (Damasio, 2003, p. 147). Happiness, for example, also has specific body states that mark its occurrence, so specific that, Damasio's experiments delineate clearly the difference between a genuine or emotion-evoked smile and a contrived smile (1994, pp. 140-141). His study shows that not only are different neural pathways activated, but also different body states are enacted, including the use of different facial muscles. These neural pathways that serve specific emotions, Damasio (2003) refers to as neural maps; and the bodily responses that accompany specific emotions, he

refers to as body maps (pp. 111-112). This corresponds with William James' description of "standard emotions" such as fear and anger, where he argues that feelings are based on a perception of bodily states (1967, p. 13). Whereas Damasio explains a feeling as a neural map of a body state, Ledoux seeks to explain a feeling as a representation of the activity of specialized emotion systems in the brain "that give rise to consciousness" (1996a, p. 282). He specifically examines the activation of amygdalae output that converts an occurrence into an emotional experience. Connections from the amygdalae to many different cortical areas allow the amygdalae to influence attention, perception, and memory in collecting and assessing pertinent information which is relayed back to the amygdalae and used to monitor and delay, maintain or change a bodily reaction (Ledoux, 1996a, p. 285, 287; 2000, p. 143). What makes these systems function on high alert is the brain's arousal system. Several systems, many of which are located in the brain stem close to the amygdalae, create different neurotransmitters, which enhance axon receptors via neural and humoral pathways. These neurotransmitters arouse brain cells to incoming signals.

Arousal is important to attention, perception, memory, emotion, and problem solving (Ledoux, 1996a, p. 289). Damage to the amygdalae prevents arousal (Damasio, 2000b, p. 202). When the amygdalae are involved in arousal, they also activate networks that control behavioural and visceral responses. Certain emotions, such as fear, cause the amygdalae to heighten prolonged arousal in several parts of the brain. This is why, after a traumatic event,

surmises Ledoux, it is difficult to relax and/or sleep for some time. In addition to emotional arousal stimuli, there is also novel arousal stimuli, which are not as strong nor prolonged and are activated by systems other than the amygdalae (Ledoux, 1996a, p. 290). As well as the amygdalae sending messages from the brain to the body, the body sends messages back to the brain about the state of the body, which Ledoux acknowledges as Damasio's somatic marker hypothesis (SMH) and as "gut feelings" (Ledoux, 1996a, p. 293), which play a role in decision making processes (Damasio, 2003, p. 148; Suzuki, Hirota, Takasawa & Shigemasu, 2003, p.87).

According to Damasio's theory, objects perceived by the senses are assessed for emotional content and marked. This marking may be based on prior neural maps and/or body maps associated with the object, or based on general instinctive associations. Thus, each object is marked or signalled as either positive or negative (Damasio, 2003, p. 148). Damasio, Tranel, and Damasio, (1991), posit that somatic markers activate a covert effect, namely the release of neurotransmitters dopamine and serotonin, that have the ability to alter processing of information in the cerebral cortex (p. 221). These somatic markers or emotional signals do not make decisions, but guide decisions (Bechara, Damasio, H., Damasio, A.R., & Lee, 1999; Dunn, Dalgleish, & Lawrence, 2006; Jamieson, Hinson & Whitney, 2004) by helping to focus attention on certain aspects of the environment and thus enhance the quality of reasoning and, theoretically, the appropriateness of our responses (Damasio, Tranel, and Damasio, 1991, p. 147). There is some evidence that heart rate may play a part

in these markings. McCraty (2004) cites evidence that heart rate, which is directly influenced by signals evoked by the amygdalae, is correlated to hormonal pulses that are carriers of emotional information; specifically that “biologically relevant information is encoded in the time interval between hormonal impulses which are correlated to heart rate” (p. 542).

Damasio and Ledoux paint a picture of an integrated body and mind, linked together by the emotion and feeling functions of the brain. Arnold (1960) also acknowledges that emotion is “not a mere psychological state; it is an impulse to action that brings with it a host of physiological changes” (p. 178). Emotions, which are unconscious, create body states; but feelings, which are conscious, most often arise from neural maps, which are based on repeated body states (Damasio, 2003, p. 112). Feelings then, have a cognitive component, since they rely on activities and processes within the thinking part of the brain. Ledoux and Damasio have hypothesized how emotion and feeling colour the working of the brain, influencing every function so that cognition can no longer be examined without its cohort, emotion. Ledoux distinguishes feelings from thoughts by the different brain systems which are active for each one, and contests that feelings “involve many more brain systems than thought” (1996, p. 299). Emotions, writes Ledoux, “cause a mobilization and synchronization of the brain’s activities” (ibid., p. 300) that is functionally dissimilar to thinking which does not have significant emotional content.

3.2 Neuropsychology: Neurobiology of emotion as behavioural function

Daniel Goleman draws on the neurobiology of Damasio, Ledoux, and others to establish the importance of emotion in day-to-day functioning in our lives. The term emotional intelligence (EI), the focus of Goleman's commentary, was coined by Salovey and Mayer (1990) as a set of skills which contribute to accurate appraisal, expression, and regulation of emotion in self and others used to motivate, plan, and undertake positive life action. Goleman argues that it is emotional intelligence "that makes us more fully human" (1995, p. 45) and that while meta-cognition is important, self-awareness is critical. Self-awareness he defines as "the sense of an ongoing attention to one's internal states" where "the mind observes and investigates experience itself, including the emotions" (ibid., p. 46).

Goleman, Damasio, and Ledoux claim that the brain has evolved from the primitive, instinctive, emotional brain based on the parts of the limbic system to a combination of emotional and thinking brain, which includes the cortex and the neocortex (Goleman, 1995, pp. 9, 10; Damasio, 2003, pp. 51, 52; Ledoux, 1996a, p. 301). There are two ways of "knowing," says Goleman: one, the rational mind of which we are typically conscious; and the other, the emotional mind, which is primarily unconscious. The emotional mind, the primitive mind in the evolutionary process, primarily involves the limbic system, which includes the hippocampus that registers information and mediates memory and the amygdalae, which hold emotional memories that are often unconscious (Goleman, 1995, p. 15) and regulate basic functions and ensure survival. The

later evolutionary brain includes the cortex, which refines learning and stores long-term memory; and the neocortex, which creates, strategizes, problem solves, and is responsible for long term planning. Goleman and Damasio agree that most often these two distinct yet linked parts of the brain function in homeostatic harmony (Goleman, 1995, p. 28; Damasio, 2003, p. 42).

3.2.1 Theory of Emotional Hijackings

What Goleman focuses on in his book, *Emotional Intelligence: Why It Can Matter More Than IQ* (1995), is the ability of the emotional brain functions to override the rational brain functions in ways that are not always conducive to the user's well-being, a feat both acknowledged and lamented by Aristotle, Descartes, and Spinoza. These occurrences he calls emotional hijackings, and it is these powerful over-ridings of the rational functioning brain that Goleman regards as the root of inappropriate, passionate actions. Goleman theorizes that emotional hijackings occur because of neural connections, proximity, and the function of the amygdalae. He points out that the amygdalae, which he calls "the emotional sentinel" (ibid., p. 17), have the ability to override the neocortex because sensory input, which travels from the brain stem to the thalamus, only need cross a single synapse to reach the amygdalae, whereas this same stimuli, which is simultaneously sent to the cortex and then to the neocortex, must travel a more circuitous route (ibid., p. 17, 25). In rats, the amygdalae have been recorded as responding to stimuli from the thalamus in twelve milliseconds; the neocortex takes twice as long to respond and send processed sensory input information back to the amygdalae (ibid., p. 20). The amygdalae are also in

closer proximity and have more direct synaptic links to the body centers, such as the adrenal glands, which control autonomic body functions, such as those used in the fight or flight reaction to fear (Damasio, 1999, p. 62; Damasio, 2000b, p. 197; Goleman, 1995, p. 20; Ledoux, 1996a, p.163). According to Goleman, this explains the how; he goes further to theorize why emotional hijackings occur.

The amygdalae play the primary role in Goleman's reasoning as to why emotional hijackings occur. In the limbic system, the hippocampus stores memory that Goleman (1995) calls "dry facts" (p. 20); the adjoining amygdalae store the emotions that accompany the facts. The amygdalae, according to theory, have the capacity to attach neurotransmitters that mark certain facts with emotional intensity (Damasio, A.R., Tranel, & Damasio, H.C., 1991, p. 221; Goleman, 1995, pp. 20, 21; Ledoux, 1996a, pp. 207, 289, 290, Merali, Michaud, McIntosh, Kent, & Anisman, 2003). These emotional markers signal the potency of the memory. For this reason, Schindler remembered the girl in the red coat in the ghetto, for that was the moment when he was struck with the horror of what Hitler's eugenics machine was doing (Fogelman, 1994, p. 54). Eva Fogelman, a psychologist, reports in her book, *Conscience and Courage* (1994) that a common phenomena among rescuers of Jews during the Holocaust is that they had vivid memories of heightened awareness of sight, sound, and smell related to the moments of epiphany when they became committed to saving Jews. The stronger the intensity of amygdalae arousal, the stronger the memory imprint (Goleman, 1995, p. 21; Phelps, 2005). This would ensure that a primitive homo sapien who had a near death encounter with a large animal would be on high

alert when he saw another such animal, even if there was only a resemblance. While the amygdalae's provocation is fast, it is not always accurate (ibid., p. 22). The amygdalae's method of comparing new stimuli to old memory is associative (Goleman, 1996, p. 21) and in its primitive role, this was essential to survival (Ledoux, 1996a, pp. 174-176). Perhaps survival governs the fact that the amygdalae are more fully formed at birth than other parts of the brain, especially the cortex and neocortex (Goleman, 1995, p. 22).

Evidence of the influence of emotion on human functioning and its ability to override the rational mind must prompt educators to consider what neuroscience and neuropsychology can tell us that will better inform teaching and learning.

3.3 Neuroscience in Education: Not Brain-based Education

A new perspective on emotion by both neuroscience and neuropsychology, a collective perspective often referred to as affective neuroscience, prompts this educator to question how this new concept of emotion should be woven into the tapestry of education.

While neuroscience, the study of brain mechanisms and their functions, and neuropsychology, the study of brain functions and resultant behaviours, offer many insights into human behaviours, such as learning and thinking, researchers are reluctant to have their findings directly translated into classroom practice, which is precisely what brain-based education proponents have done. Brain-based educators, in their welcome enthusiasm to improve pedagogy, err in two

ways: firstly, they err in taking research on brain mechanism and their hypothesized functions and applying them directly to pedagogy; and secondly, they focus almost entirely on cognitive functions and largely ignore emotive functions.

Brain-based education, also referred to as brain-research education and brain-compatible education, is a burgeoning topic of interest to educators, parents, and policy makers. Despite its growing popularity, brain-based education has been discounted as sponsoring and promoting “neuromyths” (Hall, 2005; Goswami, 2006; Organization for Economic Co-operation and Development [OECD], 2002) and “folk theory” (Bruer, 2002) in a “band-wagon approach” (Beltz, 2004, p. 15) in that its claims are often vague, speculative, over-generalized, over-simplified, over-interpreted, outdated, metaphorical, or based on misconceptions (Beltz, 2004; Bruer, 1997, 1998, 1999, 2002; Davis, 2000; Hall, 2005; Goswami, 2006; OECD, 2002). While these espoused “brain-based” educational practices (e.g. Forester & Reinhard, 2000; Hannaford, 1995; Jensen, 1998; Smilkstein, 2003; Sousa, 2001; Sprenger, 2002; Sylwester, 1995; Weiss, 2000; Yorks & Kasl, 2002) couple enthusiasm with a desire to inform educators about brain physiology in order to improve learning, brain-based authors are deemed to engage in “uncritically transmogrifying results from a field concerned primarily with the nature of neurons and applying them to teaching” (Campbell & Patten, 2005).

Brain-based education includes inaccurate theorizing about such things as local-brain function, brain laterality, critical periods of development, the necessity

of enriched environments during early childhood, the use-it-or-lose-it concept, gender-based brain function differences, and the concept of emotion as a tool to improve learning. It is worthwhile here to briefly address the issues as to why each of these brain-based claims is faulty.

The neuromyth of local brain function advocates that certain parts of the brain have specific functions, but this simplistic view is contradicted by neuroscientists who assert that almost any cognitive function is composed of the combined activity of a number of brain regions (Hall, 2005, p. 7), including the regions associated with emotion (i.e. Damasio, 2003; Davidson, 2000).

The brain-based educators' claim (i.e. Sprenger, 2002; Sousa, 2001, p. 167; Sylwester, 1995, pp. 50, 51) to brain laterality, where the right brain is largely responsible for intuitive and creative thinking and the left brain is largely responsible for logical thought, is a concept not supported by cognitive neuroscience (Bruer, 1999; Byrnes & Fox, 1998; Hall, 2005). Rather, the concept of brain laterality is based on a gross oversimplification of results of research conducted on split-brain epileptic patients. Scholars assert that most cognitive tasks require brain functioning in multiple areas of the brain, as the brain is highly integrated and "most tasks require both hemispheres to work in parallel" (OECD, 2002, p. 72). Even such seemingly simple tasks as identifying Arabic numerals and decoding written words involve both halves of the brain (ibid.).

Brain-based enthusiasts' claim that there are critical periods of cognitive brain development to learn specific skills and capacities, often referred to as "the window of opportunity" (Forester & Reinhard, 2000; Sousa, 2001), is based on

research studies whose subjects are cats, rhesus monkeys, and children with biological disorders (Bruer, 1997; Hall, 2000). These research studies' findings relate to synaptogenesis, or the formation of new neural connections, and neuroscientists have found that synaptogenesis occurs in all age groups, (OECD, 2002; Uylings, 2006). There do not appear to be critical periods in brain development, although there are sensitive periods during which certain learning, such as second language acquisition, is optimal (OECD, 2002, p. 51; Uylings, 2006, p. 79).

There are obvious problems with extrapolating conclusions from neuroscience and applying these results to normal children in classrooms. Firstly, it is never wise to generalize results from different species (Beltz, 2004; Byrnes & Fox, 1998), since animal behaviours differ significantly from human behaviour in that animal behaviours are more instinctive; humans have higher-order skills that animals lack. Also, the locations of certain processes differ from animals to humans, and maturational processes differ among species. An example is that rhesus monkeys experience peak synaptogenesis in all parts of their brains simultaneously; humans do not. Different parts of the human brain mature at different times (Bruer, 1997; Hall, 2005). In addition, it cannot be assumed that synaptic excess indicates a critical period for learning. In humans, synaptic density correlates to the emergence of skills and capacities, not to the best function of these skills and capacities. Also, some of these skills and capacities continue to improve after synaptic density reaches its peak. Synaptic pruning, which is the elimination of excess synapses, is important for human brain

development (Byrnes & Fox, 1998). There are also neural interconnectivity differences among species. Neuroscientists say that we do not know that synaptic excess indicates critical periods for learning (Bruer, 1997); there are other factors, such as synaptic patterning, which are linked to improvement of skills and capacities. There is also clear evidence that synaptogenesis occurs throughout our lives. For example, learning a new musical instrument can cause increased synaptogenesis in specific parts of the brain (Hall, 2005). Likewise, a study of London, England taxi drivers revealed up to a twenty-five percent increase in synapses in the posterior hippocampus, an area of the brain utilized in spatial representations, depending on the amount of time spent driving taxi, irrespective of age (Maguire, Gadian, Johnsrude, Good, Ashburner, Frackowiak, & Frith, 2000).

Many brain-based education authors (i.e. Jensen, 1998; Sousa, 2001; Smilkstein, 2003; Sprenger, 2002; Sylwester, 1995; Wolfe, 2001) exhort teachers and parents to expose young children to all manner of special, extra stimuli and experiences. Advocating that this enriched environment will enhance cognitive development is based on extrapolating the results of studies done on rats (Beltz, 2004; Byrnes & Fox, 1998; Davis, 2000; Hall, 2005) and is not supported by neuroscientific research, since there is no evidence that increased stimulation will have any positive effect on children in normal environments (Byrnes & Fox, 1998). The studies of rats cited by Jensen (1998) and Sylwester (1995) were conducted by Diamond (1967), who regarded an enriched environment as anything that was not a plain lab cage. Diamond's conclusions are very clinical

and do not speculate in any way regarding extrapolating the findings to humans, let alone to teaching (1967). Clearly, a plain lab cage is not a normal environment for a rat. Rats placed in cages with objects with which they could interact showed twenty-five percent more synapses per neuron related to sensory perception and they learned mazes more quickly than their lab cage control cohorts (Ibid.). However, a later study also found that older rats in these so-called enriched environments also ran the maze faster (Davis, 2000; Hall, 2005). In addition, there is not a linear relation between stimulation and cognitive development, although extreme deprivation is shown to have negative effects on brain development and cognitive performance (Bruer, 1997; Byrnes & Fox, 1998). Bruer (1997) states that stimuli that are essential for children's development of sensory and motor function and language acquisition are available in any normal environment.

The use-it-or-lose-it claim of brain-based enthusiasts (i.e. Jensen, 1998; Ratey, 2001; Smilkstein, 2003; Sprenger, 2002) postulates that if one does not provide enriched stimuli for one's mental functions, these functions will deteriorate. Critics claim this to be an exaggeration of the truth (Bruer, 1997; Hall, 2005). Brain plasticity, the ability of brain structure and organization to change based on demands and experience, is retained throughout our lives (Maguire et al, 2000).

Some brain-based education supporters claim that students need different learning environments and strategies to address gender-based differences in the brain. Bruer (1999) asserts that the scientific community agrees that what gender

differences have been found are minor and “have no practical or instructional consequences” (p. 650).

Other common concepts presented in brain-based literature are that emotion is a tool to improve learning, and emotion is a type of intelligence (Jensen, 1998; Smilkstein, 2003; Sprenger, 2002; Sylwester, 1995). Sylwester (1995) claims emotion “is very important to the educative process because it drives attention” (p. 22). Emotions also are presented as a useful tool to “engage meaning and predict future learning because they involve our goals, beliefs, biases, and expectancies (Jensen, 1998, p. 93; see also Glenna, 2002; Smilkstein, 2003). Many brain-based writers regard emotion as in need of regulation and advocate teaching control by metacognitive activities (Smilkstein, 2003; Sprenger, 2002; Sylwester, 1995). Some advocate that classrooms must be safe, supportive, caring, and stress-free places in order for emotions to be managed so that optimal learning can occur (Jensen, 1995; Smilkstein, 2003). None of these claims should be dismissed, but validated by neuroscience, neuropsychology, and educational neuroscience (Campbell, 2005a, 2005b, 2006) and supported by appropriate theoretical bases designed with a teacher/learner perspective. While Gardner (1993) does not list emotions as an intelligence, brain-based advocates often refer to “emotional intelligence” (i.e. Forester & Reinhard, 2000; Jensen, 1998; Sprenger, 2002) or discuss emotions as falling under Gardner’s intrapersonal intelligence and interpersonal intelligence (i.e. Sylwester, 1995). There is no quarrel with claims that emotions can and do affect cognitive performance and general health (Goleman, 1995). In

addition, emotional engagement is important because it is linked with attention. Damasio (2003) hypothesizes that the emotion components of the brain are capable of “marking” sensory input with neurotransmitters that improve memory storage and retrieval, but neuroscience has yet to produce research to verify how this marking takes place (see also Carter, Smith & Pasqualini, 2004).

However, issue is taken with the idea that emotion is a tool to enhance cognition or a subset of intelligence. Neuroscientific evidence asserts that emotion is a primal function of the brain that is just as significant as cognition (Davidson, 1999, 2000; Damasio, 2003; Gray 1999; Ledoux, 1996a; Ohman, 1999; Panksepp 1994; Porges, 1995; Zajonc, 1980). Neuroscience presents evidence that every cognitive event has an emotive valence (Damasio, 2003; Davidson, Jackson, & Kalin, 2000); that the emotional parts of the brain can override the thinking parts of the brain (Damasio, 2003; Goleman, 1995; Ledoux, 1996a); that cognition does not occur without emotion, but emotion can occur without cognition (Damasio, 2003; Goleman, 1995; Ledoux, 1996a); that emotion serves as motivations for both cognition and behaviour (Izard, 1984); and that emotions affect evaluation of stimuli, processing of events, memory encoding, and memory retrieval (Briner & Reynolds, 1996; Meinhardt & Pekrun, 2003; Parkinson, Totterdall, Briner, & Reynolds, 1996).

Each of the above mentioned neuromyths might be variously dismissed as speculative, over-generalized, oversimplified, and misleading (Atherton, 2002; Beltz, 2004; Bruer, 1997, 1999, 2002; Davis, 2000; Hall, 2005). We must not be too quick to dismiss the brain-based educators, who often advocate sound

principles of instruction, such as using a variety of learning activities. However, this valid information is largely based on cognitive and developmental psychology results (Bruer, 1999) and practitioner experience (Wolfe, 2001) and not on neurobiological research (Bruer, 1999; Wolfe, 2001). While brain-based literature generally contains accepted information on how neurons work, Wolfe (2001) acknowledges that “neuroscience seldom gives us knowledge that can be applied to classroom practice” (p. 128). Such claims as Jensen’s that since the brain is the organ in the body with the highest water content, “teachers should encourage students to drink water throughout the day” to improve learning (Jensen, 1998, p. 26; see also Smilkstein, 2003, p. 70) illustrate the highly speculative nature of some assertions.

Bruer (1997) calls the leap from neuroscience to educational practice “a bridge too far” (p. 5) and argues that educators err in looking to neuroscience as a guide to improve pedagogy and policy. Davis (2000) cautions against “jumping on the brain-based bandwagon, or using inadequate information to rationalize our decisions” (p. 101) about classroom practice. While there is general consensus about a cautious examination of brain-based proposals, there is also agreement that neuroscientific findings coupled with psychological data offer a promising area of valuable insight into learning and teaching (Beltz, 2004; Bruer, 1997, 1999; Davis, 2000; Hall, 2005a; 2005b). Bruer (1999) suggests that educators look to cognitive scientists who study the mind and mental function related to behaviour and also to cognitive neuroscientists who study mind/brain function interfacing to determine the neural correlates that underlie cognitive

function. Others urge cross-collaborative research (Beltz, 2004; Byrnes & Fox, 1998). I agree with Hall (2005) who states “any ‘grand theory’ of learning will emerge from a combination of neuroscience, psychology, and education, and not from neuroscience alone” (p. 21).

While there is “no grand scheme of ‘brain-based education’” that can miraculously transform learning and teaching (Hall, 2005, p. 4), we must not alienate the brain-based enthusiasts who are keenly interested in the advances of neuroscience, but rather engage them in building the bridge. Brain-based education must be superseded by neuropedagogy. Jensen’s (2000) claim that “basic neuroscience research...may soon have potential applications in schools” (p. 77) is premature. What I propose to advance the legitimization of neuropedagogy is the newly minted field of educational neuroscience. Educational neuroscience can be a vehicle to provide the “checks and balances” Ledoux claims must be in place to deter educators from “applying isolated facts from neuroscience to an issue in education” (1996b, p. 17). Educational neuroscience is informed by both neuroscience and neuropsychology. It is about the mind-brain/body of teachers and learners: their emotions, thoughts, brain/body functions, and resultant behaviour. Educational neuroscience will not only provide a much needed forum for the “meshing of theory with practice” (Beltz, 2004, p. 15) as well as a safeguard “against applying scientific findings hastily or haphazardly” (Kagan, 1996), but will provide a bridge between brain/body and behavioural research and pedagogy, based on theoretical models connecting emotion and cognition in the teacher’s/learner’s lived experience with

neuro-research findings. Neuropedagogy must be founded on a neuroscientific theory that validates emotion and a model that reflects the many facets and functions of emotion that require definition and elucidation in order to understand the function of emotion in learning and teaching.

CHAPTER 4: THE NEED FOR A NEW EMOTION THEORY IN EDUCATION

4.1 Recognition of the Significance of Emotion

Theories of emotion help us to understand the phenomenology and neurobiology of an emotion, but research provides insight into possible behavioural consequences of an emotion. Beyond regarding emotions as a multi-system brain/body neurobiological process, I see emotions as separate and distinct, interfacing with cognition, but not as a subset of cognition. Emotions are not the other side of the brain coin: they are essence of who we are as humans. As well, emotions have risen to pre-eminence in the disciplines of philosophy, neuroscience, and psychology, and have prompted new disciplines, such as neuropsychology and affective neuroscience. We have historically denied them, decried them, and defied them; and yet they persist. While neuroscientists, psychologists, and philosophers have embraced the topic of emotion wholeheartedly, educators have been somewhat loath to theorize its place in education. Some educators have jumped on the proverbial bandwagon without a theory and become practitioners of brain-based research who rush into the amorphous arena of non-theoretical praxis without first explicating the complex ontology of emotion. Ria, Seve, Saury, Theureau, and Durand (2003), who cite Damasio's work, postulate that the lack of research on emotion in situ "is in part

because of the difficulty of adopting a coherent theory and method to document emotions” (p. 219).

Murphy, Nimmo-Smith, and Laurence (2003), in analyzing the various models of emotion based largely on neuroimaging, clearly endorse the multi-systems model that delineates the process and function of emotion. Damasio’s multi-systems model, which incorporates the findings of Ledoux and other neuroscientists, fits Murphy, Nimmo-Smith, and Laurence’s model in that there are “affect programs” in the brain for basic emotions which refer to “a neural mechanism that stores patterns for and triggers complex emotional responses that are often quick, complex, organised, and difficult to control” (Murphy, Nimmo-Smith, Laurence, 2003, p. 209). These patterns correspond to Damasio’s somatic marker theory. Emotion then, as I see it, is a multi-system process. In the understanding of this process, like Damasio, Ledoux, and Goleman, I see the possibility of improving our lot as humans. Goleman also comments that his faith in neuroscientific studies of emotion to improve human affairs is in part based on “growing evidence that fundamental ethical stances in life stem from underlying emotional capacities” (1995, p. xii) and Damasio suggests that the spiritual state is “some state of perfection” of body states, and is therefore a type of feeling which we have not yet explored (2003, pp. 284, 285).

4.2 Emotion as Distinct from Cognition

In order to develop a neuro-educational theory of emotion, emotion must be recognized as distinct from cognition. Emotions are not a subset of cognition; they are not just thoughts about a situation or stimuli. Ledoux is adamant; he

refuses to regard emotion as a type of cognition, saying he wishes to save emotion "from being consumed by the cognition monster" (1996, pp. 68, 69).

Emotion and cognition are distinct but interacting mental functions interfaced by separate but interacting brain and body systems. We know this because brain damage to certain areas of the brain causes emotional malfunction, but does not seem to affect knowledge and mental capacities (Damasio, 2003, 34-41).

Emotion and cognition differ in that emotions do not normally function independently from the body; thoughts do. Emotion has the ability to make the body attentive to one stimuli and exclude others; thoughts are only capable of this if they have high emotional content which trigger emotion systems (Damasio, 2003, pp. 60, 61; Ledoux, 1996a, p. 300). Additional evidence that emotion is distinct is demonstrated when emotional signals can be appraised before the cortex has time to identify and assess the same stimuli, as in emotional hijackings. Because emotion systems, such as the amygdalae, have direct access to response systems, the responses of emotional appraisal systems are automatic; the responses of cognitive appraisals are delayed and can be willed to lag. In this way, emotions restrict or preclude certain responses, but cognition provides choices. Ledoux (1996) argues that emotional feelings and thoughts are generated by different symbolic systems in the brain; indeed, emotional feelings "involve many more brain systems than thought" (p. 299). In addition, emotion, unlike cognition, is not easily verbalized; it is not readily accessible from consciousness (ibid., p. 71).

Neuroscience reveals that emotions are key to our functioning as humans, in fact, Goleman refers to emotion as “a master aptitude” (1995, p. 80). Damasio and Goleman acknowledge that the basic emotional systems of the brain evolved before the rational systems: from the brainstem, to the limbic system, to the neocortex (Damasio, 2003, pp. 40, 80; Goleman, 1995, pp. 10,11). Ledoux (1996) and others (e.g. MacLean, 1990; Panksepp, 1998) assent that the basic components of the emotive system, including the amygdalae, also exist in primates and develop early in the embryonic brain (p. 303). If emotion systems are the first to develop, this implies their primacy in the importance of functioning. Damasio argues that “[k]nowing about emotion, feelings and their workings does matter to how we live” (2003, p. 287) and he is convinced that neurobiological knowledge about emotion has “a role to play in human destiny” as a “pillar to help humans endure and prevail” (1994, p. 253).

We cannot ignore emotions, not on a personal level nor on a scholarly level. Emotions have gained a place of importance in brain research, prompting new research groups, such as the American Educational Research Association's (AERA) Brain, Neuroscience, and Education Special Interest Group; the International Mind, Brain, and Education Society (IMBES); and the Educational Neuroscience Group for Research into Affect and Mentation in Mathematics Education (ENGRAMME). As well, several journals, such as *Emotion and Cognition*, *Cognitive, Affective, and Behavioral Neuroscience*, and *Mind, Brain and Education*; and a growing number of texts have arisen in recent years.

4.3 Need for a new discourse: Educational neuroscience

The evidence is clear; emotion is important. I propose that educators abandon their diasporadic ramblings and begin a new journey by examining and continuing the work of neuroscience and neuropsychology, using the newly minted field of educational neuroscience as a new focus for discourse. As educators, we have done a dismal job at improving the human lot through our attempts at validating, improving, and championing the intellect. Consider that many of the previous generation may have hailed Hitler in an effort to bolster their country's economy and national pride, but our generation has elected Arnold Schwarzenegger to swagger in front of cameras and swear that he thought those women liked it, being treated as sexual chattels. The need to reconceptualize the field of education is obvious. Neuroscience and neuropsychology have provided a basis for a much needed paradigm shift. I propose a new cynosure called neuropedagogy, defined as an applied neuroscience, primarily concerned with educational practice both informed by research in educational neuroscience and informing research in neuroscience and neuropsychology, to theorize the role of emotions in learning and teaching.

However, as educators begin their research in educational neuroscience to join other fields in discovering, exploring, and consolidating the neuroscientific role, function, and behavioural constructs of emotion, it is helpful to construct a conceptual framework and a functional model of the same. Before presenting my model of emotion, first I present the two key theories that serve as foundational constructs in my somatically based appraisal model. While Damasio's Somatic

Marker Hypothesis (SMH) and Lazarus' Cognitive-Motivational-Relational Theory (CMRT) appear to be contradictory in that they espouse different foundational views, (Damasio's is neuroscientific, Lazarus' is teleological), and opposing bases, (Damasio's is emotive; Lazarus' is cognitive); aspects of both models are utilized to explain the complex phenomenon of emotion in my model, since affective neuroscience indicates that there are different types of emotion, some that arise from emotive brain functions that are largely instinctive; and others that originate in the emotive parts of the brain, but which utilize complex cognitive brain functions.

4.4 Damasio's Somatic Marker Hypothesis

While I have previously commented on facets of Damasio's perception of emotion, let me here elucidate his theory and explain why I have chosen his hypothesis as the basis of my new model of emotion for education. Damasio recognizes the distinction between instinctive and complex emotions and theorizes how these different levels of emotions arise and interact.

Fundamental to Damasio's theory is the idea that emotion is a manifestation of a relationship between an organism and its environment, specifically the effect of stimuli from the environment on a human's survival or well-being. Emotions then, correspond to the value that stimuli and situations have for the person in relation to optimal functioning and well-being, or, in biological terms, homeostasis. This view is shared by other theorists' perception of emotion (e.g., Frijda, 1986; Lazarus, 1996). Expanding on psychologist William James' idea (Lange & James, 1890/1894) that emotions are elicited by changes

in a person's situation or environment, Damasio suggests that emotions are composed of collective changes in body and brain states provoked by these environmental stimuli. These changes in body and brain states evoke somatic changes (such as facial expression, visceral changes, endocrine changes, and body movement), and changes in the neural modes or the way the brain processes information (such as processing via the low road or limbic route instead of via the high road or cortical route). These somatic and neural states form distinct multidimensional patterns, that Damasio calls maps, of corresponding body and brain conditions. It is when the brain recognizes these patterns or maps relating to a specific emotion that a person becomes aware of these emotions, making them feelings, or conscious emotions. The subjective process of feeling an emotion correlates to activity patterns in brain regions that map the dynamic internal states of the body and brain. These patterns are different for each emotion (Arnold, 1960; Damasio, et al, 2000), which helps to explain why each emotion "feels" different. For example, Damasio and others have found that brainstem activation, specifically of the columns of the periaqueductal gray, changes with each emotion condition and changes even within some varieties of the same emotion. In a study featuring anger, sadness, happiness, and fear, all emotions were found to engage brain structures related to the representation and/or regulation of body state (for a more detailed analysis of this phenomenon, see Damasio, et al, 2000). It is Damasio's distinction between emotions and feelings that is a primary factor in choosing his theory as a basis for my model.

Damasio's hypothesis is distinct in that it not only distinguishes between emotions and feelings, but also between emotions evoked by stimuli in the environment and emotions evoked by thought in the mind. The latter are generated by thoughts and created by signals sent from the brain to the body provoking re-creation of the somatic patterns associated with a memory. Emotions that arise from thoughts that are capable of reconstructing similar feelings that Arnold refers to as "as if" emotions (1960, p. 181), Damasio says utilize the "as-if body loop" (1994, p. 155, 1999, pp. 280, 281, 283), and likely arise from the prefrontal cortices involving mirror neurons (Damasio, 2003, p. 118).

These prompted bodily representations are generally not as strong as those evoked by actual real-time events; their strength depends on how strongly the memory was marked by or assigned a valence of emotion when it occurred. Damasio believes that each event in our lives is evaluated for its significance when it occurs and marked for emotional valence; this valence represents the body/brain state responses to that particular stimulus. Davidson (2003) claims the amygdalae send emotion-related signals to determine valences. To give an example of a recalled event evoking a pre-assigned valence, if a person recalls, either voluntarily or not, a traumatic event, his/her body registers the same emotion evoked by that original event; although the heart may not speed up as much, the skin may not perspire as much, and the gut may not feel quite as twisted.

Damasio's SMH also posits that somatic markers, or patterns marking an event previously recorded and stored in the brain, are recalled if a current event is similar to a previous event. When this occurs, "the prefrontal circuits that hold records pertinent to that category of event become active " (Damasio, 2003, p. 147). The first effect of a somatic marker would be to provide the person with a conscious "gut feeling" (ibid.). He argues that these 'gut feelings' are a simple emotional signal to guide our decisions by marking them as positive or negative. Frijda (1984) agrees that emotions are the primary source of decisions. This emotional signal, Damasio, warns, is not a substitute for proper reasoning, but rather it plays an auxiliary role in guiding decisions, thereby improving their speed and efficiency. It is possible, he states, that this signal can operate without conscious appraisal or recognition, perhaps accounting for what we refer to as intuition. This emotional signal produces "alterations in working memory, attention, and reasoning so that the decision-making process is biased toward selecting the action most likely to lead to the best possible outcome" (ibid., p. 148; Damasio, Tranel, & Damasio, 1991; see also Davidson, 2003).

Damasio has conceptualized how the phenomenon of emotion is evoked by stimuli and is actualized in body states that, when recognized by the mind, become conscious feelings. His neuroscientific hypothesis recognizes the different levels of emotions and their interactions and interrelations. His research provides a basis for understanding how emotions can unconsciously guide our decisions and evoke our actions. While Damasio has not linked his findings to praxis, he has constructed a palette of colours with which educational theorists

can paint a scene to illustrate how we can approach learning from a new discourse.

4.5 Appraisal Theory of Affect

It is in examining the more complex, more sophisticated emotions that appraisal theory can be applied. While Damasio applies neuroscientific findings to the processes of different types of emotion to create his SMH, he does not elucidate the theoretical details of cognitive assessment utilized in the more complex emotions, such as jealousy. Appraisal Theory does construct a model of processes involved in the detailed analysis of stimuli involved in evoking higher order emotions.

Although appraisal theory was initiated by psychologist Magda Arnold (1960), Richard Lazarus (1991) has expanded the concept to create his Cognitive-Motivational-Relational Theory (CMRT) that presents emotion as a cognitive appraisal of the environment. Kappas (2006), in fact, argues that Lazarus did not dismiss “implicit and unaware” (p. 952) judgments of stimuli, but that he regarded cognitive appraisals as being more important.

CMRT presents the identities of specific emotions as determined by patterns of appraisal that give rise to them. Lazarus' CMRT contains three concepts. First, are antecedent variables that include environmental conditions of an encounter and a person's characteristics that interact to produce appraisals of that environment/person relationship. Second, there is a mediating process,

involving appraisal, action tendencies, and coping processes. Third, are the outcomes, or resultant emotional states that reflect the appraisal.

Appraisals, the central construct of the model, are analyses of the significance of the event in relation to the person's well-being. Lazarus cites two types of appraisal: primary appraisal that determines personal relevance of the event, and secondary appraisal that determines coping options and their corresponding prospects in relation to values and goals. In addition to appraisal, the mediating process also includes action tendencies or impulses and coping processes. Action tendencies, or action readiness as Frijda (1989) calls them, are the link between the emotion and the physiological response. If an event involves significant harm or benefit, Lazarus (1991) claims that this event would generate an emotion that involves an innate action tendency that provides a "basis for the unique physiological activity characteristic of each individual emotion" (p. 40). Coping processes are capable of altering the relationship between the person and the environment, with the potential of changing the emotional state.

Patterns of appraisal arising from evaluating the person-environmental relationship consolidate in the concept of core relational themes relating to harm or loss, challenge, threat, and benefit. Each emotion, says Lazarus (1991), has a core relational theme "defined by unique and specifiable relational meaning" (p. 39). Relational themes are produced by recurrences of similar appraisals founded on relatively stable personal values, goals, and beliefs that shape our responses to our environment. The emotion process, he agrees, is distinctive for

each individual emotion, of which he identifies fifteen (*Stress & Emotion*, 1999). Lazarus (1991) has developed what he calls a working classification system for emotions where he analyzes each emotion concept as relating to four main concept categories: 1) goal relevance and consequence for the positive emotions; 2) goal relevance and incongruence for the negative emotions; 3) borderline emotions; and 4) nonemotions [sic], such as frustration and curiosity (pp. 82-83), which he says have emotional content but do not constitute emotions. Each core relational theme is composed of a particular primary and secondary appraisal pattern and each emotional family is characterized by a particular action tendency. He acknowledges that these classifications are “problematic” (ibid., p. 81) with some types of emotions.

In addition, the mediating process involves coping. Coping, according to Lazarus (1991), includes cognitive and behavioural efforts to regulate and ameliorate internal and external demands that are appraised as “exceeding the resources of the person” (p. 112). Coping may be evoked by emotion and aim to change either the conditions prompting the emotion or to change the emotion itself. Because coping influences subsequent appraisals, Lazarus argues that coping can affect the emotion process by 1) altering the relationship between the individual and the object, person, or environment being appraised, or 2) altering the manner in which the individual interprets or reacts to the object, person, or environment being appraised. Coping is provoked by intense emotions and is by nature cognitive, asserts Lazarus, as it involves not only evaluation of the stimulus and its subsequent emotional state, but also management of that state.

Outcomes, posits Lazarus, are based on whether or not goals and expectations have been met, and in what manner they have been met. Two types of outcomes in Lazarus' model are 1) short term, and 2) long term. Short term outcomes refer to the immediate response elements of emotion: the actions and action tendencies, physiological changes, and subjective states. Long term outcomes refer to the collective effects of recurrent or chronic emotions on social, emotional, and physical health.

In brief, Lazarus (1991) regards emotions as cognitive-motivational-relational configurations with differing action tendencies and coping processes. He believes that emotion, motivation, and cognition are interdependent and operate together in a continuous flow (Lazarus, 1999a). While he acknowledges the somatic responses accompanying emotion states, he does not regard body states as provocative nor antecedent to feelings. However, his work in explicating a more detailed cognitive appraisal of stimulus is invaluable to creating a model that explicates the higher order emotions that involve cognition.

CHAPTER 5: A NEUROPEDAGOGICAL MODEL OF EMOTION

5.1 Need for a New Model of Emotion for Education

The findings of affective neuroscience reveal that understanding the neurobiology and neuropsychology of emotion and how it applies to human behaviour is not only essential to human flourishing; it is essential to overhauling pedagogy (Patten, 2004). However, while much work has been done in identifying the biological and neurological brain/body processes of emotion and the role of emotion in human behaviour, a conceptual or theoretical model of emotion that is *both* rigorously grounded in this work *and* suitable for educational researchers and practitioners is lacking. What is also lacking is a model that clearly delineates the different levels of emotions and their interrelations. I propose a model of emotion suitable for neuropedagogy, that is, for a neuroscientifically informed and grounded pedagogy.

5.2 The Somatic Appraisal Model of Affect

Based primarily on the work of Damasio (2003), Ledoux (1996), and others (e.g., Arnold, 1960; Dalgleish, 2004; Davidson, 1999, 2000; Forgas, 1999; Gray, 1991; Izard, 1984; Panksepp, 1994), along with elements of appraisal theory (Beedie, Terry, & Lane, 2005; Kagan, 1984; Lazarus, 1999a; Sabin & Silver, 2005; Scherer, 2000), I propose the Somatic Appraisal Model of Affect (SAMA) as a new educational model for emotion.

SAMA embraces an embodied philosophy of mind wherein observable behaviours and brain/body functions are objective manifestations of lived experience (Campbell, 2005a, 2005b; Ferrari, 2003). SAMA has several integral elements, namely clarification of the terminology of emotion necessary to articulating the body/brain process and function of emotion, and delineation of the components and facets of emotion inherent in this phylogenetic phenomena.

5.2.1 *Definitions of Affect*

In order to avoid disparate discourse and the resultant confusion related to what are commonly termed emotions (e.g. Cole, Martin, & Dennis, 2004; Damasio, 2001; Leventhal, 1982), SAMA seeks to provide clarity regarding distinctions among the various types of what I shall hereafter refer to collectively as affect. SAMA presents three categories of affect in phylogenetic order: dispositions; basic emotions; and feelings, of which there are two types, namely conscious feelings and secondary feelings.

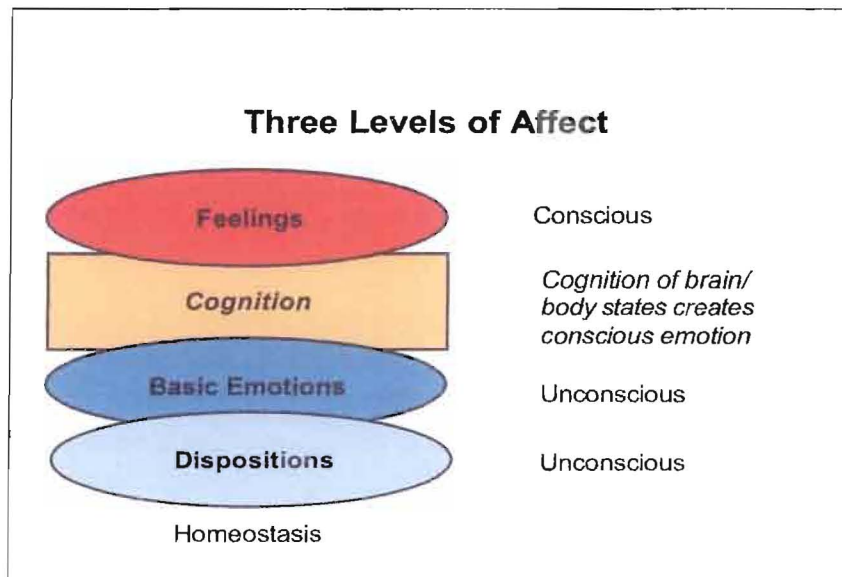


Figure 2: Three Levels of Affect

Dispositions, variously referred to as “background emotions” (Damasio, 2003, p. 45), tonal emotions, internal tone (Kagan, 1984), or more generally mood, are states of being composed in the basal ganglia and limbic regions reflecting composite mind/body expressions of regulatory status in regard to homeostasis. Dispositions, or what Panksepp (1998a) terms “mood states,” constitute “distinct reverberatory neural patterns” (p. 318). Dispositions are largely unconscious; they register a fusion of underlying somatic states, including both chemical and visceral conditions over time, contributing to their vague nature and generalized essence. Because of their representation of the body/mind’s state relative to homeostasis and basic existence, dispositions are by nature primitive and basic to survival.

The second level of affect, basic emotions, is also referred to as independent emotions (Dougherty, Abe, & Izard, 1996), and primary emotions (Damasio, 2003). Arnold (1960) refers to these “simple” emotions (p. 196) as “not attended to “ (p. 180) emotions, in other words, unconscious emotions. He also states that they are “direct, immediate, nonreflective [sic], nonintellectual [sic], automatic, instinctive, intuitive” (ibid., p. 175) and Ekman (1994) would agree. SAMAs define basic emotions as specific and relatively consistent representations of physiological, chemical, and neural responses evoked by certain brain systems when a person perceives or recalls objects or situations. Basic emotions are prototypic and characterized by autonomic and simple judgments, positive/negative, approach/withdraw, which primarily involve the limbic system, and occur in the “low road” (Ledoux, 1996a, p. 164) of stimuli processing. This unconscious appraisal is “quick and dirty” (Ledoux, 1996a, p. 163), “instinctive” and “intuitive” (Arnold, 1960, p. 175); it evaluates incoming stimuli from the external environment in relation to survival or life preservation. Basic emotions are elemental affects in that they are largely innate (Damasio, 1999, 2003; Ledoux, 1996a; Panksepp, 1990) and somewhat instinctive (Arnold, 1960). Basic emotions are generally accepted to include happiness, sadness, fear, anger, disgust (Ekman, 1993) and sometimes surprise (Damasio, 2003, Porges, 2001). The essence of these emotions is present at birth (Arnold, 1960), is cross-cultural (Ekman, 1993), and also exists in primates (Damasio, 2003; Ledoux, 1996a). Basic emotions are “not dependent on cognitive development

for emergence nor on cognitive appraisal for their activation” (Dougherty, Abe, & Izard, 1998, p. 29).

SAMA's third level of affect shall be termed feelings. Also referred to by others as secondary emotions (Damasio, 1994), complex emotions (Arnold, 1960), social emotions (Damasio, 2003), and emotional feelings (Rolls, 1999), feelings are mental recognitions of the pattern of physiological, chemical, and neural responses evoked by certain brain systems when a person perceives or recalls objects or situations. Feelings involve cortical appraisal systems and therefore have a cognitive component; they take place in the “high road” (Ledoux, 1996a, p. 164) of the brain. These cortical appraisals involve detailed analysis of incoming stimuli in relation to memory, knowledge, and a sense of self. Feelings involve two types of cognitive analysis: 1) recognition of somatic patterns or maps of body/brain conditions; and 2) the pairing of somatic maps with detailed analysis of object/event stimuli in regards to learned knowledge and experience, which include cultural norms, personal goals, and the constructed self. When the first type of cognitive appraisal occurs, when somatic maps are recognized, consciousness accompanies this recognition of somatic patterning, and these I refer to as conscious feelings. Arnold acknowledges these conscious feelings when she writes, “[basic] emotion can grow in intensity and the physical effects can become cumulative, though they may not be felt until some time after the first appraisal” (p. 180). When the second type of appraisal occurs, what Arnold (1960) refers to as “reflective judgment” (p. 175); when stimuli is evaluated in regards to the stored essence of self and prior experience, basic

emotions may be transformed into what I refer to as secondary feelings. These secondary feelings are evolved basic emotions; they are cognitive in nature, they are learned, and their causal emergence may differ from person to person. Secondary feelings include such affects as shame, guilt, jealousy, and pride. Secondary feelings require analysis of stimuli in regards to personal goals, social and cultural norms, family values, a sense of self, as well as context. For example, shame may be regarded as a type of sadness combined with a touch of disgust arising from a cognitive analysis of personal performance in regards to evaluation of social and cultural norms, values, and the context in which the event occurred. For instance, one would not feel ashamed if one were noisily and malodorously flatulent when one was alone far from any madding crowd, but one would feel ashamed if this event occurred in a crowded elevator. While within North American culture such an event would evoke shame, other cultures may regard it as an unremarkable event, and even perhaps as a somewhat musical tribute to the cook.

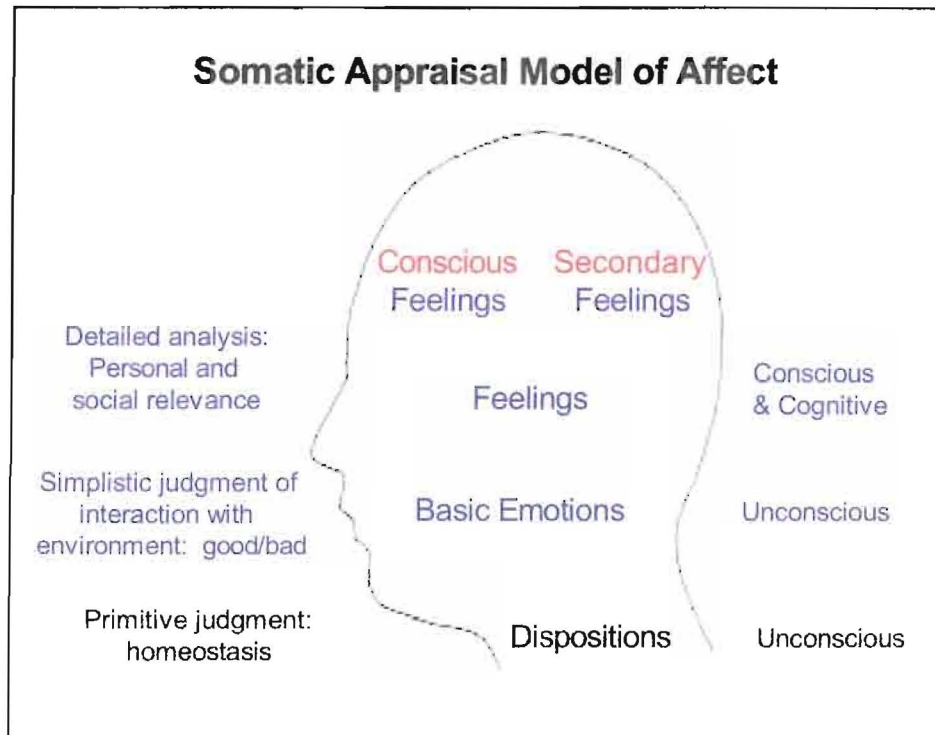


Figure 3: Somatic Appraisal Model of Affect

To clarify the various levels of affect in SAMA, let me give my version of William James' bear analogy. Picture a person walking in the forest alone. His disposition is one of contentment: his body is in a pleasant state of relative homeostasis. He turns a corner in the path and suddenly sees a large bear. The sensory input regarding the bear is sent to the brain. The amygdalae quickly and simplistically assess the information and send signals to make the body react: for example, the heart speeds up, the muscles tighten, blood rushes to certain parts of the body, and the person freezes. At this point, there is no conscious feeling of fear. Simultaneously, the sensory perceptions of the bear are sent to other parts of the brain, such as the neocortex, for analysis. This cognitive analysis accesses stored knowledge, memories, and the person's sense of self. These analyzing

regions of the brain send further information to the emotional hub, the amygdalae, which then sends a subsequent message telling the body to relax. Gradually, the heart slows, the muscles relax, the blood flow returns to normal. Why? The bear is a victim of taxidermy. The neocortex unconsciously processed the details of the sensory information pertaining to the bear that included perceptions that the bear was not moving, the bear did not smell, the bear did not make any sounds, and the bear was in an unnatural position. The person breaks into laughter and tears run down his face. His mind recognizes the somatic patterns of fear and as a result, he consciously understands that he was afraid. As the exciting neurotransmitters subside, he begins to feel relieved as his body returns to a state of homeostasis. Upon reflection, he feels somewhat embarrassed, a secondary feeling, because he has erred in fearing a stuffed bear. This person has experienced emotion and feelings, both conscious feelings and secondary feelings. He may now reflect on his emotional experience and create a story to tell his friends.

The various types of affect differ by virtue of the regions of the brain activations, levels of consciousness, and roles in influencing human function, including evoked behaviours, (Ledoux, 1996a; Ohman, 1999), yet their phylogenetic composition ensures that they are interconnected physiologically, chemically, and functionally. Common sensory input, shared neuronal pathways, and interaction of neurotransmitters or chemicals that evoke or inhibit brain/body behaviour both promote and accommodate an ever-changing brain/body system. Because of the many levels of interconnection, each level of affect is capable of

influencing those levels with which it has efferent and afferent communication, those levels for which it is a contributing determinant. In real life terms, a person's disposition can influence cognitive analysis and interpretations of objects and events, and ultimately, all types of affect have the ability to influence behaviour because they influence brain/body function. Because many aspects of affective responses are observable by the naked eye or through neurophysiological and psychological measurements, affect can be investigated objectively (Campbell, 2005a, 2005b; Damasio, 1999).

Clarification of the different types is essential to a working model of affect for education. For the purposes of this model, cognition in the function of affect is taken to imply that the neocortex is the primary or evocative appraiser of stimuli. In the cognition versus affect debate, which will be presented in detail later in this paper, there is overwhelming support that the systems that comprise affect function primarily but not limited to the limbic region, are distinct and capable of operating without cognitive regions of the brain (e.g. Braeutigm, Bailey, & Swithenby, 2001; Damasio, 2003; Davis, Hitchcock, & Rosen, 1991; Geary, 1996; Gray, 1999; Izard, 1982, 1984; Lang, Davis, & Ohman, 2000; Ledoux, 1996a; Panksepp, 1994; Zajonc, 1980; Zajonc, Pietromonaco, & Burgh, 1982), especially for primal levels of affect, such as fear. In other words, early appraisal of incoming stimuli need not involve higher order cortical processing or conscious appraisal in order to evoke basic emotions and produce bodily responses such as changes in heart rate, sweating, muscular tension, eye blinking, chemical responses, and neuronal activation of other brain regions. The ability of the

amygdalae to assess incoming stimuli for affective content and then activate other regions of the brain more rapidly and dramatically than the thinking part of the brain, the neocortex, lends credence to evidence that the amygdalae is capable of overriding the cognitive brain (Damasio, 2003; Goleman, 1995; Ledoux, 1996a).

5.2.2 *Phylogenetic Development of Affect*

Implicit in SAMA is the phylogenetic development of affect, where primary affects, such as dispositions and basic emotions, originate in the primal limbic system and the secondary affects, or conscious feelings and secondary feelings, involve the later evolved neocortex as well as the limbic system. Perhaps the most detailed phylogenetic story of the human brain is given by Paul MacLean, who coined the term “limbic system.” MacLean’s theory of the triune brain (1990), where the human brain reflects its evolutionary composition in the reptilian brain or archipallium brain, the limbic system or paleomammalian brain, and the neocortex or neopallium brain. In his theory, the reptilian brain or primitive brain includes the brain stem: the medulla, pons, mesencephalon, globus pallidus, olfactory bulbs, and the cerebellum. The reptilian brain controls muscles, balance and autonomic functions, such as breathing and heart rate. The limbic system or intermediate brain corresponds to the brain of most mammals. It consists of the hypothalamus, hippocampus, and amygdalae and is involved in affect, and instinctive behaviour associated with survival, such as fight or flight, approach/withdraw, and sexual behaviour. The neocortex or cerebrum comprises almost two-thirds of the total brain mass, including the left and right hemispheres.

It is larger and involves much more complex functions, such as language, spatial and abstract reasoning, and predictive cognition in humans. MacLean's paradigm that each of the three layers of evolutionary brain has its own operating system with distinct capacities that interact through extensive neuronal connections is reinforced by neuroscience. In fact, it is this bottom-up construction that Damasio (2003) and others (e.g. Goleman, 1995) say is responsible for the ability of affect to override cognition.

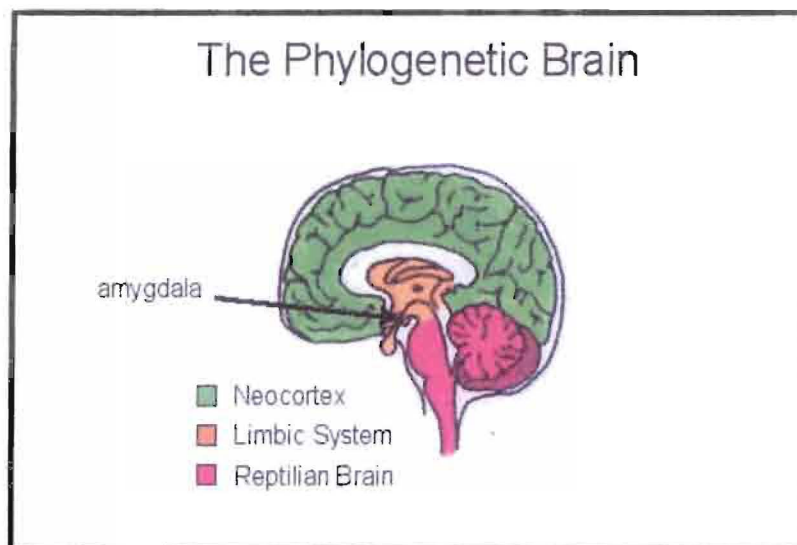


Figure 4: The Phylogenetic Brain

It is wide-spread acceptance of this triune model of the brain that allows neuroscientists to extrapolate from research findings done on basic emotions on mammals in order to propose hypotheses about how human affect works. Evidence shows that different species exhibit similar expressions using the same or similar muscle groups. For example, muscles involved in exposing the teeth to express anger are similar in dog, chimp, and human, illustrating that certain basic

expressive functions critical to survival have been preserved through the process of evolution. This preservation of basic expressive affective behaviour is explained through brain organization namely that the basic building blocks of affect originate in the early lower brain, which includes the limbic system and in particular the amygdalae. The amygdalae are essential in activating survival mechanisms, and when the brain evolved to include the neocortex, this higher brain system, although it contains different and more sophisticated analysis functions, is still dependent on and works in conjunction with the lower brain system. Ledoux (1996a) posits that feelings can only occur in brains that have the capacity for consciousness and a concept of self as being distinct from the rest of the environment. I would argue that secondary feelings may be possible only for species that recognize and process social rules and context as well.

5.2.3 Ontogenetic Development of Affect

The ontogenetic development of human affect coincides with cognitive development, motoric development, and development of sense of self (Damasio, 1999; Griffin & Mascolo, 1998; Tucker, Derryberry, & Luu, 2000). What is commonly referred to as emotional development, I will hereafter term affective development in keeping with the terminology of SAMA. While I will not venture into the different theories of affect development, I will summarize its key features as they pertain to educational phenomena, such as emotion regulation or affect regulation. Affective development is not linear, nor is it a continuum (Saarni, 2007). For example, the amygdalae mature at approximately eight months, the sensory areas of the brain mature during early childhood, the limbic system

matures by puberty, and the frontal lobes, considered the “seat of emotional control, understanding, and artful response” continue to develop until late adolescence (Goleman, 1995, p. 226). As a result, emotional habits established and repeated until age eighteen can form and reinforce synaptic neural pathways that have longitudinal perseverance (ibid., pp. 80-82). As well, children’s neuronal connections grow rapidly, and then are pruned at puberty. However, neuronal projections can grow at any age, depending on usage and the result of novel experiences that are repeated.

Affect development involves both experiential and neuropsychological developmental processes (Campos, Kermoian, & Witherington, 1996). Different features of affect develop at different ages and stages; for example, affect characteristics of infants do not necessarily persist into adulthood (Kopp & Neufeld, 2003). Affect development is a complex, dynamic process both contributing to and linked to perceptual, motor, cognitive, and social functioning (Fischer, Shaver, & Carnochan, 1990). Perceptual development involves the ability to focus sight, interpret touch, identify taste, and discern smells and various aspects of hearing, such as when a smell or sound is close and when it is far away. All of these senses directly impact generation of emotion and development of emotion. Motor skill development includes being able to manipulate objects, to crawl, and to walk. For example, walking corresponds to affective reorganization of mother/infant relationships (Biringen, Emde, Campos, & Applebaum, 1995), as the child becomes more mobile and independent, and this motorization precipitates changes in the quality, intensity, and variety of

affect experiences (Campos, Kermoian, & Witherington, 1996). Cognitive development relies on neurobiological growth and pruning and neuropsychological processes. Cognitive development involves creating memories, validating experience, acquiring knowledge of the environment and personalities, developing language abilities, and forming a sense of self. Social functioning involves developing interactions with main caregivers and siblings; establishing security and monitoring changes in security attachment; comprehending parental socialization techniques and parental emotional expressiveness; interacting with others, including strangers; and family communications of feelings (Dunn, 2003).

Prior to birth, babies' autonomic systems receive the same neurotransmitters as their mothers, and thereby receive neonatal conditioning, where they associate, for example, an angry voice with an agitated body state, a departure from homeostasis. At birth, infants are limited by perceptual abilities, such as the ability to focus at a distance, and are responsive to direct stimuli from their bodies and the environment. The goal of their autonomic nervous system is survival and the system's arousal is evaluated in the lower brain, based on the simplistic pain/pleasure and deprivation/satiation standards. There is agreement that babies experience the basic emotions at birth: happiness, sadness, disgust, fear, anger, and surprise. They exhibit both facial and bodily expressions of affect.

In infancy and on into childhood, a child acquires more complex cortical appraisal functions with which to assess stimuli from his/her body, environment,

memories, and an evolving sense of self. The child creates a perception of cultural and social contexts, begins to develop and recognize conscious and secondary feelings, such as shame, pride, and guilt. He/she develops simplistic goals and in later childhood, refines these goals and begins to understand motivations. Development of language abilities is critical to naming affect, manipulating ideas, and predicting the future, in the function of affect regulation (Denham, 1998).

In adolescence, cortical appraisals become increasingly complex, and stimuli from the body, environment, memory, and an enhanced conscious sense of self are involved in homeostasis. In adolescence, the sense of self shifts: from a dependent child to an independent adult, and a sense of social survival and concomitant development of social rules becomes acute. The frontal lobes mature and the cortex, especially the frontal lobes, undergo a course of development that continues through adolescence (Greenburg & Snell, 1997). At this stage, conscious and secondary feelings are often reported verbally and their physical states recognized in both self and others. As the prefrontal cortex matures, adolescents' goals become more complex, and so do their affect regulation strategies (Goldsmith & Davidson, 2004); for example, manipulation of others.

Considering the impact that affect has on our development and our daily lives, it would appear salient that educators become aware of affects' role, function, and importance. Levels of affective development may dictate the type of interventions educators make in helping students understand and regulate

behaviour as well as interact with others. Affect development has implications for improving affect regulation skills, a topic that will be dealt with in more detail in a later chapter.

SAMA has its roots in Damasio's somatic marker hypothesis that asserts the phylogenetic primacy of affect and presents emotion as deriving from bodily or somatic states, such as heart rate, homeostatic condition, and neuronal arousal. Provoked by incoming stimuli, bodily states are then appraised, and behaviours are evoked or inhibited based on this evaluation (Damasio, A., Grabowski, Bechara, Damasio, H., Ponto, Parvizi, et al., 2000; Hinson, Jameson, & Whitney, 2002). These bodily states which are prompted by signals, both neuronal and chemical, from the amygdalae and other limbic regions, allow the affective brain to ascribe valences to information that, in turn, influence attention, memory, and well-being in ways that cognition does not (Maier, 1991; Meinhardt & Pekrun, 2003; Moore, Underwood, & Rosenham, 1984; Tugade & Fredrickson, 2004).

William James' idea that a feeling is the minds' perception of bodily changes that occur as expression of an emotion, expanded by Damasio in his somatic marker hypothesis, is implicit in SAMA. We are born with the neural mechanisms required to generate body or somatic states, such as fear, in response to certain sensory stimuli (Damasio, 1999, 2003). When fear or disgust, for example, is generated, certain bodily responses correspond to each of those emotions. These responses are largely universal: for example, babies respond to the fear caused by a sudden, loud, unusual noise by tensing muscles,

accelerating heart rate, and crying. As time passes, however, while bodily reactions or somatic states that correspond to such emotions as fear remain the same, the machinery of emotions develops more sophisticated biases through the autobiographical self's collection of memories. For example, if that child lives in a war zone where loud noises are frequent, the child will come to not react as significantly or fearfully to loud noises.

5.2.4 Somatic States and Affect Valences

SAMA asserts that body or somatic states are positive or negative. Negative body states slow down and limit the processing of stimuli, thus affecting the efficiency of reasoning, but allowing the brain to focus on reacting to stimuli critical to survival. Positive body states enhance rapid processing of stimuli, thus speeding up reasoning, but such reasoning is not necessarily efficient (Damasio, 2003). Specific neural pathways, physiological responses, and chemical configurations correspond to specific emotions. Arnold (1960) presciently wrote in support of this concept: "For each emotion, there is a distinct pattern that remains more or less constant and is recognized as characteristic for that emotion" (p. 179). Her example of fear states that "we tremble, our heart races, we feel chilly, have clammy hands, and suffer from general malaise, the more pronounced the longer it lasts" (ibid.)

SAMA is based on an integrated body and mind, linked together by dispositional, basic emotional, and feeling functions of the brain. Basic emotions, which are unconscious, create body states; but feelings, which are conscious, most often arise from neural maps, which are based on repeated body states

(Damasio, 2003). Feelings are cognitive, since they rely on activities and functions within the cortical regions of the brain as well as the limbic system and other areas.

5.3 Components and Facets of SAMA

While SAMA incorporates the neuroscience or brain/body mechanisms of affect with the neuropsychology or brain/body behaviour resulting from affect, it also proposes the components and facets of affect. Components are taken to be the constituent parts of the states and processes of affect. Facets are taken to refer to the aspects or features of affect itself, much like the facets of a gem. When investigating affect, it is essential that researchers are cognizant and understanding of its many components and facets.

5.3.1 *Components of Affect*

SAMA's components of the emotion process include: elicitors; receptors; emotional states; brain processes; expressions, and emotional experience, which includes reflection on the emotional experience itself, interpretations of perceived changes in emotional state, and finally, interventions.

Elicitors, also termed inducers, include both internal and external provokers. Internal elicitors include items that provoke changes in physiological state, such as chemicals, including neurotransmitters and hormones; and internal items that provoke changes in emotional state, such as physical mechanisms, including muscles and viscera. For example, the amygdalae are capable of triggering the release of cortisol and other neurotransmitters that excite the

viscera, such as the arteries and the heart. The amygdalae can also trigger production of endorphins, which create a disposition and/or feeling of well-being. Both legal and illegal drugs can produce changes in body states similar to those prompted by the amygdalae. Internal elicitors include items that provoke changes in brain function, which involve its chemicals, plasticity, synchronicity of neuronal connections, and activation of regional mechanisms. External elicitors include the physical environment and socio-cultural environment. External elicitors that influence behaviour include such things as the appearance of a policeman, extreme temperatures, sunshine, and a cut on your foot.

Receptors, on a micro level, are the cells or neural substrates of the central nervous system; and on a macro level, the various brain and body regions that receive, process, and participate in the ever-changing dance of affect.

Emotional states are somatic and neurophysiological patterns that represent the dispositions, the basic emotions, as well as the secondary feelings. Physiological changes in body state, such as responses to stimuli, directly influence affective expression and provide substrates for subjective feelings (Critchley, Mathias, & Dolan, 2001; Critchley, Wiens, Rotshtein, Ohman & Dolan, 2004). The patterns of dispositions and basic emotions may be more easily identified and mapped, since they are largely instinctive, although the reactivity of basic emotions may be modified by experience (Arnold, 1960; Damasio, 2003). Lewis (1998) argues that there are innate neural releasing mechanisms that operate as specific receptors to highly specific environmental stimuli. This idea

would correspond to and support Damasio's hypothesis that early affect appraisal does not require cortical participation.

The processing of affect includes evaluation of stimuli, or appraisals; and is influenced by brain/body states. Appraisals are integral parts of the affect process. The type of appraisal of incoming stimulus, whether the simplistic assessment of the limbic system or the detailed analysis of the neocortex, relates to which parts of the brain are activated and how much control a person has over his/her resultant behaviour. For example, if the appraisal that evoked punching someone was an instinctive reaction to being faced with a knife-wielding assailant, then that reaction was unconscious and could not be controlled by conscious willpower. However, if the appraisal to punch someone was consciously conducted in response to a previous insult, then that reaction could possibly be controlled.

Valence factors influence affect in that they bias decision-making (Damasio, 2003; Davidson, 2003). For example, if you were considering a choice between purchasing one of two cars, and one of them was red, a past negative experience with a red car could create a negative "gut feeling" (Damasio, 2003) that may subconsciously bias your decision. Similarly, if you were choosing what flavour of ice cream to have, and one type of ice cream resembled maple walnut, your favourite flavour; you may be unconsciously biased to choose that flavour, not knowing that it was mocha.

Brain processes and brain states also help determine the processing of affect. For example, if a tumour or accident has damaged the brain and affected

some brain function, then that damage may influence the processing of affect. The famous example of Phineas Gage (see Damasio, 1994), an engineer who suffered damage of the prefrontal cortices when an iron rod was accidentally shot through his brain, is a clear example. Upon what appeared to be a complete recovery, Phineas was no longer capable of planning for his future or governing his behaviour according to social and emotional norms, but was fully able to make mathematical calculations, walk, talk, and work. Brain states also sway the processing of affect. For example, if a person's brain has been compromised by prolonged use of crystal methamphetamine, brain mechanisms utilized in processing emotion may not function normally, and the resultant behaviour in response to stimuli may be unexpected.

Physiology, or current somatic/body states, also influences the processing of emotion. Current somatic states can influence the processing of affect. For example, if a person is under a lot of stress, meaning that high levels of cortisol were extant in the body and brain, that chemical state of the body in heightened awareness would affect processing of incoming stimuli. Somatic states influence the markers or valences assigned to an event or stimulus, thus biasing the judgment or further consideration of that particular stimulus. Consider how you might react to someone cutting you off in traffic when you are anxious about being late for an important appointment. That reaction may well differ from how you would react if someone cut you off and you had just received news of a pay raise.

The expressions of affect are physical manifestations of emotional body states and they involve four modalities: face, voice, body, and brain. Face, voice, and body expressions are apparent or immediately processed by the senses and also readable via other manifestations attributable to patterns of affect, such as heart rate and skin conductance response. Expressions of the brain, as we know and experience them, are manifested in brain activity as measured in various parts by electroencephalography (EEG), functional magnetic resonance imaging (fMRI), and positron emission tomography (PET). Since neuroscience asserts that these four modalities are involved in the manifestations of affect, we can monitor and measure them when considering and researching affect.

Emotional experience involves conscious self-reflection involving interpretation and evaluation of perceived changes in emotional states and expression, as well as the perception of resultant influence on well-being, including actualization of goals, beliefs, and values. For example, an individual may initially feel joyful and proud that s/he has won a race, but may also later feel sadness or even guilt that a friend sustained an injury in the same race. These emotions would reflect happiness at achieving a goal, but empathy for the valued friend. Emotional experience is not automatic and depends on cognitive processes such as feelings, both presently evoked and recalled; as well as contextual values and rules. Lewis (1998) defines emotional experience as “the consequence of attending to one’s condition” (p. 42), implying that initiative and effort are necessary.

Interventions are a component of the process of affect which hold hope for mankind, an area where educators may play a critical role. Interventions can be intrapersonal, interpersonal, or environmental. Intrapersonal interventions are self-induced. As a result of self-reflection upon an emotional experience, a personal intervention may occur. Interpersonal interventions originate outside the person processing the affect, such as from an observer. An example of an interpersonal intervention would be a hug, or a reprimand. Environmental interventions come from outside the individual processing the affect. Environmental interventions are non-personal; for example, a dog may growl, the sun may come out, a song may be heard. Interventions can prolong, subjugate, alleviate, or diminish an emotional experience. Interventions in the affect process include various types of emotion regulation and emotional contagion. These complex phenomena, and the roles educators may play, will be discussed in a later chapter.

SAMA Components of Affect

Elicitors:

Internal

External

Receptors:

Neural Substrates

Brain and body

Emotional States:

Somatic patterns

Neurophysiological patterns

Processes:

Appraisal

Brain state

Body state

Expressions:

Physical manifestations: face, voice, body,
brain

Emotional Experience:

Conscious self-reflection

Interpretation and Evaluation of perceived
changes in emotional state and expressions

Interventions

Figure 5: SAMA Components of Affect

These components of affect process are not purely linear, nor are they purely cyclical; they form a complex dance that is not choreographed, but spontaneous. While an elicitor must be received by a receptor and an appraisal then ensues, the nature of that appraisal, whether unconscious or conscious, is based on body state and brain state. Expressions will be formed based on those brain/body states, but expressions also may be influenced by cognitive appraisal, which may include reflection and intervention. At any point in the process, new elicitors can become part of the metaphorical dance and influence or alter the other components. Indeed, a reflection can result in a new elicitor, albeit an internal one. Interventions can prolong, divert, or diminish the process. Researchers must be aware of and understand the many components if they wish to be clear about what emotion processes they are encountering, measuring, evaluating and interpreting.

Perhaps affect has been shunned to a large degree because it is such an amorphous thing, and as such, difficult to define, understand, and also to measure. Delineating its components, both conscious and unconscious, is one step toward a fuller understanding of the grand production of affect. Conscious experiences of affect, or feelings, are valuable in assessing affect and at this point in research methodology, more easily accessed and measured. The practice of recording subjects' cognizant affect as qualitative and quantitative data is widespread. While this type of data is subjective, there are other measures, such as fMRI, EEG, SCR, that can be used to support and validate self-reported affect (Davidson, Jackson, & Kalin, 2000). It is in accessing and

assessing the unconscious processes of affect that educational neuroscience holds the most promise. While researchers have long been able to access and assess the conscious processes of affect and visible behaviours, it has only given access to part of the performance, like watching a dance without the music.

5.3.2 Facets of Affect

SAMA also includes the facets of affect: tone, valence, intensity, duration, context, integrity, intentionality, physiology, and cognitivity. Tone relates to the fusion of somatic conditions that determine dispositions when a stimulus evoking affect is received. Tone is important to affect since it can influence both valence marking and cognitive analysis of the stimulus. Intensity refers to the degree or strength of the valence. Stimulus with a low degree of intensity may not influence attention and may not elicit the triggering of a response by the amygdalae. Intensity of affect evoked by a stimulus will also determine if the amygdalae continues to trigger a response and will influence not only the duration of the affect, but also the strength of the resultant response, which may include overt behaviour. The context of the emotion includes factors that can influence the analysis of the stimulus. These factors may involve homeostasis context, emotional context, socio-cultural context, as well as personal context. For example, if a person is hungry, an advertisement for a certain type of food will have a different influence on homeostasis processing than if this person is not hungry. Similarly, if that same person is hungry, but angry that someone has just made comments about his/her weight problem, an advertisement for food may have a different effect on the emotion processing of that stimulus. Integrity refers

to the clarity and purity of an affect. It is difficult, but perhaps important in research situations to ensure that a subject is indeed experiencing the desired emotion or feeling and not a combination of different affects evoked by present stimulus, or stimulus outside the perimeters of the experiment or a stimulus related to recall. Intentionality refers to deliberateness of the affect: is the affect presently evoked or recalled, as when ruminating about a past negative incident; and if recalled, the intention of the recall may influence affect processing and outcomes, such as behaviour. Intentionality may also influence aspects of emotion regulation. Cognitivity refers to the phylogenetic level of appraisal utilized to evoke the affect and the possible responses and/or resultant behaviour(s). The facet of affect termed physiology includes both brain and body biological states and chemical functions. Physiology concerns what regions of the brain/body are activated; how they are activated, such as via neuronal or humoral pathways; neurotransmitters present; and the physical consequences of that activation.

Delineating both components and facets of affect is vital when determining the theoretical basis for a hypothesis, what entity is being examined, and how that entity will be observed and measured. Educational researchers must be clear as to what it is they are hypothesizing about and what components and facets of affect are critical to their experiments, and ultimately, their interpretations of affect.

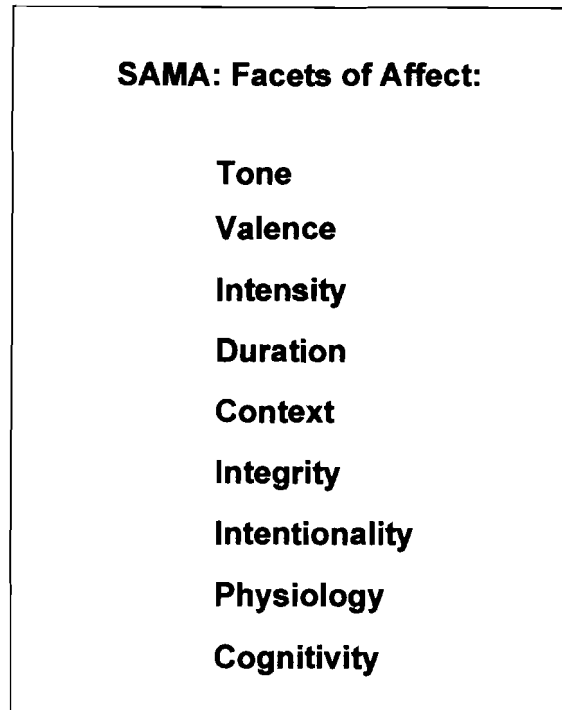


Figure 6: SAMA Facets of Affect

5.4 Arenas of Cognitive Appraisal of SAMA

While Damasio's SMH serves as the essential neuroscientific foundation of SAMA, his hypothesis focuses on the largely unconscious evaluation of stimuli that occurs primarily in the limbic system, but utilizes other brain areas, and what is known about the processing of secondary feelings. While his hypothesis is critical to understanding the science of dispositions, basic emotions, and the emergence of feelings, it does not yet elucidate in any detail the higher behavioural levels of appraisal associated with the function of secondary feelings. If educators mean to address how affect influences learning and teaching, it is important to understand what role cognitive appraisal plays in evoking affect, assessing affect, and managing affect.

It is here that appraisal theory, especially that of Lazarus' Motivational-Relational Theory of Emotions (MRTE) may have application (1994, 1999a). Like the SMH, SAMA proposes the neurobiological functions of dispositions (i.e. background emotions, Damasio, 2003) and basic emotions (i.e. primary emotions, Damasio, 2003) as lower level affect where the amygdalae serve as the hub for triggering activation and coordination of other brain regions essential to affect. Basic emotions become conscious feelings when the somatic representations, or facsimiles produced by mirror neurons, are recognized by regions in the neocortex. Not only do conscious feelings involve cognition, so too do secondary feelings (i.e. social emotions, Damasio, 2003), which are phylogenetically more evolved brain functions than basic emotions. While dispositions involve primitive judgments regarding homeostasis; and basic emotions involve simplistic judgments regarding external and environmental aspects of survival; feelings, both conscious and secondary, involve higher levels of detailed analysis relating to emotional well-being.

It is secondary feelings where appraisal theory may be cautiously applied. I say cautiously, since neuroscience has yet to specify the neurobiological workings of secondary feelings. Secondary feelings, more sophisticated versions of basic emotions, both evolve and mature with neural, social, and emotional development, demanding delineation to help unravel their complex nature. SAMA proposes the appraisal of secondary feelings as three interacting arenas that are collectively both cognitive and conscious. In the first appraisal arena, Phase A, the object or event is examined in relation to present context and past

experience. This phase corresponds to Lazarus' primary appraisal. In the second appraisal arena, Phase B, the possible actions/reactions to the object or event and corresponding possible outcomes in relation to present and future goals and motives, are examined. This phase is similar to what Lazarus (1999a) terms secondary appraisal, and can be seen to include Lazarus' action tendencies. In Phase B, possible outcomes are considered and then initiated and directed. In the third appraisal arena, Phase C, coping strategies and future avoidance strategies are formulated and considered in relation to the enacted or realized outcomes of response(s) to the stimulus.

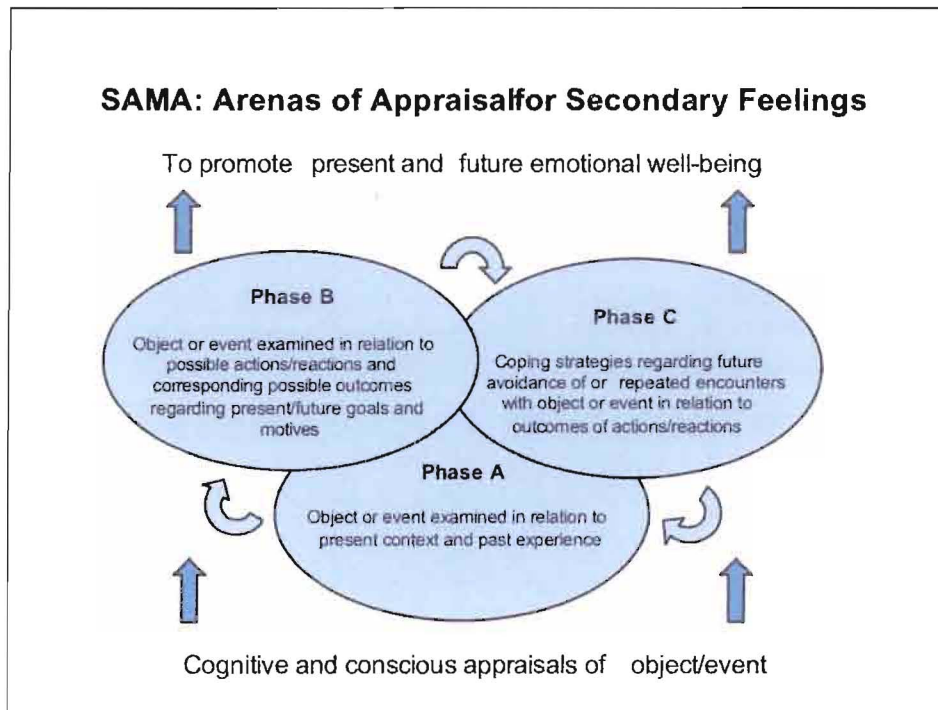


Figure 7: SAMA: Arenas of Appraisal for Secondary Feelings

The critical point regarding these arenas of appraisal is that they, like brain regions and brain/body interactions, function, not as distinct units, but rather as various instruments of an orchestra playing a fugue, with a combined conscious effort to produce the best possible result, which in our case is to promote present and future emotional well-being. This complex emotive-cognitive living being that we call a human remains much of an enigma, but it is the intent of SAMA to combine what is now known from the research and theorizing of neuroscientists and neuropsychologists into a tentative whole for educators, as a foundation for neuropedagogy.

CHAPTER 6: THE PRIMACY OF AFFECT

6.1 Affect: Distinct and Primal

While I have earlier argued that affect is an entity distinct from cognition, I now wish to take that argument further and assert the primacy of affect. In establishing the need for a new perspective on affect for educators, it is important to assert affect's primacy in human functioning.

While emotions and cognition are inter-relational, they constitute separate subsystems of the brain/body function (Davis, Hitchcock, and Rosen, 1991; Gray, 1999; Gray and Jeffrey, 1991; Panksepp, 1990, 1994). SAMA presents affect function as primal to cognition function in several ways: namely, phylogenetically, ontogenetically, physiologically, neurologically, and functionally.

6.2 Phylogenetic Primacy

The function of affect is primal to cognition phylogenetically (Damasio, 2003; Ledoux, 1996a; Levenson, 2003; Panksepp, 1998; Porges, 2001) since the original purpose of the lower brain and the function of affect in animals and humans was to manage physiological behaviour to optimize survival and homeostasis. Man's limbic system is similar in mechanism and function to lower animals in that basic emotions and expressions are shared by primates and humans (Ledoux, 1996a; Panksepp, 1998). The evolution of the human brain to include the neocortex involves monitoring and altering the state of mind and body

in increasingly more complicated ways. The nervous system reacts to homeostatic challenges by changing physiological states, such as narrowing sensory awareness, and limiting motoric behaviour and cognitive potential (Porges, 2001), such as when one freezes in fear. Phylogenetic development of the brain illustrates a progressive increase in the complexity of neural mechanisms to regulate neurological behavioural states in order to deal with increasingly complex challenges, from basic survival to socio-emotional interactions that will improve the well-being or status of an individual. It makes sense that the neocortex does not operate separately from the limbic system, but in fact relies on the emotional brain for primary and simplistic analysis of incoming stimuli, as well as somatic adjustments to promote homeostasis. Feelings, which involve the thinking part of the brain or neocortex, are appreciably more complex than basic emotions. One could say that feelings are necessary for survival in humans' complicated social and cultural lives, as well as both developing and dynamically contributing to and deriving from each individual's sense of self. Watt (2004) simplifies the relation between affect and cognition by positing that affect, or what he calls emotion is "an evolutionary *extension of homeostasis*" and "*cognition is an extension of emotion* [*italics in originals*]" (p.77).

6.3 Ontogenetic Primacy

While the lower brain, including the limbic system, is functional at birth; the neocortex reaches maturity in late adolescence. Humans are born with innate basic emotions (Cicerelli, 1996; Davis, Hitchcock, & Rosen, 1991; Dougherty,

Abe, & Izard, 1996; Forgas, 1999; Izard, 1984; Ledoux, 1996a; Panksepp, 1990; Porges, 1995) necessary for survival which are shared across many cultures (Ekman, 1993). Affect is primal in development (Izard, 1984; Panksepp 1992) and Panksepp (1998) argues that we must first understand how basic emotions function before we can hope to understand the more complex feelings because of the former's underlying and influencing status. SAMA argues that later-developing affect, namely feelings, coincide with acquisition of knowledge through life experience and the concomitant development of a sense of self. Secondary feelings such as guilt, shame, embarrassment, jealousy, and pride, or what Panksepp (1998) refers to as "cognitive-type emotions" (p. 301), are linked to the basic affective substrates in the limbic system. For example, guilt may be a neocortical recognition of somatic states of sadness coupled with an individual's perception that his/her response to stimulus did not meet with social and/or personal expectations of conduct.

6.4 Physiologic and Neurologic Primacy

SAMA recognizes that affect does not involve only what some refer to as "the emotional brain" (Goleman, 1995, p. 209). The limbic system, specifically the amygdalae, Ledoux (1996) likens to "the hub of a wheel" (p. 168) of affect, especially when relating to basic emotions such as fear (p. 170). The amygdalae receive input from sensory-specific lower level regions of the brain, from higher level regions of the brain such as the sensory cortex, and also from yet higher level information regions that assess the situation in more detail, such as the neocortex.

Since innate affect responses coordinated by the amygdalae are critical to survival, it makes sense that they, in the very simplicity of analysis, are immediate and autonomic. These responses occur in the lower level limbic system voluntarily before the cortical brain has time to think about the situation and plan a response. I say plan, because the neocortex does not trigger its reaction itself: the neocortex must send its response to the triggering mechanism, the amygdalae. The amygdalae serve as the controller of affect: they have both efferent and afferent neuronal projections to most parts of the brain and affect attention, perception and memory. The amygdalae have single synapse connections to release neurotransmitters that evoke chemical (e.g. hormones), visceral, muscular, somatic, and neuronal changes. The cortex, in contrast, must use multiple feedback projections to create the same types of changes via the amygdalae.

The fact that the amygdalae have more neuronal projections to the cortex (Ledoux, 1996a, p. 284; Rolls, 2003, p. 195) than vice versa indicates that the amygdalae are more the controllers than the controlled: they modulate feedback from other parts of the brain. As well, there is evidence that the limbic system constitutes a “separable subsystem of the brain” (Gray & Jeffery, 1991, p. 274), and that different parts of the limbic system share a common antigen that is not present in other brain regions. Gray and Jeffrey (1991) also cite a “unity of response” in the limbic system, even though the whole system contains diverse and distinct components (p. 276). Parksepp (1994) supports the distinction between affect and cognition by citing evidence that basic processes of affect

take place in different brain regions and involve different dispersal and receptor patterns.

6.5 Functional Primacy

There are several arguments that support the primacy of emotion's function. Firstly, emotions perform the first level of appraisal for incoming stimulus in brain function, thus affecting subsequent cognitive appraisals. Secondly, emotions have the capability of easily influencing bodily functions and responses; and thirdly, emotions, specifically through the functions of the amygdalae, have the ability to influence and override cognition. In addition, emotions involve many more brain systems than thoughts (Ledoux, 1996a). Emotions, writes Ledoux, "cause a mobilization and synchronization of the brain's activities" (1996a, p. 300) that is functionally dissimilar to thinking that does not have significant emotional content.

Others avow the primacy of emotion because of its role in human behaviour. Kagan (1984) promotes the primacy of emotions when he writes that "feelings can dominate consciousness in a way that thoughts cannot" (p. 69). Izard (1984) argues that emotion is not only primal in human development, but serves as a fundamental core of human existence that is the motivation for both cognition and behaviour. Damasio has long been an advocate of emotions as capable of influencing and enhancing decisions (1994, 2003; see also Bechara, 2004; Davidson, 2003; Davidson, Jackson, & Kalin, 2000; Frijda, 1986), and others declare that affect influences memory and attention (Lee, Josephs, Dolan, & Critchley, 2006, p. 122). Goleman (1995) states that the intensity of emotion

enhances memory and Parkinson, Totterdall, Briner, and Reynolds (1996) argue that the valence of underlying emotions or mood influences the style of thinking, the encoding of material, as well as storage processes. Davidson, Jackson, and Kalin (2000) state that emotion "provides the motivation for critical action in the face of environmental incentives" (p. 890). Silvia's study notes that self-awareness of emotional experiences "reduces egocentrism and enhances perspective taking" (2002, p. 21) and speculates that this emotion-salience can influence appraisal and regulation variables. Indubitably, emotion plays a vital role in brain/body function and influences aspects of cognition, two assertions that cannot be ignored by educators.

CHAPTER 7: THE AFFECT-COGNITION DEBATE: OR WHO'S ON FIRST

7.1 Cognitivity of Affect

Aristotle, Descartes, and Spinoza have advocated, in their various ways, the temperance of affect by understanding, training, and habituating affect through rational methods. Understanding, training, and habituating affect invariably involve the intellect. If we as educators are to play a role in this process of understanding and managing affect, then we must ascertain what role cognition plays in the function of affect if we are to effectively utilize cognition to manage affect in order to improve teaching and learning, with the ultimate goal of improving the human condition.

The debate of the cognitivity of affect is central to SAMA, as SAMA presents dispositions and basic emotions as involving primarily lower level, non-conscious brain functions; and feelings, both conscious and secondary, as involving higher level, cognitive brain functions. Leventhal (1982), Panksepp (1994), and Scherer (1994) correctly argue that this debate hinges upon agreement of a cogent definition of cognition. Lack of cohesive terminology is noted as an issue in the Lazarus (1984) and Zajonc (1984) duelling articles on the primacy debate pitting affect and cognition as opponents, as well as in other writings (Izard, 1984; Lazarus, 1999b; Ledoux, 1994; Panksepp, 1994; Scherer, 1994). I do not see affect and cognition as rivals, but rather as distinct entities

that are perpetual partners in the dance of human existence. While I have attempted to clarify the terminology of the types of affect in SAMA, I will now address the debate as to what constitutes cognition in relation to affect.

Ledoux (1994) rightly cautions that cognition is a label used to describe elements connected by a variety of information-processing brain functions, such as perception, attention, memory, and problem-solving. So, too, is affect a label referring to closely related brain functions that primarily involve the limbic system, but also involve various other parts of the brain, including cognitive regions, at higher levels of affect complexity. It appears a large part of the problem is that these labels, cognition and affect, refer to broad collections of diverse phenomena whose functions interrelate at various levels in different ways that can be both subtle and complex. The literature illustrates the lack of clarity in terminology that perpetuates the debate. The enigma of affect/cognition interaction and the nebulous nature of accompanying labels may be more than attenuated by our newly evolving neuroscientific knowledge of brain/body function. To lend validity to the premise of SAMA, that not all types of affect require cognition, let me first present a précis of both components of the affect/cognition debate.

7.2 The Debate: Affect Involves Cognition

Those who argue that all types of appraisal involved in evoking affect are cognitive include Lazarus (1984), Frijda (1994), Clore (1994), Lyons, (1999), and Rolls, (1998, 1999). Because these scholars' views and arguments are based on

different theories, I will discuss them separately in their relation to the affect/cognition debate and in their relation to SAMA.

7.2.1 Lazarus: All Appraisals are Cognitive

While I earlier presented a précis of Lazarus' appraisal theory, let me here focus on his conception of affect in relation to the affect/cognition debate.

Lazarus, who considers himself a cognitivist (1984) as well as a social scientist (1999a), regards affect as a phenomenon that cannot be understood from happenings inside a person or brain, but as a phenomenon that arises from the analysis of ongoing transactions with the environment. He states that “cognitive activity is a necessary precognition of emotion because to experience an emotion, people must comprehend - whether in the form of a primitive evaluative perception or a highly differentiated symbolic process – that their well-being is implicated in a transaction, for better or worse” (1984, p. 124; see also Lazarus, 1994, p. 208). These appraisals, he argues, provide the cognitive basis, or relational meaning, of an “emotion”. He defines what he calls “emotion” as being composed of three components: behaviour, subjective reports, and physiological changes. He states that when people “cognize” stimulus as pleasant or unpleasant, it is not an emotion. However, he argues that when people “further cognize” the relevance of this stimulus regarding its possible benefit or harm, the experience then becomes an emotion (Lazarus, 1984, p. 126). Lazarus (1994) acknowledges that some appraisals happen “without elaborate and deliberate cognitive processing or even being conscious of doing so, [where] we intuitively sense fundamental evaluative features of the significance of our person-

environment relationships” (1994, p. 215). He also recognizes that “[i]nfant and adult human anger may well be quite different in their causation as well as in quality and consequences” (1994, p. 209), and with this I concur. There is indeed a neuroscientific difference between an infant’s anger at being hurt or hungry and an adult’s anger at missing a plane. The infant’s anger arises from a simple, homeostatic need; while the adult’s anger has, to use an apt cliché, “welled up within,” implying that it has been evoked from a personal goal that has been thwarted, perhaps building up from when the person left work late, raced to get to the airport, parked the car, and ran to the check-in, only to discover it was too late to board the flight. SAMA would call the infant’s anger stemming from a basic innate emotion provoked by the limbic system in the lower brain, and the adult’s anger a sophisticated response to a unmet desire relating to a personal and unique goal that was consolidated in the neocortex, and relayed to the limbic system in cyclical fashion that evolved and intensified as the series of events unfolded.

Lazarus, in a later writing, admits that he is not saying that cognition comes first, but that “emotion” and cognition occur in a continuous flow of cognitive, motivational, emotional processes (1999b), where “emotion” cannot occur without both cognition and motivation, and “emotion is never completely divorced from meaning” (p. 8), and therefore cognition. However, I would argue that Damasio’s affect valence, evoked in the limbic system, gives the simplistic meaning necessary for prompting basic emotions.

Unlike others (i.e. Zajonc, 1984), I do not regard Lazarus as at odds with those who argue what is presented in SAMA: namely that all levels of affect involve evaluation. The confusion lies in definitions. Lazarus accepts that “emotion process can get in the way of reason” (1991, p. 88). However, he does not cite the neuroscientific explanation of this “emotional hijacking” (Goleman, 1995), but rather posits that there are three explanations why affect or what he calls “emotion” overpowers cognition: 1) attention is distracted or misdirected, 2) a lack of capacity to control behavioural impulses, or 3) a decision was based on an inaccurate premise (Lazarus, 1999a). Lazarus (1994) agrees with SAMA’s neuroscientific view that “particular patterns of appraisal result in particular emotions” (p. 16). Where I differ from Lazarus is that evaluation for low levels of affect does not involve cognition, as I define it. Lazarus (1984, 1994) regards all levels of evaluation, whether simple or complex, as cognition; whereas SAMA distinguishes between the low level simplistic evaluation of stimuli necessary for dispositions and basic emotions and the higher level more sophisticated analysis prerequisite for feelings. Clearly Lazarus does not regard unconscious affect as “emotion,” since he argues that “emotion” must be conscious or reportable, and result in observable behavioural and physiological manifestations, or what SAMA would refer to as the higher level of affect termed “feelings.”

Lazarus’ (1999a) later definition of “emotion” as “a complex organized system consisting of thoughts, beliefs, motives, meanings, subjective bodily experiences, and physiological states all of which arrive from our struggles to survive and flourish by understanding the world in which we live” (p. 100) is too

general and lacks SAMA's more critical neuroscientific distinction among the various levels of affect. However, Lazarus' contributions in the realm of appraisals necessary for secondary feelings are valuable in their complexity and usefulness in delineating the levels of possible emotion regulation, which will be discussed in a later chapter.

7.2.2 Frijda: Even Primitive Evaluations are Cognitive

Frijda (1994) argues that what he calls "emotions" require cognition, even if this cognition is simple. He posits that awareness of the meaning of events, not the objective nature of stimuli, is the "primary determinant of most emotions" (p. 197). I would argue that cognition is not needed to shape unconscious affective experience; rather, awareness of the somatic state evoked by the meaning of an object or event *is* the subjective affective experience, since it is the consciousness of affect that are feelings. This consciousness of affect, or more specifically, feeling, involves cognition and is necessary for naming, reflecting on, and managing the feeling.

Although Frijda's assertion that all of affect is cognitive, his theories share some similarities to SAMA. Frijda (1994) agrees that emotions, or types of affect occur "along a continuum from simple to complex" (p. 198). His classifications of emotional stimuli correspond with SAMA's levels and phases of affect. For example, his "internal stimuli" that include direct influences on biochemical or neural processes, "simple sensory stimuli that act directly on the affective system" (ibid.) and conditions that affect mental or physical responses may correspond with SAMA's dispositions and basic emotions. Frijda's stimuli that

“act through their assimilation or juxtaposition to stored schemata or expectations” and stimuli that “act through the inferential and meaning schemas” can be interpreted to correspond to what SAMA terms feelings. Frijda differentiates among different types of affect, defining them by their links to objects, states of action, inaction, and action-readiness, as well as intentional status. He agrees that cognitivity varies according to the type of affect (1994, p. 199) and acknowledges that “physical state... influences mood” (ibid., p. 200). When physiological states influence mood, he agrees that this is non-cognitive in the sense that affect is outside of awareness, but argues that this involves “primitive cognitions” (p. 201). This argument appears a paradox if one takes at face value his earlier definition of cognition as “complex information processing” (1994, p. 196). Advocates of the primacy of affect, mostly neuroscientists (e.g. Damasio, 2003; Dalgleish, 2004; Davidson, 2000; Gray, 1991; Ledoux, 1996a), argue that primitive or basic emotions involve primitive areas of the brain that do not involve complex information processing. Frijda’s argument is somewhat diluted by his conclusion that “cognition has perhaps more of a function in emotion control than in emotion arousal” (1994, p. 202), his concession that physical state is capable of influencing mood (ibid.), and his recognition that affective valences influence cognitive judgments related to goals. Frijda says it is possible to have stimulus “that evokes affect without cognitive mediation” (1994, p. 200), and that “there is no disagreement on the possibility of noncognitive elicitation of affect and mood” (ibid., p. 199). However, it is important to note that he defines “affect” as “pleasant and unpleasant feelings” and “mood” as “diffuse

states of affect or of action readiness (or both)” (ibid.). He does not include “affect” and “mood” in what he terms “emotions,” which he says involve “a change in action readiness,” involve an object, and are intentional and goal related. Once again, the definition of cognition appears to be the root of disagreement.

7.2.3 Clore: Emotions Must Involve Agency and Cognition

Clore (1994) classifies emotions as mental states, as subsidiary of a larger information-processing system whose “minimal cognitive prerequisite...is world knowledge required for things to have meaning” (p. 182) in order to be evaluated as negative or positive. According to Clore (1994), these evaluations are not generally conscious. Affect that does not involve cognitive mediation, he refers to as “quasi-emotions,” which he explains as being non-intentional, such as sudden fright (Ibid.). Sudden fright reactions, he argues, while they may produce facial expressions and some “emotion-like reactions...would not by themselves constitute fear” (Ibid., pp. 182-183). Rather, sudden fright responses, such as startle reflex, “may activate related mental content or make one vigilant for stimuli that become objects of emotions” (Ibid., p. 183). According to SAMA, sudden fright is a type of affect; it is innate, it is a basic emotion that actuates itself in the neurology and physiology of a startle response and the resultant conscious feeling of fear. Since his construct of affect must involve intentional agency, and “emotions always involve cognitive appraisals” (Clore & Ortony, 2000, p. 24), innate reactions cannot be, in his mind, what he terms emotions.

What confounds Clore's and others' arguments with those of neuroscientific background is not necessarily their understanding or sequencing of affect events, but a lack of lucidity among writers in labelling the constructs. An additional problem arises from forming constructs based on philosophy that does not coincide with neuroscientific findings.

7.2.4 *Rolls: Emotions as States Elicited by Rewards and Punishers*

Rolls (1999), a neuropsychologist, agrees on the phylogenetic and ontogenetic development of affect and bases his theory on the brain mechanisms involved. He does not regard affect as having primacy. Rather, he defines what he terms "emotions" as resultant "states elicited by rewards and punishers, including changes in rewards and punishers" (1999, p. 60; 2005, p. 11). Rewards, according to Rolls, are anything for which an animal or human will work to gain, and punishers are anything for which an animal or human will work to avoid or escape. Simply put, he states that "emotions can be produced by the delivery, omission, or termination of rewarding or punishing stimuli" (Ibid., p. 61). His division of stimuli into 1) primary or unlearned stimuli and 2) secondary or learned stimuli, would harmonize with SAMA's 1) basic emotions and 2) secondary feelings.

While space does not permit an exposition of Roll's "theory of emotion" put forward in his book, *The brain and emotion* (1999), his theory is included here for two reasons: firstly because he is an appraisal theorist whose arguments are derived from neuropsychology, and secondly because he openly rejects the

James-Lange theory and Damasio's SMH which both posit that body states elicit affect.

In appraisal theories, affect is described and classified based on whether the stimulus or event being expressed is a positive or negative reinforcer. Rolls proposes an appraisal-based theory of affect that focuses on what he terms the cognitive assessment of stimuli in regards to rewards and punishments. Rolls argues that the fundamental phylogenetic design of the brain is fashioned around the mechanisms of reward and punishment. He argues that the brain, using the mechanism of emotion and motivation, computes the value, in terms of reward or punishment, as a sensory input or stimulus and "emotion systems" serve as a simple interface between stimuli and actions. Simply put, he states that "emotions can be produced by the delivery, omission, or termination of rewarding or punishing stimuli" (ibid., p. 61).

He acknowledges that there are different neural circuits for primary or unlearned stimuli and secondary or learned stimuli. His distinction between "mood state," which he says is produced without specific external stimuli; and "emotion," which involves cognitive processing of an environmental event, appear to correspond to SAMA's dispositions and feelings. In Rolls' theory, a stimulus or event is also categorized on four different reinforcement contingencies. What he calls "emotions" are classified on a continuous scale based in intensity, with the four axis of the grid representing: vertically, positive reinforcement and its opposite, negative reinforcement; and horizontally, the omission or termination of positive reinforcement and its opposite, the omission

or termination of negative reinforcement. Different “emotions,” claims Rolls, are due to several factors, namely, 1) different contingencies, 2) different intensities, 3) different reinforcement associations, 4) different primary reinforcers, 5) different cognitive associations, 6) environmental or contextual constraints, 7) prior history or experience, and 8) underlying mood state. Rolls posits that different intensities create different degrees of emotion. For example, apprehension can intensify to fear, and fear can intensify further to become terror. Rolls’ theory requires cognitive input, whether conscious or not, to process even the simplest of evaluations of sensory input. He argues that not all stimuli produce “emotions” because only stimuli which are reinforcing produce “emotions” (Rolls, 1999, p. 67), and argues that the parts of the brain that determine “whether stimuli are reinforcing” (ibid.) can be regarded as producing affect. I would counter that argument by saying that only the emotionally competent stimuli (ECS) evoke affect (Damasio, 2003). In addition, the regions of the brain that determine positive or negative outcome are only *part* of the affect process: affect-triggering parts of the brain are not the same as affect-execution parts of the brain (Damasio, 2003, p. 58).

While Rolls (1999) does not directly address the issue of defining cognitive assessment of stimuli, he does note that “cognitive processes will very often be required to determine whether an environmental stimulus or event is reinforcing” (p. 65), and excludes homeostatic drives from producing affect (ibid.). I would argue in Damasio’s favour, and ultimately supporting SAMA, that when one is satiated with food, whether infant or adult with an experienced palate, this

homeostatic condition contributes at least to one's basic disposition, contributing to the notion of "feeling good" after a satisfying meal.

Rolls' theory is dissonant with other's neuroscientific assertions. For example, Roll's theory is at odds with the view that the various types of affect are not generally recognized as linear (Lewis, Sullivan, & Michalson, 1984) in their unfolding. Also, his model recognizes only two variables of affect, namely reinforcing effects and intensity, although he does recognize in his writing that "emotions" have several factors. Rolls' model of affect is thus problematic in its lack of complexity. As well, I see a problem in Rolls' method: he presents his theory and then seeks mechanisms to validate it; rather than examining the neural mechanisms and creating a theory from functions of those neurobiological mechanisms. Given our evolving neuroscientific knowledge of brain/body interaction and the role of affect in human function, it would appear wise to found a neuropsychological model of affect on modern neuroscientific research as it unfolds rather than on a tired psychological construct.

It is worthwhile to examine Rolls' arguments, as he rejects the James-Lange theory and Damasio's SMH which assert that body states elicit emotions. Instead, he argues that emotions are provoked by cognitive evaluations of stimuli as either negative or positive reinforcers. Rolls (1999) classifies the James-Lange theory as well as Damasio's SMH as "peripheral theories" (p. 71) which are fatally flawed because they do not answer the "most important question" (ibid.): why do certain stimuli elicit affect related responses while others do not. However, in *Looking for Spinoza* (2003), Damasio specifically states that not only

the amygdalae, but also the ventromedial prefrontal cortex is engaged in appraisal of incoming stimuli to determine if that input is emotionally competent, or of sufficient significance to evoke an affect. Damasio (2003) hypothesizes that emotionally competent stimuli (ECS) are those stimuli that create neural signals of specific configurations and magnitudes relayed simultaneously along multiple pathways to specific combinations of brain regions and/or structures known to trigger affect (p. 58-59). If certain combinations of trigger sites are activated, they in turn send neural signals to emotion-execution sites, such as the hypothalamus, the basal forebrain, and some nuclei in the brain stem tegmentum (Damasio, 2003, p.62). The amygdalae, says Damasio (2003), serve as “an important interface between visual and auditory emotionally competent stimuli and the triggering of emotions,” especially fear and anger (p. 60). However, Lee, Josephs, Dolan, and Critchley (2006) avow “the primacy of affective behaviours in engaging action-perception (mirror neuron) systems” (p. 133) that are capable of creating behavioural changes such as the facial mimicry associated with empathy. Lee et al found that the more facial muscle movement in subjects smiling to imitate happiness, the greater the activity in cortical and subcortical regions of the brain including the amygdalae (ibid.).

SAMA's hypothesis appears to be supported in Rolls' statement that “activations in the human amygdala [sic] and primary olfactory cortical areas are more closely bound to the eliciting stimulus and are less influenced by cognition than are activations in the orbitofrontal and cingulate cortices” (Rolls, 2005, p. 125). SAMA also accommodates Roll's claim that cognition can and does

influence affect, but only when it involves higher order affect, such as feelings. Rolls' assertion that "cognitive top-down influences can play an important role in influencing affective representations in the brain" (ibid.) is incorporated in SAMA, but only in the later, more sophisticated levels of appraisal and affect. The fact that Rolls' experiment involved negative and positive language labels paired with a smell indicates that this affect involved neocortical analysis, as language function resides there, and not just the simple analysis of the limbic system.

While Rolls has some aspects of his emotion theory in common with SAMA, such as the parallel routes of sensory input and evaluation in the brain, (see Rolls, 2005, p. 413), he does not believe that affect can be caused by somatic conditions, including homeostatic functions such as hunger or satiation (Damasio, 2003, pp. 38-39), although Rolls describes the states homeostatic functions produce as "affective," (Rolls, 2005, p. 21). Rolls posits that "emotional feelings... called qualia" are "at the heart of the problem of consciousness" (2005, p. 400). He proposes that there are two routes to action: 1) the implicit route that is automatic, direct and reward-based, and 2) the explicit route that is connected to consciousness. According to Rolls, the implicit route involves early evolutionary brain systems, including the amygdalae and the orbitofrontal cortex and is "direct action-based" (2005, p. 415). The explicit route, says Rolls, involves the brain regions that produce language, and also the regions that involve the ability to plan and that are necessary in delaying gratification. Consciousness, he claims, "arises by virtue of having the ability to think about one's own thoughts" (2005, pp. 414-415). Rolls offers that alcohol may affect

behaviour by swaying the balance between implicit and explicit routes to action so that the implicit systems are more influential in provoking behaviour.

It is important here to present Rolls' rejection of a somatic based model of affect, specifically the James-Lange theory and Damasio's somatic marker hypothesis, and, implicitly, SAMA. The James-Lange theory has three main tenets: 1) the elicitation of emotion-provoking stimulus by physiological changes, such as heart rate and musculature tension; 2) the mind's sensing of the physiological changes; and 3) the elicitation of emotional feelings in response to the recognition of the physiological changes. Damasio and SAMA would add that the mind's recognition of a pattern or map of physiological changes, and not the physiological changes themselves accompanying an emotion, produces a conscious emotion, or feeling.

Rolls believes the major weakness of the James-Lange theory is that it does not explain why some stimuli cause a behavioural response, such as running away, and others do not. He argues that the physiological changes "produced during an emotion are not sufficiently distinct to be able to carry the information that would enable one to have subtly different emotional feelings to the vast range of different stimuli that can produce different emotions" (Rolls, 2005, p. 26). I would counter his argument by saying that Damasio (1994) has found such distinctions (pp. 140-142) and that this present lack of mapping of all basic emotions does not prove the somatic and chemical distinctions among types of affect do not exist. Also, if Rolls says that a vast array of physiological and chemical changes cannot be variant enough to produce the range of affect,

where is his evidence to prove that reward/punishment evaluations can produce these same degrees of distinctions to evoke the broad range of basic emotions and feelings? Feelings, according to somatic based models such as SAMA, rely on body-sensing regions of the brain to “produce a precise map of what is occurring in the body, yet in some instances they do not for the simple reason that either the activity in the mapping regions or the signals coming toward them may have been modified in some way” (Damasio, 2003, pp. 111-112); so the evocation of a feeling relies on the interpretation of somatic changes, not on just the occurrence of somatic changes. Also, I would propose that the body-sensing brain regions are selective regarding what stimulus would activate a response; or example, if a bear was chasing an individual, his brain would ignore the somatic communication that he had a sharp stone in his shoe. The body-sensing regions of the brain may not react the same way to the same stimulus on different occasions for various reasons: 1) there may be subtle differences in the stimulus, 2) different underlying basic dispositions may be extant at the occurrence of the stimulus, 3) there may be interference from other parts of the brain, such as the amygdalae, and 4) there may be differences in the neurotransmitters present in the somatic and or brain regions resulting in inhibitive or promotional signalling.

Rolls also argues that because spinal cord injuries in humans do not abolish feelings, somatic states are not involved in affect. I would attest that spinal cord injuries still allow the brain and body to exchange some information; if these injuries severed communication between brain and organs essential for homeostasis, such as the heart and skin, the person would not be alive. He notes

that for spinal cord injuries “in some patients there was apparently some reduction in emotions in some situations,” (2005, p. 27). It would make sense that some damage in the spinal cord could compromise signals sent to the brain regarding physiological status, which would compromise the brain’s somatic analysis, and hence the evocation of feelings. However, neurotransmitters not only are involved in neuronal transmission of somatic states, but also carried in the humoral system, or veins and arteries. I would argue that if the neuronal transmission of somatic conditions was compromised by spinal cord damage, the humoral transmission of somatic conditions would continue to function.

Supporting my argument is Reizenzein’s article that is referenced by Rolls. Reizenzein (1983) states that the spinal cord injuries affected “input from a substantial portion of the body,” but certainly did not affect cardiac feedback (p. 245). Reizenzein also notes that research such as his on spinal cord injury feedback is “very small and methodologically controversial” (Ibid.). It is interesting to note that Schachter (1964) cites the same spinal cord injury research to support his two-component theory that physiological arousal *is* an essential component for the production of affect.

In further support of his rejection of somatic-based affect, Rolls (2005) argues that drugs that produce autonomic changes (i.e. adrenaline) cannot produce particular types of affect, and reiterates that “emotions” depend on “cognitive decoding of the reinforcers present in the situation” (p. 27). I posit that administering a single drug that does not evoke a particular affect neither supports Rolls’ argument nor denigrates the James-Lange theory, Damasio’s

SMH, or the SAMA. The latter two constructs argue that it is not the body states that elicit feeling, but the brain's body-sensing regions that detect somatic changes and create maps whose patterns prompt a specific conscious feeling. Again, these body maps include physiological data, not just the presence or absence of certain neurotransmitters or neural chemicals, such as adrenaline (see Damasio, 2003, pp. 111-113 for a more detailed explanation), as well as being influenced by other factors earlier cited.

Rolls also claims that if physiological changes associated with affect are blocked with drugs, the "perception of emotion" (p. 28) or feelings can still occur, more evidence that affect is not somatic-based. As evidence for this point, Rolls (2005) cites research dating back to 1979 that, he asserts, illustrates that behavioural expressions of emotion (for example, smiling when at a bowling alley), "does not usually occur when one might be expected to feel happy because of success, but instead occur when one is looking at one's friends" (p. 28). Upon reading the original article, Kraut & Johnston (1979) indeed conducted their research in a bowling alley and found that smiling "showed no association with [bowling] score" (p. 5) and concluded that "social smiling need not be mediated by happiness" (p. 12). Damasio (1994), in fact, has found that social smiling and smiling related to the basic emotion of happiness do indeed differ in musculature utilized and brain regions activated (p. 141).

Rolls (2005) refers to the six arguments summarized and refuted above as "overwhelming evidence against an important role for body responses in producing emotions or emotional feelings" (p. 28) in relation to both the James-

Lange's theory of emotion and Damasio's SMH. I submit that Roll's arguments are troublesome and lacking substantive evidence.

However, Rolls' "theory of emotion" cannot be dismissed in the cognitive/affective debate. While his theory is based primarily on the cognitive reward/punishment appraisal mechanisms and he dismisses somatic appraisal as a basis for affect responses, his theory cites neuroscientific evidence that, from a different perspective, support SAMA and other somatic-based theories of affect. As with others who pose that affect is primarily cognitive, his definition of cognition is at variance with those who assert the primacy of the function of affect in human brain/body interaction. Like Clore (1994), Frijda (1994), and Lazarus (1984, 1996), Rolls argues that all appraisals of stimuli involve cognition, and that affect arises from these cognitive appraisals. His analysis of the neural mechanisms of affect are "concerned primarily with how stimuli are decoded to produce emotional states" (Rolls, 2005, p. 194), and that these "emotional states" can influence behaviour. In addition, he recognizes that "current mood state can affect the cognitive evaluation of events or memories" (ibid.), just as SAMA proposes. Rolls' assertion that stimuli are evaluated simply as reward or punishment is not without merit: SAMA maintains that the quick and simple limbic analysis of positive or negative stimuli occurs in parallel with the more sophisticated neocortical evaluation. Rolls' lack of clearly differentiating among the phylogenetic levels of affect and their different mechanisms to produce the vast variations in types of affect is troublesome. While his model presents that intensity creates some variations, such that fear intensifies to become terror, his

explanation for the cause of the differentiating is vague. Rolls' work is valuable in setting out the various neurological structures involved in emoting; however, his positivistic model is confounded by the apparent dichotomy of being based on behaviouristic theory: that all affective evaluations arise from cognitive reward/punishment assessments.

7.3 The Debate: Not All Affect Involves Cognition

Rather than discussing the many proponents of the argument that not all affect involves cognition (e.g. Arnold, 1960; Damasio, 2003; Dalglish, 2004; Davidson, 2003; Davis, Hitchcock, & Rosen, 1991; Geary, 1996; Gray, 1999; Izard, 1982, 1984; Kagan, 1994; Lang, Davis, & Ohman, 2000; Ledoux, 1996a; Levensen, 2003; Lewis, 1998; Lewis, Sullivan, & Michalson, 1984; Ohman, 1999; Panksepp, 1990, 1998; Porges, 1995; Scherer, 1994, 2000; Zajonc, 1984), I will attempt to consolidate the arguments thematically. Firstly, the definition of cognition is crucial: both level of processing and region of processing must be considered. Secondly, there exists an essential distinction between primary (or what some call primal) and secondary affect. Thirdly, the affect/cognition relationship is not linear. Fourthly, neuroscience posits that not all types of affect involve cognition, but that affect influences cognition.

7.3.1 Clarifying the Definitions of Affect and Cognition

While I have posited that the disparate definitions of emotion have created considerable confusion and confounded the debate as to what constitutes that which I term affect, consternation about the definition of cognition clouds the

affect versus cognition debate. The problem arises from use of general terms to refer to collections of diverse phenomena. While SAMA has delineated the different levels of affect, cognition requires clarification. The cognition/affect debate hinges on the definition of cognition (Izard, 1982; Panksepp, 1994; Scherer, 1994). Earlier I described cognitive appraisal simply as evaluation where the neocortex is the primary or evocative appraiser of stimuli. Panksepp (1994) and Izard (1982) add further clarification to my definition. Izard (1982) posits that stimuli can evoke affect without cognition if cognition is defined as “something more than sensory feedback and the cortical-limbic interactions that integrate it” (p. 236), describing the brain functions employed. Panksepp (1994) argues that cognition “be reserved largely for neocortical and hippocampal processing of exteroceptive information [meaning external stimuli] (and perhaps thalamic memory retrieval circuits)” (p. 225), adding clarification by identifying the brain regions involved.

Inherent in the cognition/affect debate is the level of processing and the brain regions involved in the processing. The level of processing problem implies that affect is not a single stage process (Arnold, 1960; Gratton, Coles, Sirevaag, Erikson, & Donchin, 1988). Indeed, SAMA presents affect as having a hierarchy based on both phylogenetic and ontogenetic development of brain function and processes that are differentiated by their sophistication of analysis and level of consciousness and cognitivity. Regarding affect and cognition, Panksepp (1994) argues that the “basic impulses for each appear to arise from distinct geographic areas of the brain (hypothalamo-limbic [for affect] versus thalamo-cortical [for

cognition])” (p. 225). Panksepp believes that it is necessary to be mindful of the demarcated distinctions between affective and cognitive processes in order to understand the interactions between them. He espouses that a closer study of the dispersal of neuropeptides and corresponding receptors in the cortico-cognitive brain regions may reveal further clues as the differences in operating systems for cognition and affect (Panksepp, 1994).

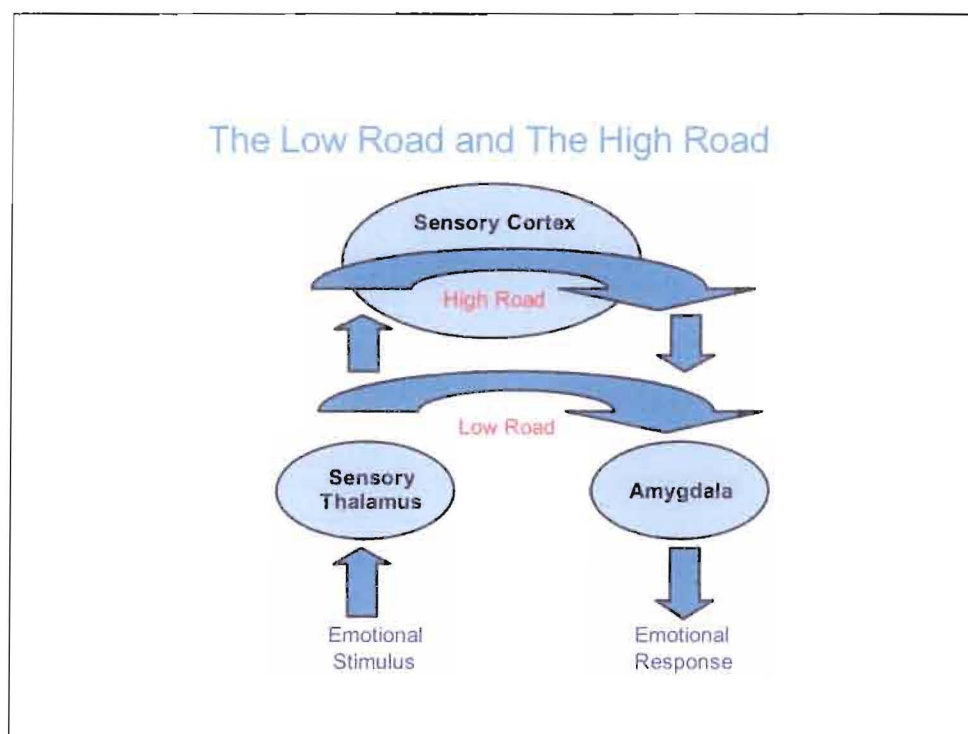


Figure 8: The Low Road and the High Road

SAMA presents a dual route for processing affect: stimulus that is evaluated via the low road, the thalamo-amygdala route (Daggleish, 2004; Phelps & Ledoux, 2005); and stimulus that is analyzed via the high road, the thalamo-cortico-amygdala route (Daggleish, 2004; Phelps & Ledoux, 2005). The low road evaluation of stimulus produces dispositions and basic emotions, which are both

unconscious types of affect. Dougherty, Abe and Izard (1998) refer to “independent emotions,” which, like SAMA’s dispositions and basic emotions, are not dependent on cognitive appraisal or cognitive development for emergence. They also refer to “dependent emotions,” which, like SAMA’s feelings, are dependent on cognitive appraisal and cognitive development for emergence and expression. Cicerelli (1996) discusses developmental levels of affect, with Level 1 Emotions being universal and primitive affects that are elicited by sensory representations of stimuli features related to and necessary for survival that are exhibited by young infants. These correspond roughly to SAMA’s basic emotions. Cicerelli’s Level 2 Emotions are developments of universal and primitive affects in relation to experience and modelling in childhood, and these are experience-enhanced basic emotions that become secondary emotions. Level 3 Emotions, according to Cicerelli’s developmental hierarchy, involve higher order cognitive processes and language. This level would correspond to what are termed feelings in SAMA. Evaluation of stimuli occurs at different levels of a hierarchy (Parksepp, 1992): innate preferences or aversions at the first level, followed by learned preferences or aversions, and then, at the highest level, by goals, experience, beliefs, and anticipated outcomes.

7.3.1 Distinction Between Primary and Secondary Affect

The dual route for evoking affect provides a distinction between primary and secondary affect and this distinction is crucial in the affect/cognition debate.

Rather than arguing contrary to the cognitivists assertion that all cognition is preceded by affect (e.g. Zajonc, 1984), I prefer the alternative inclusive

concept that different levels of affect involve different types of appraisals: the low road is capable of producing types of affect that are “genetically ordained but experientially modulated” (Panksepp, 1990, p. 291) and the high road produces types of affect that are socially and experientially determined that can be cognitively and behaviourally managed.

Basic emotions, those that are innate, do not require cognition as it is previously defined (Damasio, 2003; Davis, Hitchcock & Rosen, 1991; Forgas, 1999; Geary 1996; Gray, 1999; Izard, 1984; Lang, Davis, & Ohman, 2000; Panksepp, 1990,1994; Parkinson, Briner & Reynolds, 1996; Phelps, 2006; Porges, 1995; Scherer, 1994). Panksepp (1994) states that “[basic] emotions require no cognitive inputs (although they may often be triggered by them)” (p. 225) and that “neocortification experiments [or the severing of cortical connections] in rats early after birth leaves basic emotive tendencies intact, indeed intensified” (ibid.). He argues that such experiments “affirm that cortico-cognitive processes are not essential for the expression of basic emotional tendencies” (Panksepp, 1994, p. 225). Braeutigm, Bailey and Swithenby (2001) also state that there is evidence that early appraisal of incoming stimuli does not involve higher order cortical processing.

High road affect or feelings, both secondary and conscious feelings, involve cognition. The complex appraisals that provoke secondary feelings, such as embarrassment, may involve memory, context, beliefs, knowledge, goals, and a sense of self and an evaluation of context. Conscious feelings arise when the mind becomes aware of the somatic state created by a significant basic emotion.

This basic emotion may gain significance by provoking cognition relating the current event to a past event with affect significance. Where confusion may arise is in the difference between fear that is simple, innate, and general; and fear that is complex, learned, and specific (Dalglish, 2004). For example, an individual's fear of large, wild animals is different from that individual's fear of falling off a camel. The first fear is hard-wired; it is general and based on an instinct that promotes survival. The second fear is based on experience and is not a fear of the large animal itself, but of an activity that evokes similar knowledge or experience that is associated with fear. For example, the individual may never have ridden a camel before, but may have witnessed a fellow traveller fall off a camel, or may be experiencing a slipping sensation that recalls a previous experience when the individual fell off a horse.

7.3.3 Non-Linear Relationship Between Affect and Cognition

The affect-cognition relationship is not linear, (Lewis, Sullivan, & Michaelson); since affect can provoke cognition and cognition can provoke affect. Every basic emotion that is evoked by stimuli does not result in conscious feeling (Damasio, 2003; Scherer, 1994). As well, every cognition does not prompt a basic emotion or a feeling (Zajonc, 1984). While affect and cognition are distinct and partially independent systems, they most often function together. Like a man and a woman in a ballet, cognition and affect each has a distinct part, sometimes dancing alone on the stage, and sometimes dancing separate on the stage, yet together they change and enhance the drama of life.

7.3.2 Neuroscience: Not all Affect Requires Cognition

Neuroscience posits that while the neural systems of both dispositions and basic emotions may exist and operate independently from feelings, they also provide an ontogenetic and phylogenetic foundation for conscious and secondary feelings, which require cognition to emerge and change as an individual matures and gains life experience.

There is neuroscientific evidence, most notably in research on fear and anxiety, that primal processing of incoming sensory stimuli do not require conscious appraisal (Davis, Hitchcock, & Rosen, 1991; Forgas, 1999; Lang, Davis, & Ohman, 2000; Panksepp, 1990) nor access to stored schemata or conceptual-associative structures of the brain (Gray, 1999; Scherer, 1994). In addition, there is general agreement among neuroscientists that the basic emotions, including fear, anger, disgust, sadness, happiness and surprise, are innate and “biologically wired” (Forgas, 1999, p. 593). For example, Davis, Hitchcock, and Rosen (1991) found that the fear response of freezing is not due to conditioning, since electrical stimulation of the central nucleus of the amygdala produces the same response as an explicit fear stimulus, including changes in autonomic activity such as blood pressure, heart rate, respiration, enhanced reflexes, increased attention, and facial expression. This can transpire because the amygdalae, which are primary processors of incoming stimuli, have direct connections to brainstem systems involved in these innate, species-typical autonomic and endocrine reactions. For example, the amygdalae have

connections to brainstem nuclei that control facial muscles that produce facial expressions (Ledoux, 1994).

These lower regions of the brain, primarily the amygdalae, but including the hypothalamus and other limbic areas, which generate dispositions, basic emotions, and instinctive tendencies, serve as a foundation for more complex affect that develops as an individual matures physiologically and psychologically. The more simple neural substrates of dispositions and basic emotions serve as the basis for the complex neural pathways which support a growing concept of self, based on development of the multi-modal cortex and the commensurate bank of experiential memory that makes each individual unique. Panksepp (1990) maintains that affect is mediated by cognitive appraisals in a very distal neural sense, since cognitive appraisal cannot create affect without the active participation of very specific types of neural affective circuits in primitive parts of the brain, namely the hypothalamic and limbic systems (*ibid.*), specifically the amygdalae (Ledoux, 1994a; 1996a; Phelps, 2006). The amygdalae, capable of orchestrating dispositions and basic emotions without cortical processing due to their direct neuronal connections to other parts of the brain such as the hypothalamus and periaqueductal grey (Panksepp, 1998a), become a strong interface between cortical information processing and affective arousal as a function of brain development and encoding of life experiences. The amygdalae also play a critical role in this affective encoding of life experiences (Damasio, 2003; Ledoux, 1998; Panksepp, 1994; Scherer, 1994). Panksepp proposes that basic affective states are comprised of “distinct reverberatory neural patterns” (p.

318) and Kagan (1994a) accepts that different brain sites are activated for what he terms different families of affect (pp. 9-10). Damasio (2003) and Phelps (2006) propose that specific neurotransmitters orchestrated by the amygdalae may “mark” a memory for affective valence, thereby enhancing memory consolidation in the hippocampus, to which the amygdalae has direct neuronal connections. This “marking” does not occur in patients with damage to specific parts of the amygdalae. As well, thalamic connections from the amygdalae are the gateway to the neocortex where the many representations of objects are consolidated and processed in relation to memory, knowledge, and context. Thalamic connections also feedback from the neocortex to the amygdalae, allowing the amygdalae to provoke voluntary as well as involuntary actions and reactions. This indicates that the amygdalae can influence responses both pre- and post-cortical processing. Clearly we cannot underestimate the role of the amygdalae in all levels of affect and human functioning, including cognition. Affect, in the manifestation of the amygdalae, not only chooses the dancers in the ballet, but also directs the orchestra and the choreography of the spectacle of life.

CHAPTER 8: AFFECT-RELATED CONSTRUCTS AND NEUROPSYCHOLOGICAL PHENOMENA IMPORTANT TO EDUCATION

8.1 Constructs and Phenomena to Consider

Of the many affect-related constructs and neuropsychological phenomena, this paper will present emotional intelligence, meta-emotion, emotional contagion, and emotion regulation because of their salience to SAMA and importance to educational neuroscientific research necessary for developing neuropedagogically sound curriculum that addresses the affective needs of humankind. The construct of emotional intelligence will be examined and subsequently rejected, since it views affect as a subject of cognition. Research into meta-emotion, emotional contagion, and emotion regulation reveal that understanding affect and its effect on others, as well as the empowering of individuals to manage affect in themselves, have potential for a vital role in the field of education, both for teachers and learners.

From the burgeoning field of affective neuroscience (Davidson, Scherer, & Goldsmith, 2003), arise the study of three neuropsychological phenomena of great interest to educators, namely meta-emotion (M-E), emotional contagion (EC), and emotion regulation (ER). Some of the many other constructs that will not be examined here that are related to ER are emotional and social competence (Saarni, 2000; Zins, Travis, & Freppon, 1997), positive

affect/positive emotion (Davidson, 2003; Davidson, Jackson, & Kalin, 2000; Frederickson, 2001, 2004; Sheldon & Lyubomirsky, 2004, 2006; Tugade & Fredrickson, 2004), affective style (Bell & Wolfe, 2004; Davidson, 1999, 2003, 2004; Davidson & Irwin, 1999; Davidson, Jackson, & Kalin, 2000), social intelligence (Goleman, 2006), and psychological resilience (Tugade & Frederickson, 2004). The expanding constructs and the increasing interest in the field of ER in the last seven years reveal the emerging recognition that developing the ability to recognize, reflect upon, and self-regulate affect is a salient task to human functioning that involves cognition.

8.2 Emotional Intelligence

While the emergence of the phenomenon of emotional intelligence has done much to create awareness of affect and its significance in human functioning, its transformation into being recognized as another type of cognition has been detrimental to modern understanding of what truly constitutes affect.

Affect is a major phenomenon, not another type of intelligence. The term “emotional intelligence” (EI) was first defined by Salovey & Mayer, (1990) as “the ability to monitor one’s own and others’ feelings and emotions, to discriminate among them, and to use this information to guide one’s thinking and actions” (p. 189). Unfortunately, the construct of emotional intelligence been expanded to include personality traits, social skills, and motivational skills (Lopes & Salovey, 2004) as well as to stand for the cognitive perception and cognitive control of affect, and in extremity, to stand for affect itself.

There are several reasons why I do not accept the concept of emotional intelligence (Goleman, 1995) as a social nor educational stand-in for affect. Firstly, I reject the cognitive model of emotion upon which emotional intelligence is based. Secondly, I take umbrage with educators' and business leaders' new idolization of emotional intelligence because this concept lacks conceptual rigor.

Affect is not a type of intelligence; it is not a type of cognition. Researching affect as a subset of cognition is counter productive to understanding its differences (Panksepp, 1990) and denies the neuroscientific research that indicates affect arises from differing neural substrates (Damasio, 1998, 2000b, 2001a, 2003; Davidson, 2000, 2004; Gray & Jeffery, 1991; Ledoux, 1994; Zajonc, 1984); and chemical states (Panksepp, 1990;) than cognition; and it denies its phylogenetic origins and ontogenetic nature. Buckley, Storino, and Saarni (2003) also take umbrage with the construct of emotional intelligence because it regards affect as a "distinct mental ability" and excludes culture, context, self-representations, the role of emotional development, and the belief and value systems of the individual (p. 181). In addition, defining affect as a result of cognitive functions such as evaluation, judgement, appraisal and decision-making is to limit its facets to those that involve cognition, and clearly, affect is much more. Panksepp (1990) argues that in order to propose a viable concept of affect, we must "credibly answer, in neurobiological terms, what it means for a creature to express and experience the central states" (p. 291) of affect that are "caused by distinct types of neurochemical activities in the brain"

(ibid.). We must first understand how primal affects function before we can hope to understand more complex cognitive feelings (Panksepp, 1998, p. 301).

As well, defining one's ability to read and manage the affects of one's self and others as a type of intelligence ascribes a certainty to it. The implication that we are limited by a certain innate potential to manage affect is misguided. If emotional intelligence referred to emotion recognition and regulation, or affect recognition and regulation as I prefer to term it, that appellation would be more palatable. Salovey, Hsee, & Mayer (2001) refer to "emotion regulation" as an "aspect of emotional intelligence that is most relevant to mental control," and as "strategies people use to adjust their feelings" (p. 108), implying, as SAMA posits, that conscious affect or feelings can be cognitively managed or adjusted.

Nicola Schutte and others use Salovey and Mayer's EI construct to investigate the relationship between "the ability to perceive, understand, regulate and harness emotions in self and others" (Schutte, Malouff, Simunek, & McKenley, 2002, p. 769), a definition that more closely resembles affect regulation (AR) than intelligence. Reinforcing the findings of the research of others (Martinez-Pons, 1997; Ciarrochi et al., 2000), Schutte and her fellow researchers found evidence that higher levels of emotional intelligence, or ability to manage affect, measured with the Multi-factor EI Scale, are associated with higher positive general mood and higher self-esteem. They also report that persons with higher EI were better able to maintain a positive mood and self-esteem when presented with negative stimulus, and that they also maximized the positive mood impact of a positive stimulus (Schutte, Malouff, Simunek, &

McKenley, 2002, p. 780). Subjects with higher EI also showed a faster recovery of positive mood state after a negative experience (ibid., p. 782). These findings in EI correspond to research in affect regulation (AR); indeed, they appear to be researching the same phenomena, but referring to it using different terms.

The fact remains that affects are different from cognitions in that they are “special-purpose, gene-based, neurochemical readouts” (Buck, 2000, p. 47). As already argued, not only is affect different from cognition, it is also primal to cognition. I agree that cognition can be utilized to comprehend and manage affect, as in higher levels of affect regulation. Kristjansson (2006) paraphrases Salovey and Mayer’s definition of emotional intelligence as “the capacity to process emotional information accurately and efficiently, including the capacity to perceive, assimilate, understand, and manage emotions” (p. 41); and with this I have no argument. However, I have great difficulty in accepting emotional intelligence as presented by Goleman (1995) as the core concept in defining and interpreting emotion. Like Kristjansson (2006), I take issue with Goleman’s goal of managing affects, which is to achieve success (e.g. Goleman, 1998; Goleman, Boyatzis, & McKee, 2003) and specifically in business, which is rather unlike the Aristotelian goal of controlling affect, that of eudaimonia, or happiness, and well-being not only of the self, but of the self for the betterment of the social community. Goleman’s goal, as further exemplified in his more recent book where he talks about “the emotional economy” (Goleman, 2006), is egocentric and lacks the moral agency of Aristotelian happiness which is loaded with self-

respect and enhancement of the moral community rather than personal success in business.

Emotional intelligence has yet to be documented as an identifiable state or process and its description (see Goleman, 1995, pp. 43-44) is a compendium of other qualities and several complicated processes, such as “knowing,” “managing,” “motivating,” and “handling relationships” (Goleman, 1995, pp. 43-44). While Goleman attempts to present emotional intelligence as the function of specific brain structures, he does not present evidence that individual differences in regulating affect are structure-related. That said, I do not oppose moral education nor affect education. What I do espouse is that we carefully define what affect is, based on neuroscientific evidence; and create a theoretically sound paradigm upon which to conduct research to confirm its worthiness before we translate such concepts into curriculum and pedagogy. SAMA is proposed as such a paradigm for education.

8.3 Meta-Emotion

Another area of research that could well have implications for pedagogy is that of meta-emotion, defined as awareness of one’s own emotions, the emotions of others, and I would add, how emotions function. A longitudinal study by Garner (1999) of fifty children, beginning at age four and ending at age eight, revealed that preschool children whose mothers label and discuss emotional states and experiences with their children may have higher levels of knowledge and implementation of emotional display rules four years later. Knowledge of emotional display rules are defined in the study as knowledge of facial

expressions, knowledge of normative emotions in emotionally charged situations, and awareness of emotional context in regard to self and others (Garner, 1999, p. 249). The study suggests that children who are taught about emotions tend to be more emotionally aware, empathetic, and able to self-regulate their own emotions (ibid, p. 262). Gottman, Katz & Hooven (1996) also note that children who were emotion coached by parents were less likely to be ill. Results of these studies imply that preschool childcare workers, kindergarten teachers, primary teachers, and parents could facilitate emotional knowledge by discussing emotions and emotionally charged situations with children. With training, these people could improve children's emotional knowledge by creating awareness of emotions, and aide children's emotional development by establishing emotion norms. Silvia's study on self-awareness and emotional intensity suggest that "self-focused persons are more likely to notice their affective experiences" (2002, p. 210) and may as a result of this emotion-salience be more likely to modulate their behaviour. Silvia also notes that "self-awareness reduces egocentrism and enhances perspective taking" (ibid, p. 211) and speculates that self-awareness may amplify the ability to be empathetic and also influence emotion by aligning emotion-relevant attitudes and habits with behaviour. Stoker (2002) also advocates that teaching students identification of and strategies for effortful management of emotions are related to cognitive functioning and social competence. As children age, they increase knowledge of the duration of their affect; the ability to discriminate and verbalize the different basic emotions; the capacity to assess the affective states of others; the ability to describe and

distinguish among different simultaneous feelings, and knowledge of cultural rules regarding expression of affect (Denham, 1998). Ciarrochi and Scott's longitudinal study of 163 university students found that students' difficulty in identifying and describing affect predicted increased anxiety and decreased positive affect (2006, p. 239). In addition, this study showed that low levels of "emotional competence," or ability to effectively manage emotion, predicted decreases in well-being over time. (ibid., p. 238). Brenner & Salovey (1997) suggest that teachers could help children in labelling, understanding, and interpreting affective clues and rules.

Meta-emotion programs are generally referred to as social and emotional learning (SEL) programs (see Zins, Weissberg, Wang, & Walberg, 2004 for an overview), or social and emotional education (see Cohen, 2001 for an overview) emotional literacy programs (see Faupel & Sharp, 2003 for an example), or emotion coaching programs (see Gottman, Katz, & Hooven, 1996). There are a several programs that claim to address the affective needs of students (see Goleman, 1995, pp. 268-278), such as the Self-Science curriculum, the Social Competence Program, Life Skills, Child Development Program, Head Start, Resolving Conflict Creatively Program and Promoting Alternative Thinking Strategies, or PATHS, but many address emotional literacy indirectly or as sub-curriculum in the program.

While some research on SEL programs indicates that teaching about social and emotional learning in the context of curriculum "can improve children's success in school and life" (Walberg, Zins, & Weissberg, 2004, p. 209), others

claim there is “little empirical data on the relationship between social and emotional skills and academic outcomes” (Lopes & Salovey, 2004, p. 79). SEL programs are not clear as to how they “teach students to manage emotions” (Walberg, Zins and Weissberg, 2004), and there appear to be many variations within programs, with many of their goals vague, such as “promoting positive student attitudes” and “developing awareness of self and others” (Fleming & Bay, 2004, p. 94). As well, SEL literature indicates that many of the diverse programs that fall under its umbrella are based on neurocognitive models, with the aim to improve cognitive performance. Indeed, Walberg, Zins and Weisberg (2004), in their conclusions on an overview of SEL programs, lament that increasingly SEL programs address practices and use evaluations geared to improve and measure academics and not affect competence. They go so far as to suggest that SEL be changed to SEAL, or Social, Emotional, and Academic Learning, to better represent current conceptualization and practice (ibid., p. 217).

Social and Emotional Education (SEE) has recently evolved to be termed Social, Emotional, Ethical, and Academic Education (Cohen, 2006), perhaps a trend responding to increased pressure on educators to raise academic standards. Cohen (2006) views social-emotional skills as part of the foundation for participation in democracy and a better quality of life. His approach differs in that he espouses teaching social and emotion skills as a formal course that he hopes will help to end the “cycle of misunderstanding, violence, and despair” (ibid., p. 228) in today’s society. He advocates a pedagogy “informed by social-emotional and ethical concerns” (ibid., p. 201) based on action-research

partnerships between researchers and practitioners and using scientifically valid evaluation measures.

The National Emotional Literacy Interest Group (NELIG) in Britain, whose main proponent, Peter Sharp, an educational psychologist, has few scholarly publications (Sharp, 2000), has been instrumental in establishing wide-spread emotional literacy programs in Britain. The most notable is the Southampton Emotional Literacy Interest Group (SELIG) which has published a book of guidelines for their literacy project, *Promoting emotional literacy*, edited by Adrian Faupel and Peter Sharp (2003). While there is no theoretical base given in the guide book, there is acknowledgement given to Goleman's work. In Sharp's own book, *Nurturing Emotional literacy: A practical guide for teachers, parents, and those in the caring professions* (2001), he presents a précis of several "theories of emotions" (pp. 7-9), including Darwin's principles of emotion, the James-Lange theory, the Cannon-Bard thalamic theory, Schachter's two-process theory, and Lazarus' appraisal theory. However, beyond giving an overview, he does not espouse any of these theories as providing the basis for his work. The two programs, NELIG and SELIG are based on Goleman's emotional competence framework (Faupel & Sharp, 2003, pp. 4,18; Sharp, 2001, p. 2), but there are no details on how meta-emotion is taught. Sharp (2001) explains that he prefers the term emotional literacy to emotional intelligence, because intelligence implies a fixed state and because intelligence has "accrued a perjorative connotation" (p. 2). Gottman, Katz, and Hooven (1996) have developed and tested apparent training intervention in emotion coaching, based on a meta-emotion philosophy

that examines feelings and cognitions about individual parents' affects and their children's affect. These researchers claim that emotion-coached children "have a heightened sense of awareness of their own emotions, a better ability to self-regulate their own upset, and a greater ability to attend to the salient aspects of any challenging peer situation" (p. 262).

Despite the problematic lack of a researched theoretical base or paradigm, and the blatant rationale that "Improving Emotional Literacy = Improving Standards" and the statement that "emotions" are "a lever (perhaps the [italics in original] lever) for raising standards" (Faupel & Sharp, 2003, p. 2), the program does have some merit. Firstly, it recognizes the importance of affect in learning and in interactions with others. Secondly, it does not see emotional literacy as an add-on activity, but as imbedded in a "curriculum for all" (ibid., p. 18). Thirdly, the program involves teachers, school employees, managers, trustees, parents, as well as social and health services, with the implication that healthy affect involves the entire workplace and requires the support of the community. The program for parents involves "assertive parenting," a style of parenting deemed conducive to appropriate emotional coaching and modelling. Fourthly, a strength of the program is that it is not prescribed in detail for each school. Rather, each school is given the franchise to develop their own goals, rationale, and implementation strategies. While there appear to be no scholarly publications on the projects, there are evaluation processes included in the guidelines. Without scholarly research and at least a hands-on view of the

program, it is difficult to analyze it with any academic rigor. However, it does appear to have some positive aspects, although it lacks a stated theoretical base.

A Canadian program that could well be a vehicle for implementing meta-emotion is the Healthy Schools project, whose aims involve improving physical, mental, social, and intellectual health as part of a holistic education mandate. This project recognizes that “[p]hysically and emotionally healthy, engaged students make better learners” (Vamos & Lewallen, 2006, p. 23), focuses heavily on the emotional component, and stresses that the well-being of teachers is key to quality education.

It appears that most programs developed to improve affect are based on cognitive models and are implemented with the goal of improving academic performance. What is needed is a meta-emotion program based on a neuroaffective model that more closely reflects current research and develops related methodologies, such as Gottman, Katz, and Hooven’s (1996), designed with the goal of improving well-being and not necessarily cognitive output. We do not need a more powerful weapon or a more powerful internet; what we need is individuals who care about themselves, their fellow man, and preservation of the planet which we co-habit.

8.4 Emotional Contagion

The phenomenon of emotional contagion (EC), also referred to as mood contagion (e.g. Neumann & Strack, 2000), should be of interest to educators. Indeed, Aristotle recognized its function when audiences vicariously experienced

the affects of characters in theatre. Emotional contagion occurs when mimicked or practiced bodily expressions of affect induce that affect. There are two types of (EC): 1) empathetic EC where the individual mimics the affect expressions of another, and 2) self-induced EC, where the individual deliberately practices the expressions of a particular affect. Emotional contagion, often referred to as empathy (e.g. Levenson & Ruef, 1992), is a phenomenon whereby people tend to be influenced by the affect of others around them to feel what others are feeling (Doherty, 1998; Goleman, 2006; Hatfield, Cacioppo, & Rapson 1992, 1994; Kubota, Sato, Murai, Toichi, Ikeda, & Sengoku, 2000; Levenson, 2003; Neumann & Strack, 2000; Vianna, Winstock, Elliott, Summers, & Tranel, 2006) as a result of shared physiology (Levenson & Ruef, 1992). According to Doherty (1998), this is due to “afferent feedback generated by elementary motor mimicry of others’ expressive behaviour” (p. 188). This mimicry refers to a “tendency to automatically mimic and synchronize expressions, vocalizations, postures, and movements” (ibid.) with those of a person with whom one has close contact and often, emotional affinity. This leads to emotional convergence, where two or more people experience the same affect, not because they experience the same external stimulus, but because of mimicry. Evidence that people in close proximity experiencing empathy exhibit “psychophysiological synchrony” (McCraty, 2004), or synchronization of heart and EEG, both intrapersonal and interpersonal enriches the argument for the influence of affect on well-being (McCraty, Atkinson, & Lipsenthal, 2000; McCraty & Tomasino, 2006) and the contagion of affect (McCraty, 2004). Mirror neurons may also play a role in EC

(Damasio, 2003; Gallese, 2005). Gallese's recent research on mirror neurons, subsets of neurons in humans that provide a direct internal experience of another person's act, intentions, or affect, may help explain mimicry and the functional brain correlates of empathy (2005). The phenomenon of emotional contagion reflects Damasio's hypothesis that body states evoked by basic emotions create body maps which in turn elicit neural maps that can evoke feelings (ibid, pp. 88, 89). Goleman (1995) notes that this synchrony happens even if the affect is negative (1995, p. 116). Neumann and Ruef (2000) note that mood or disposition contagion occurs even if the responder is occupied with another task, and even if the responder is only listening to another's emotional expression. The latter implies that not only bodily expressions, but also vocal tone can induce EC.

Self-induced EC is a method of changing or improving personal affect, notably involving basic emotions, by consciously enacting the expression of an affect (Doherty, 1998; Duclos & Laird, 2001; Lee, Josephs, Dolan, & Critchley, 2006; Schnall & Laird, 2004). Ekman's research verifies that subjects who deliberately perform muscular configurations of an affect generate "the physiology and often the subjective experience" (1993, p. 390) of that affect (see also Duclos & Laird, 2001). Damasio (2003) agrees that "'acted' emotional expressions have the power to cause feelings" (p. 71). Levenson's research supports that "facial actions are sufficient for producing subjective emotional experience" (2003, p. 352). In addition, Levenson notes that practiced facial expressions exhibit "the capacity to activate the autonomic nervous system" (ibid., p. 353), which is the body's most critical life support system responsible for

maintaining homeostasis by regulating heart rate, respiration, digestion, sweating, and hormone secretion. Schnall & Laird (2004) call this self-perception theory where if one acts like one is feeling an affect, one will likely experience this affect. They found that not only did the basic emotions result from “practiced expressions” of happiness, sadness, or anger (Schnall & Laird, 2004, p. 788), but that these basic emotions also persisted after the participants stopped practicing the expressions (ibid, p. 793). This study also suggests that participants who are more attentive to their own bodily expression of affect are more responsive to practiced expressions. Ledoux (1996) concludes that “[p]utting on a happy face may not be such a bad idea when you are feeling blue” (p. 295).

Doherty’s results also suggest that emotional expressions have an effect not only on emotional behaviour, but also on cognition: recall varied with the intensity and quality of the emotional state. For example, recall was enhanced by the intensity of happiness, but negatively affected by sadness (1998, p. 203). The findings of his study reinforce the hypothesis that participants who are more cue responsive are more susceptible to emotional contagion and its related effect on memory. In related research, Casciaro, Carley, and Krackhardt (1999) showed that positive affectivity (PA) positively impacts short-term cognitive processes and also influences long-term perceptions of patterns of evolving relationships. A person with high PA is typically cheerful, enthusiastic, happy, and feels good about him/herself, and leads a happy, stimulating life (Casciaro et al, 1999, pp. 287, 288). Casciaro, Carley, and Krackhardt (1999) project that persons with high PA contribute to healthy group dynamics and effectiveness (p. 301) and that

positive working conditions may help foster PA among workers. While it would be somewhat premature to generalize these findings to the emotional work of teachers who endeavor to project a positive self in the classroom, Doherty (1998) expresses the utility of exploring the “dynamics of emotional contagion in relationships between...teachers and students” (pp. 205, 206), among other pairings.

Fiedler, Nickel, Asbeck, and Pagel (2004) found that mood supports congruent cognitive processing. In other words, information that is congruent with a learner’s present affective state has a cognitive processing advantage. Positive moods support the cognitive process of assimilation, where internalized structures are inferred on the stimuli from the environment; it is a knowledge-driven process. Negative moods support the cognitive function of accommodation, where stimulus facts are predominant; it is a stimulus-driven process. Positive moods are best for tasks that involve creativity and generative processes. Negative moods are best for tasks that require quick analysis and action (Fiedler, et al., 2004, p. 587). Parrott and Spackman (2000) state that “mood congruent memory biases can be seen to play a role in self-perception; in judgment of other people; in the effect of persuasive communications; and in evaluations of ...just about anything else” (p. 480). These findings would appear to reinforce Damasio’s somatic marker theory, where positive/negative markers, based on the body states elicited by the object or event in relation to oneself, aid in making decisions by colouring choices as positive or negative and thereby

“increasing the efficiency of the reasoning process” (Damasio, 2003, p. 148; see also Forgas, 1999). Once again, affect is seen to influence cognitive functions.

Given the power of EC to influence classroom affect and concomitantly the teaching and learning taking place, EC is an area ripe for exploration and research for educators.

8.5 Emotion Regulation

Aristotle, Descartes, and Spinoza are advocates of managing affect. Aristotle extolled training the body and intellect to contain and habituate emotions. Descartes advocated cultivating and habituating the passions by teaching how to assess affect and by practicing and modelling control of affect. Similarly, Spinoza espoused educating individuals to utilize ‘right reason’ to understand and habituate affect. Emotion regulation can be regarded as the modern version of managing affect, but its premise is different: affect is not regarded as an inherent destructive force that must be suppressed and controlled, but rather as a positive phenomenon whose normal function is constructive and conducive to well-being. Negative affect is “linked to increases in health problems, including an enhanced susceptibility to infection” (Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 1993, p. 186). Affective neuroscience demonstrates that positive affect is more desirable for human health and relationships and that emotion regulation enables attainment of positive affect.

Also referred to as “emotional coaching” (Goleman, 1995; Gottman & Scott, 2006), “coping” (Garnefski, Kraaij, & Spinhoven, 2001; Gross, 1998;

Lazarus, 1996), and emotion-related regulation (Eisenberg & Spinrad, 2004), emotion regulation or ER (Campos, Frankel, & Camras, 2004; Cole, Martin, & Dennis, 2004; Gottman & Katz, 2002; Gross & Thompson, 2007; McRaty, Atkinson, & Tomasino, 2003; McRaty, Atkinson, Tomasino, Goelitz, & Mayrovitz, 1999; McCraty & Tomasino, 2006), has been shown to foster positive affect and reduce stress (Diamond & Aspinwall, 2003b; McCraty & Tomasino, 2006). As well, ER is an important factor in determining well-being and successful human functioning (Carstensen, Fung & Charles, 2003; Garnefski, Kraaij, & Spinhoven, 2001). There are many ER strategies (e.g. Diamond & Aspinwall, 2003a; Garnefski, Kraaij, & Spinhoven, 2001), both unconscious and conscious, both innate and learned, and it is the latter that can be studied and practiced to improve human functioning.

Emotion regulation is as amorphous a concept as emotion, and it is “embedded in emotion” (Lewis & Steiben, 2004, p. 372), meaning it cannot exist separately from affect. There has been much discussion on the definition of emotion regulation (ER) (e.g. Beedie, Terry, & Lane, 2005; Diamond & Aspinwall, 2003a, 2003b; Eisenberg & Spinrad, 2004; Lewis & Steiben, 2004; Thompson, 1994;), its constructs, (Silk, 2002; Zins, Weissberg, Wang, & Walberg, 2004), and its perimeters, Thompson’s definition is most inclusive of the research conducted at the time of its publication: “ER consists of the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one’s goals” (1994, pp. 27-28).

Because powerful affect can disorganize and disrupt cognitive and psychological processes, modulation of affect is “essential for basic state regulation [homeostasis], behavioral exploration, cognitive processing, and social competence” (Diamond & Aspinwall, 2003a, p. 126). Emotion regulation capacities and strategies developed during childhood and adolescence are internalized through use and carry over into adulthood where they are influential relating to affect management, problem solving skills, social support network building, relationship quality, goal setting and realizations, as well as mental and physical health (Diamond & Aspinwall, 2003a).

The increasing interest in the phenomenon of ER in the last dozen years reveals the emerging recognition that developing the ability to recognize, reflect upon, and self-regulate affect is a salient task to human functioning (Thompson, 1994) that clearly involves, at least on some levels, cognition. Silk (2002) goes so far as to theorize that adolescents who have difficulty regulating negative affect and lack a repertoire of coping strategies may be more likely to turn to drugs for assistance. Lopes and Salovey (2004) note that children prone to aggression have limited affect response repertoires and few alternate strategies for dealing with interpersonal problems. Stoker (2002) found that children who have trouble controlling feelings or anger, frustration, sadness, fear, and exuberance are “more likely to have trouble responding appropriately to overtures and interacting with other children” (p. 94), and suggests that certain types of hyperactivity are associated with under controlled affect (p. 75). Stoker also reports that children with better ER strategies are more accepted by their peers (*ibid.*, p. 110) and

advocates for classroom-based programs that teach children to recognize and identify their feelings and provide strategies for ER (see Stoker, 2002, for two examples of such programs). As well, there is recognition among neuropsychologist that dysregulated affect is related to a wide range of emotional disorders, such as anxiety disorders, panic and phobias (Silk, 2002). Others suggest that the quality of care and modelling of ER in caregiver/infant relationships make critical contributions to a child's developing of ER strategies (Gottman & Katz, 2002; Stifter, 2002; Tonyan, 2001). There is evidence that individuals who enjoy more positive affect, such as joy, happiness, and contentment, experience social, intellectual, and physical benefits (Lyubomirsky, King & Diener, 2005; Sheldon & Lyubomirsky, 2006). High levels of stress, a type of negative affect, are associated with high levels of cortisol, a neurotransmitter whose prolonged exposure prompts cell death and decreased neurogenesis, defined as growth and development of neurons, in the hippocampus (Davidson, Jackson, & Kalin, 2000), negatively affecting memory. Research shows that both acute and chronic experiences of negative affect have immediate as well as long-term effects on autonomic, neuroendocrine, and immune functioning (Diamond & Aspinwall, 2003a). In contrast, good/pleasant dispositions or moods bias perception, thinking, judgment, memory and behaviour toward more positive content and bad/unpleasant dispositions do the opposite (Parkinson, Totterdall, Briner, & Reynolds, 1996). Other studies indicate a positive link between affect regulating skills and well-being, both psychological and physiological (e.g.

Ciarrochi & Scott, 2006; Hardie, Critchley, & Morris, 2006; McCraty, Atkinson, Lipsenthal, 2000).

Given its salience to human functioning, ER is pertinent to educators, not only in teaching and learning, but in what it is to be human, since ER involves human affective interaction and is important to cognitive functioning, as well as psychological and physiological well-being.

8.6 Affect Regulation and the Somatic Appraisal Model of Affect

Before commenting further on the important phenomenon of emotion regulation, let me clarify its definition in light of the Somatic Appraisal Model of Affect. Hereafter emotion regulation (ER) will be referred to as affect regulation (AR), since it involves managing all types of affect, including dispositions, basic emotions, and conscious and secondary feelings. Affect regulation is here defined as a neural, somatic, and behavioural phenomenon that involves the automatic and/or purposeful managing of affect, both pro-active and retro-active, involving both appraisal and reappraisal functions, and occurring both intrapersonally and interpersonally, in order to promote positive homeostasis and affect (see Levenson, 2003). High levels of well-being are associated with low basal levels of amygdalae activation, appropriate cognitive affect regulation function, and rapid physiological and chemical recovery from negative affective situations, asymmetric left-sided prefrontal cortex activation, and lower baseline measures of cortisol (Davidson, 2004). The phenomenon of AR is highly organized and intertwined with all other types of development (Gross &

Thompson, 2007; Kopp & Neufeld, 2003; Saarni, 2007), such as neural, physiological, cognitive, affective, and social. AR can involve diverse brain regions (Beer & Lombardo, 2007; Ochsner & Gross, 2007), such as the amygdalae and prefrontal cortex (Davidson, Fox, & Kalin, 2007). However, research indicates that most documented AR involves the orbitofrontal cortex (OFC), since damage to the OFC results in deficits in many AR strategies (Beer & Lombardo, 2007, pp. 71-72). Others have researched the roles of specific brain regions activated by different types of AR (Beer & Lombardo; Davidson, Fox, & Kalin, 2007; Jackson, Mueller, Dolski, Dalton, Nitschke, & Urry, et al, 2003; Ochsner & Gross 2007; Zelazo & Cunningham, 2007). While environmental factors such as role modeling and emotional climate, both at home and outside the home, influence children's tendency to positive affect and effective affect regulation (Davidson, Jackson, & Kalin, 2000; Stifter, 2002), AR is "also apparently mediated by genetic factors" (Goldsmith, Buss, & Lemery, 1997, p. 17; see also Goldsmith & Davidson, 2004, p. 361; Kagan, 1994, p. 18). AR strategies correspond to affect development and vary from age group to age group (see Biesecker 2001; Brenner & Salovey, 1997; Elliott, 2000; Silk, 2002; Stoker, 2002; Tonyan, 2001), with developmental trends including increased use of cognitive and intrapersonal strategies (Saarni, 2007), and increased ability to distinguish between controllable and uncontrollable stressors (Brenner & Salovey, 1997). Davidson, Jackson, and Kalin (2000) note that there are changes in affect neuronal circuitry until puberty. Also, the contribution of AR to

well-being, an individual's ability to cultivate homeostasis, improves with age (Carstensen, Fung, & Charles, 2003).

8.6.1 Core Features of AR

Before venturing too far into the complexities of AR, it is essential to present its core features, namely that AR involves 1) regulating both positive and negative affect, 2) both control of one's own and others' affect, 3) a continuum of strategies, from autonomic, effortless, and unconscious to cognitive, controlled, and conscious, and 4) strategies that are neither good nor bad that can be learned and planned, and 5) changing facets of affect, such as intensity or duration.

Firstly, regulation of affect is not confined to controlling negative affect. Any affect, negative or positive can be favourable or unfavourable, depending on the situation and context. For example, it may be appropriate for a person to be angry at an injustice, and not appropriate to express joy at a funeral.

Secondly, AR involves both control of self and others' affect; it consists of both intrapersonal AR and interpersonal AR. Intrapersonal AR encompasses self-development, self image, and self-esteem (Shipman, Zeman, & Stegall, 2001); and interpersonal AR encompasses cultural values, social practices (Raver, 2004), and relationships, all of which are implicated in teacher/learner interaction. Much like affect itself, AR development is related to development of sense of self, and development of a set of social rules, associated with development of the prefrontal cortex and executive function, as well as to

accumulation of experience (Zelazo & Cunningham, 2007). One manages not only one's own affect, but also often attempts to manage the affect of others. For example, an individual may try to calm a distressed child by holding the child and singing a calming song.

Thirdly, AR includes a wide range of strategies (Gross & Thompson, 2007), from an infant's autonomic closing of eyes in response to something that is frightening to an individual using reframing to diminish her/his reaction to a person who has been rude by reasoning that the rude person was tired and stressed and did not really mean the offensive things expressed. These strategies develop over time and result in a complex repertoire of affect management methods that are retained and utilized. For example, an adult may still use simple aversion strategies such as averting gaze from the scene of a bad car accident while driving by.

Fourthly, strategies for managing affect are not classified as good or bad. A strategy that is appropriate in one situation may not be appropriate in another. For example, it may be helpful if one closes one's eyes during gory scenes in a movie, but it would not be helpful to close one's eyes while bandaging an actual wound. These strategies can be learned and planned. An example of this would be that an individual could be taught how to identify her/his somatic signals that s/he is becoming very angry and plan that when that happens, s/he will remove herself/himself from the situation that is causing the affective reaction.

Fifthly, AR may involve altering facets of affect, such as intensity and duration. These changes can be made to responses in neurological,

physiological, experiential, and behavioural domains. For example, a teacher may not be able to stop the basic emotion of anger upon hearing that one of his students has been bullied, but he can lessen the intensity and duration of his affect by focusing on seeking a way to end the bullying behaviour and providing safety and solace to the victim.

8.6.2 AR Strategies

The importance of AR to human functioning and its implicit relation to teaching and learning dictate that AR strategies be delineated and related to the brain/body function of affect as presented in SAMA. While others have written exclusively on the cognitive control of affect, it is important here to relate different AR strategies, both automatic and cognitive, to the various levels of affect. Damasio writes that we “can *willfully* [sic] strive to control our emotions [affect], to some extent at least” (2003, p. 52), but that “voluntary control over autonomic function is modest” (1999, p. 50). He argues that until we can learn to adjust the “control panels” for autonomic function which are located in the brainstem, hypothalamus, and basal forebrain (ibid., p. 40), all a part of the multi-component systems of affect triggering and affect regulation, regulation of unconscious affect, including dispositions and basic emotions, is limited. If the affect originates in the limbic system and is therefore unconscious, one cannot stop autonomic appraisal. However, one may influence the subsequent appraisal by anticipating possible inducers and avoiding, negating, or diminishing those objects or events that provoke an unfavourable affective response. For example, if sight of one’s ex-spouse makes one’s guts start clenching and one’s heart pound and evokes a

basic emotion which is an unconscious affect; then planning not to attend, or avoiding events where that ex-spouse's presence is inevitable is an example of affect regulation. However, if a chance encounter with the ex-spouse happens, affect regulation can only occur after the autonomic reaction has evoked a conscious feeling. At that point, conscious cognitive AR strategies could be employed, such as wilfully negating or diminishing the affective response so as to lessen its effect on oneself and those present.

There have been other attempts to categorize ER strategies (e.g. Brenner & Salovey, 1997; Ochsner & Gross, 2007; Gross & John, 2003; Gross & Thompson, 2007), but these attempts focus on conscious, cognitive strategies and do not include autonomic methods of AR. SAMA calls for a classification of AR that includes all levels of affect. The two main categories for AR correspond to the levels of affect: 1) autonomic strategies which involve dispositions and basic emotions that are largely unconscious; and 2) cognitive strategies, which act upon feelings, which are conscious.

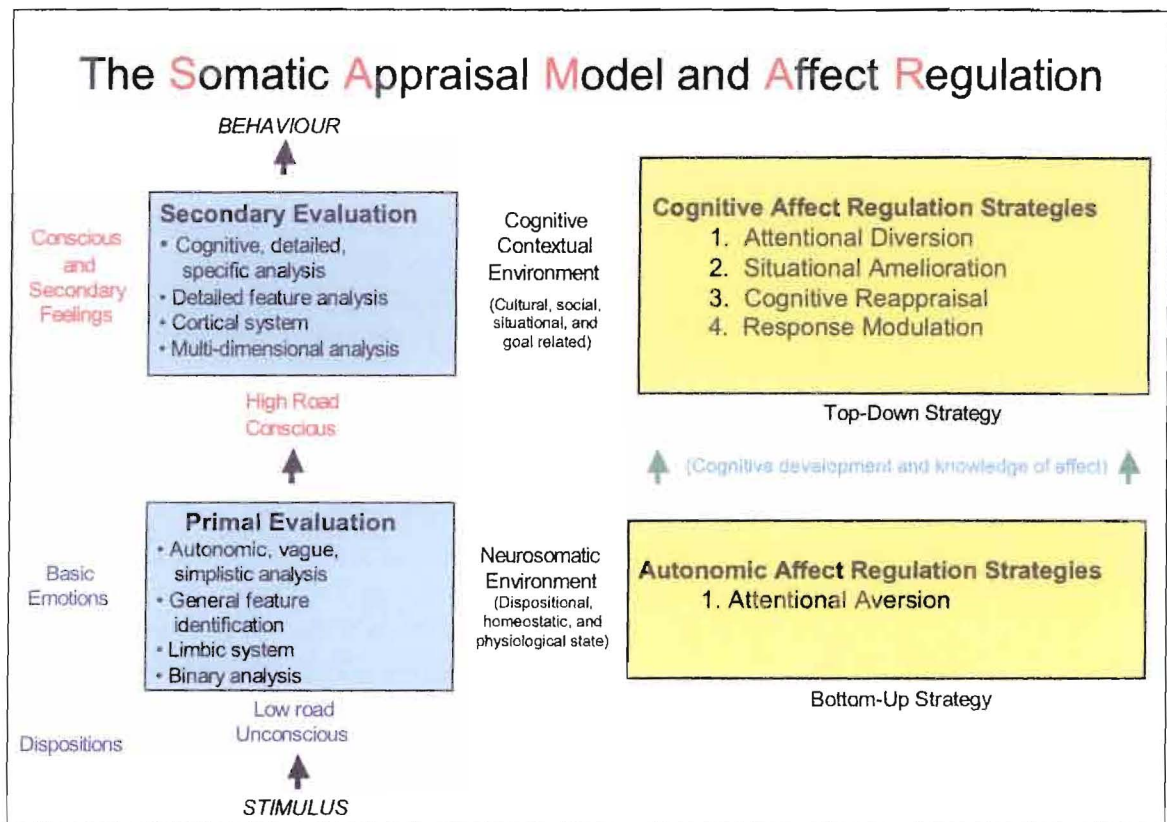


Figure 9: The Somatic Appraisal Model and Affect Regulation

8.6.2.1 Autonomic AR Strategies

Firstly, autonomic strategies are based on simple and unconscious primal evaluation of a stimulus. This low road appraisal is vague and general; it is the quick and dirty binary analysis that determines if the stimulus is positive or negative, good or bad (Ochsner & Schacter, 2000), if it should prompt approach or withdrawal. This neurosomatic analysis relies on classification of general features, such as a large, black object, rather than a bear. Such a generation of AR response is based on the intrinsic or simple learned affective value of a stimulus that involves the amygdalae, ventral portions of the striatum and insula (Ochsner & Gross, 2007), which encode the affective valence of the stimulus. These brain regions send messages to the hypothalamus and brainstem that

control autonomic and behavioural responses. They also send messages to cortical regions that result in conscious awareness of valence and features of an affective response. Autonomic strategies are bottom-up.

Autonomic AR strategies, like the evaluation from which they arise, are simple and immediate and involve attentional aversion. An example of autonomic AR is an infant who turns his head away from a stimulus that is evaluated as frightening (Gross & Thompson, 2007), since if the infant cannot see the stimulus, it registers that stimulus as not there. Fainting can be another type of autonomic AR. A personal example of autonomic affect regulation occurred when I visited a friend who had just had a heart transplant. My friend looked so un-alive with tubes protruding, monitors beeping, and lack of colour and movement, that I slumped to the floor without warning. The simple rationale could be that if my brain was no longer processing the stimulus, my anxiety would not be prolonged or increased. Certainly this was not the most advantageous response, but it could not be stopped since it was automatic. When I became conscious again, then cognitive reappraisal could begin: the nurses could explain that he was alive and why he appeared so ghostly.

8.6.2.2 Cognitive AR Strategies

Secondly, cognitive AR strategies, which involve the neocortex, are based on a conscious secondary evaluation of a stimulus within a social, cultural, and situational context. This high road appraisal examines specific, detailed features of a stimulus in relation to knowledge, past experience, goals, motives, beliefs, including possible AR strategies. Such a sophisticated analysis relies on details

of the stimulus such as the colour, relative size, smell, emitting sounds, direction of movement, relative distance away of the bear, and relate these details to such things as past experience with bears, a belief that the individual can outrun the bear if the bear is distracted, and estimation of distance from the nearest big tree. In this case, the individual may use the AR strategy of self-talk to calm himself as he slowly backs away from the bear, telling himself that he can throw his thermos at the bear and make a run for it to the tree. As the individual backs away, his brain has accessed further information from his expertise in taxidermy and further sensory information that the bear is not moving nor emitting any sound and he begins to doubt that the bear is alive. The AR strategy of self-talk may have helped him to process information about his surroundings, sending the results of the detailed analysis from the neocortex to the limbic system, thereby allowing his body to stop its freezing behaviour and his cognitive brain to create a plan to escape, and ultimately signalling that his body can relax and begin to return to homeostasis, knowing the bear is not alive.

While autonomic AR strategies are bottom-up, cognitive strategies are top-down. Top-down AR strategies involve subconscious input and conscious construction of a perspective of the stimulus. Cognitive AR strategies involve the mindful perception of and behavioural response to the stimulus. They involve the brain regions important for generating mental descriptions of somatic affective states and the affective properties and associations related to a stimulus. Cognitive AR strategies also utilize brain regions important for representing associations between affective outcomes and the choices and mental concepts

arising from perception of stimuli that predict affective outcomes (Ochsner & Gross, 2007). These brain systems function together to enable individuals to utilize various types of control over their affective and behavioural responses. Cognitive AR strategies include 1) attentional diversion, 2) situational amelioration, 3) cognitive reappraisal, and 4) response modulation.

The first major category of cognitive AR strategies is attentional diversion. Attentional diversion occurs when an individual distracts his/her attention to a stimulus by purposefully focusing attention on another object or situation nearby or by willing her/himself to think of something else. In this way, the diversion can be external or internal, but either way, it is a cognitively contrived diversion.

The second major category of AR strategies is situational amelioration. Situational amelioration consists of avoiding or changing a situation in order to alter its affective impact. Neuropsychological research suggests that several brain areas, including the amygdalae, temporal lobes, frontal lobes, and anterior cingulate cortex aid individuals in choosing or creating rewarding situations over punishing situations (Beer & Lombardo, 2007) in order to increase overall positive affect. Situational amelioration includes situation selection, situation modification, and situation intervention and can be proactive. Situation selection entails predicting affective responses to certain objects or events, predicting the types of situations in which they may occur, and planning to seek or avoid those situations in the future. For example, if an individual fears heights, that individual will avoid activities that entail being located high above ground. Situation selection is a proactive AR strategy, since it largely occurs prior to actual

affective stimulation. Situation modification is reactive in that it occurs after the affective stimulus is perceived and entails altering the affective impact of that stimulus. For example, situation modification might involve changing the music from a medieval dirge to a Celtic reel at a party. Situation intervention is also reactive and occurs after both somatic and cognitive assessment of the situation; conscious feeling has arisen. Situation intervention is when a change in the situation is brought about by oneself or others. For example, one might pretend to be ill so that someone else will be attentive and provide an affective distraction. Similarly, situation intervention may occur because one is looking teary eyed and this is noticed by another who intervenes by prompting one's behaviour or someone else's behaviour to change.

The third major category of AR strategies is cognitive reappraisal (Ochsner & Gross, 2004). Cognitive reappraisal is internal and reactive. It involves purposefully reinterpreting the meaning of an object or event that is affectively salient in a way that alters its affective impact. This cognitive reframing can change the meaning positively or negatively. However, there is some evidence that cognitive reappraisals may not lead to decreases in physiological responses (Gross, 1998a), perhaps because physiological or somatic responses are primarily triggered in the limbic system by the amygdalae, and the reappraisal is a response to that somatic mapping. An example of a cognitive reappraisal would be when a teacher is not offended by a student's angry outburst because, upon reflection, the teacher recalls that the student's parent is ill with cancer. A further

example is when a student reflects on a poor grade on a paper and decides the grade is a result of poor performance on the part of the student, rather than the teacher's dislike for the student.

The fourth major category of AR strategies is response modulation. This category is also reactive and internal. It does not involve suppressing a feeling, but includes suppression or conscious alteration of expression and behaviour and occurs late in the AR generation process. Response modulation may influence physiological, experiential, and behavioural responses. This type of AR strategy can be achieved through drugs, both legal and illegal; exercise, such as running or dancing; relaxation techniques, such as deep breathing and yoga; food, such as eating Haagen Dazs ice cream; and regulating affect-expressive behaviour, such as manipulating a response or the magnitude of a response. Regulating affect-expressive behaviour would include altering an undesirable response or amplifying a desirable response. An example of altering a response would be turning a frown into a smile, and an example of amplifying a response would be laughing boisterously to a joke told by one's boss that merely evoked a chuckle.

8.6.3 AR Habits

Research into developing AR habits that improve positive affect and hence well-being has identified several practices. These practices include counting one's blessings, such as journaling the positive events of one's daily experiences; practicing acts of kindness; personal goal striving when the goals

represent one's own values and interests; recounting the aspects of one's best self; and practicing mood enhancing activities, such as singing happy songs, skipping, or clapping one's hands enthusiastically (see Sheldon & Lyubomirsky, 2006). Other common habits of AR are self-soothing, such as humming a song; self-talk, usually silent as in the mind, but sometimes aloud; ruminating; and meditating. For example, when young children are anxious, they may hum a song that their mothers sang to soothe them; and we all have silent conversations with ourselves to encourage, or in some cases discourage us. Encouraging self-talk would include helpful mantras, such as "let it go" or "it's okay..." and silent pep talks that focus on the positive. Discouraging self-talk would include self-put downs such as "you always do that wrong" or reciting a litany of mistakes or errors from the past. Ruminating can be negative or positive, as when a person keeps mulling over a situation and focusing on the negative aspects or the positive aspects of the event or situation. Ruminating is not conducive to positive affect if it dwells on the negative without the will to find a solution or resolution. Negative ruminating has been linked to depressive symptoms (Leen-Feldner, Zvolensky, Feldner, & Lejuez, 2004) and delayed recovery from stressful situations (Ciarrochi & Scott, 2006). Training in meditation promotes brain behaviour associated with well-being (Davidson, 2003) and improved immune responses (Davidson, 2005; Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller, Santorelli, et al, 2003).

8.6.4 Applications of AR

Obviously the field of studying ER is vast and deserves further exploration than can be accommodated in this paper: suffice it to say that this is an area of study ripe with implications for educators. (For an alternate model of ER, see Gross, 1998; Gross & John, 2003; and for its dimensions, see Garnefski, Kraaij, & Spinhoven, 2001). The determining factors of successful AR include ability to identify one's own affect and the affect of others, knowledge of a range of AR strategies, the ability to select appropriate strategies, the ability to implement the strategies (Brenner & Salovey, 1997), effort expended, social support for change (Sheldon & Lyubomirsky, 2004), and the belief that one can improve well-being and social and intellectual functioning by influencing affect through AR.

Parents, caregivers, and teachers, are highly influential in the development of children's automatic and cognitive appraisals related to affect (Gover & Gavelek, 1997). Research indicates that mothers who are generally sensitive and responsive to their infants' needs and more often in a positive affective state have infants who are more secure and more willing to take risks, such as exploring their environment; as well as less prone to fear and anger (Ainsworth, Blehar, Waters, & Wall, 1978). In addition, individual differences in AR ability have their origins in infancy (Stifter, 2002). Adults influence how children evaluate affect-salient situations by 1) modeling effective AR strategies; 2) helping children identify various types of affect; 3) acknowledging affect in self and others; 4) providing affect information about the stimuli or event; 5) helping to explain the causes of affect, for example, "Your cousin is afraid of dogs because

one bit her”; 6) creating affect rules, such as, “It’s okay to feel afraid”; 7) reinterpreting a situation, for example, “How do you think your cousin feels when people laugh at her fear of dogs?”; and 8) providing contextual clues, for example, “Some dogs bite, but Uncle Dan’s dog shows he’s friendly by wagging his tail.” Understandably, developing language abilities related to affect significantly improves children’s abilities to “understand, convey, reflect upon, and manage” affect (Kopp, 1992, p. 15). In addition, a recent study indicates that types of AR strategies are related to teacher burnout (Carson & Templin, 2007).

AR is key in promoting homeostasis and positive affect, and has also been shown to be related to children’s academic success (Graziano, Reavis, Keane & Calkins, 2007). Positive affect broadens individuals’ attention and thinking, deposes negative affective arousal, improves social interactions, promotes psychological resilience, builds personal resources, fosters greater future well-being, generates better physical health, and seeds human flourishing (Fredrickson, 2004; see also Diamond & Aspinwall, 2003a; Tugade & Fredrickson, 2004). Brenner and Salovey (1997) suggest that teachers have a role to play in helping children understand and interpret affective cues, and in developing a repertoire of AR strategies. They claim that knowledge of adaptive AR strategies predicts use of strategies in stressful situations and that the ability to identify affect in self and others is related to a “tendency to help, cooperate with, and share with other children” (ibid., p. 176). Plasticity of the central circuitry of affect and evidence that down-regulating negative affect through wilful use of AR decreases signal in the amygdalae (Davidson, 2003) indicate that teaching

AR strategies can improve human well-being, since over-active amygdalae are associated with stress and depression.

Since affect arises from somatic states, and somatic conditions influence well-being and health, we cannot ignore the wisdom of improving our human condition. Perhaps teaching humans how to better manage affect can help in preventing bullying and committing acts of violence. In acknowledging the importance of AR on human functioning and well-being (Fredrickson, 2004; Tice & Baumeister, 1993), and examining the significance of improving both the AR of students and teachers, there is much work to do. Important considerations in researching AR include being aware that individuals have different abilities and strategies and that the use of these strategies may be context dependent. Sheldon and Lyubomirsky (2006) discovered that different strategies for enhancing positive affect are found to work with different people. Garnefski, Kraaij, and Spinhoven (2001) go so far as to argue that researchers should not examine a single type of strategy, but all types, in order to assess individuals' effectiveness at using coping skills. I would agree with Diamond and Aspinwall (2003a) that both laboratory experiments that isolate a specific strategy and natural environment research are necessary to further delineate the brain functions and cognitive and behavioural strategies of affect regulation. Bell & Wolfe (2004) argue that "research integrating cognition and emotion [affect] is essential in any attempt to comprehend emotion regulation" (p. 366).

8.7 Implications for Education: Neuroscience to Neuropedagogy

8.7.1 Bridging the Gap

Neuropedagogy, in its incipient state, is naturally thought of as educational practice informed by results from neuroscience. This somewhat naïve, “brain-based,” view must be supplanted by a more sophisticated view of educational practice informed by a more disciplined and critically oriented educational neuroscience. At this point, however, educational neuroscience remains in a relatively incipient state as well. However, significant advances in knowledge deriving from the neurosciences, in particular with regard to relations between affect and cognition, cannot be ignored. That educational neuroscience has yet to establish itself in providing specific disciplined guidance regarding the educational implications of neuroscience is good reason in itself to exercise caution and critique in applying results from neuroscience to educational practice. It is no excuse, however, for suspending thought and dialogue about potential educational implications. Indeed, this is just what is required to further the development of educational neuroscience.

Neuropedagogy, to my mind, must eventually be understood as an applied educational neuroscience, namely, as being primarily concerned with both educational practice informed by research in educational neuroscience, as well as educational neuroscience informed by educational practice. What makes educational neuroscience essential is that it be designed with the teacher/learner in mind; it is a research field directly involving lived experience and laboratory research. It is not enough to borrow constructs and phenomena from

neuroscientists and neuropsychologists; what must be done is to examine their constructs and phenomena in situ, and to collaborate as a community of researchers for the betterment of society. This will mean that educational neuroscientists must not only share their findings with practitioners, but that practitioners must share their experience with researchers in a two-way collaboration. To this end, the bridge must include educational outreach that not only shares applicable findings with pre-service teachers, teachers, educational leaders, and administrators, but also solicits their collaboration and input.

A meaningful neuropedagogical model of affect is needed to provide a basis for research and for consequent changes in curriculum theory and curriculum.

SAMA presents a conceptual framework that encompasses the concepts of brain/body function generally acknowledged by neuroscientists, neuropsychologists, and educators in order to delineate the interaction of affect and mentation in the processes of learning and teaching.

In order to begin to bridge the gap between neuroscience and classroom practice, the foibles of brain-based teaching must be examined and theory that is grounded in educational neuroscience, an eclectic and transdisciplinary field of study, must be planted as a foundation for neuropedagogy.

Clearly, the findings and theories of neuroscientists regarding the role of affect in brain/body function, cognitive performance, and resultant behaviour, have implications for learning and consequently for teaching. While I have discussed some possible applications for this knowledge in the realm of meta-emotion, emotional contagion, and affect regulation, I do not want to be

prescriptive. What I have done is to provide a sample of neuropsychological research to demonstrate the types of analyses that can be fostered as educators explore a new arena of discourse and propose new theories on which to base change of our praxis.

However, while I advocate caution, educators must not avoid applying what is commonly held to be true regarding the role and function of affect. There are some aspects of affect that can influence our practice today. An example of findings in neuropsychology that have implications for pedagogy is the concept of the inevitability of affect and the human ability to manage feelings. Damasio, Ledoux, and Goleman agree that the occurrence of affect cannot be stopped by an act of will (Damasio, 1999, p. 49; Ledoux, 1996a, p. 303; Goleman, 1995, p. 57), in part because their origins are unconscious. However, once affects become conscious, or become feelings, Damasio (2003) offers that individuals can to some degree avoid environmental exposure to events or objects that trigger the affect (p. 52) and Goleman (1995) suggests that by not ruminating over the object of our affect, individuals can refrain from prolonging the feeling (p. 60). In addition, Goleman states that stress prompts the amygdalae to arouse the adrenocortical branch of the nervous system, lowering the threshold for possible affect outbursts (*ibid.*, p. 61) and “emotional hijackings.” Kagan, an eminent psychologist at Harvard University, claims that children are to some degree born with a specific threshold of excitation of the amygdalae, (1994a, pp. 18-19; 1994b, 169). However, emotional capacities are not determinate at birth and emotional awareness and coaching can be beneficial, especially to infants,

children, and adolescents, since areas of the brain determined to be involved in affect processes are still developing. While emotional responses to stimuli can be altered in adults, due to neural plasticity (Davidson, 2004), the process may be arduous (Goleman, 1995, p. 277; Ledoux, 1996a, p. 265). The key point here is that it is possible and that learning to regulate affect has many positive possible outcomes.

There are possible implications here for teaching. In the forefront is providing teachers with meta-emotion knowledge and skills so that they can regulate their own affect and thereby become effective affect role models. For example, if a student comes from a stressful home environment, it would be prudent for a teacher to know about this situation and to help the student understand the function of emotional triggering, and to teach and model alternate AR strategies. Also, if a student has a strong emotional outburst in class, there is little sense in the teacher attempting to stop it; however, removing the object that stimulated the outburst would be helpful in shortening the outburst. Giving the student time to recover from the emotion would be advisable before discussing the incident. On another level, teachers trained in meta-emotion could infuse affect recognition and affect regulation into existing curricula (Lopes & Salovey, 2004). For example, educators teaching Shakespeare's *Romeo and Juliet* could teach meta-emotion by having students identify and analyze the affects of the characters, the behaviours and consequences of their enacted affects, and suggest effective AR strategies and how the characters using the alternate strategies might change the plot and possible outcome of the play.

Evidence suggests that early intervention in affect awareness and meta-emotion or what some (e.g. Goleman, 1995; Gottman, et al, 1997; Gottman, et al, 2004) call emotion coaching can be beneficial. Emotion coaching includes acknowledging and responding to students' affect in non-judgmental ways, seeking to uncover and explain the origins and effects of affect, presenting and modelling empathy and problem solving in emotionally charged situations, teaching acceptable alternatives to extreme affects, and guiding children in delaying gratification and impulsivity (Goleman, 1995, pp. 226-227). Gottman, Katz, and Hooven's research shows that when parents perform this emotion coaching well, the vagal activity, which kept the amygdalae highly active in emotional predicaments, was significantly reduced (1996). Goleman believes that society's trend toward fewer parent-child positive interactions, due in part to more single parent families and increased pressure for both parents to work outside the home, is depriving many children of parental guidance in "emotional competences and moral character" (ibid., p. 234). The result is that educators' role in teaching and modelling affect gains importance. Goleman cites Aristotle's view that virtuous life is based on self-control. He sees emotional literacy programs in schools as going "hand in hand with educators for character, for moral development, and citizenship" (ibid., p. 286). Damasio suggests that "[o]ne of the key purposes of our educational development is to interpose a non-automatic evaluative step between causative objects and emotional responses" (2003, p. 54). His credo states that "I hold these truths to be self-evident, that all humans are created such that they tend to preserve their life and seek well-

being, that their happiness comes from the successful endeavour to do so, and that the foundation of virtue rests on these facts" (ibid., p. 171).

Educational experts and practitioners must collaborate on establishing what affective neuroscience asserts about affect, establish paradigms that are validated by research, and design theories and resultant curriculum to implement neuropedagogy that is inclusive of and reflects the importance of affect. This paper explicates the historical evolution of the concept of affect, as well as elucidating the constructs and phenomena applicable to education. What remains is to examine current programs that claim to teach about affect, including meta-emotion, emotional contagion, and affect regulation. Meta-emotion should include: understanding how the neurobiology of the brain/body helps to explicate the neuropsychology of the brain/mind, how individual affect influences others, evaluating an individual's current AR strategies, and learning and implementing new AR strategies. An understanding of the duet of the neuroscience and the neuropsychology of affect is key to formulating principles, policies, theory, and curriculum capable of reducing human suffering and enhancing the songs we sing, the stories we tell, and the music we make for the future human race.

CHAPTER 9: CONCLUSION: CAVEATS AND CONVICTIONS

The Somatic Appraisal Model of Affect (SAMA) is a paradigm based on recent neuroscientific findings that assert the primacy of affect. It is an early attempt to clarify the terminology of affect, to delineate the neuroscience and neuropsychology of the brain/body interaction of affect, and to consolidate the constructs and phenomena of affect pertinent to education. Rather than a conceptual structure of affect based simply on an idea of affect, a form of affect, SAMA is founded on SMH, a hypothesis grounded in the physiological phenomena of embodied affect. However, SAMA has limitations.

A model is, by nature, an interpretation or depiction of a complex phenomena that is meant to make sense of that phenomena. A model of affect needs “a built-in flexibility and variability to emotional representations that allows their differential use in specific socio-cultural, institutional, and interpersonal contexts” (Parkinson, 1998, p. 623). Because current neuroscientific and neuropsychological understanding of affect is still limited by our technology and partial understanding of this enigma, I warrant that SAMA may need to metamorphose as our knowledge and comprehension of affect and its relation to cognition evolve. While I have attempted to build universality and flexibility into the model, whether SAMA meets these expectations remains to be seen.

Inherent in creating any model of an amorphous phenomena such as affect is the difficulty of avoiding what I will call the “boxology” of models. It is difficult to portray the amorphous and capricious nature of the interaction of the different types of affect and cognition, and while I have attempted to describe some aspects of that interconnection, I acknowledge the absence of cognition in the visual model proper. In addition, the model does not deal in any detail with the inherently related constructs such as sense of self, motivation, or consciousness. Due to the inherent enormity of cognition and its concomitant constructs such as memory, I consider the complexity of the interaction of affect and cognition to be suited to a further expansion of the model.

The implementation of such a model as SAMA is fraught with perils.

One of the perils is that neuroscience is a rapidly developing field, and a very new field for education researchers. Not only must a new model such as SAMA be current, but it must remain dynamic in order to reflect new research and findings from a vast number of fields. It is here that educational neuroscience plays a vital role, serving both as a collaborative forum for the many areas of neuroscience and education, and also as a venue to seek, process, and disseminate new findings among researchers and practitioners. Part of the challenge of educational neuroscientists is to overcome reluctance on the part of educators to accept neuroscience as a partner in educational research, and to accept its proponents as valuable collaborators in creating policy and curriculum for the twenty-first century.

Another conundrum is the question of how theory of affect actuates itself in curricula. While I have referred briefly to some of the educational programs and projects purporting to address the need for meta-emotion or understanding of affect, an evaluation of them using a research-validated method appears to be lacking.

Future research in affect-related neuropedagogy should include a range of methodologies. The embodied-mind methods of educational neuroscience, such as electroencephalography, skin conductance response, electro-oculography, electrocardiography, and eye-tracking, should be coupled with other methodologies such as self-report and action-research to add validity to what we already conjecture about affect and to extend our ideas and knowledge of affect. Research to establish and validate neuropedagogy will need to include development and refinement of schemata and methods for assessing affect and its co-existent phenomena, such as affect regulation strategies.

At the heart of SAMA is the recognition of a need for change in pedagogy, for the development, adaptation, and adoption of neuropedagogy in the form of affect-cognition based curriculum. To bring about this change, all stakeholders must be involved. Arriving at a consensus about conceptual issues and understanding the what, when, why and how of affect are not only academic queries. The answers to these questions have implications for our everyday lives, especially for parents, care givers, and educators. We must recognize the emotional work of teachers, the emotional challenges of students, and the emotional context of the society in which we live. We must examine in detail the

programs designed to teach aspects of affect that exist and collectively develop the best programs to serve the affective needs of today's humanity. We must educate parents, childcare workers, educators, administrators, and all who care to improve the well-being of humanity.

While the intellect has long played the leading role on the stage of education, and emotion played its rogue counterpart, a new theatre has emerged where affect is the protagonist bathed in the light of human functioning. Whatever the reasons for initially shunning affect and then condescending to give it bit parts in cognition, continued discoveries about the role of affect in brain/body function have demanded recognition. Perhaps a shift from intellect to affect as the focus for educational theory and pedagogy will enable a renewed interest in the pursuit of authentic happiness and what it means to be an integral part of a flourishing community. DiPardo and Potter (2003) see affect or what they term "emotion," as a possible "interdisciplinary focus" (p. 337). They see the role of affect as "an untapped vein" that "holds key implications for research, policy, and practice" (ibid., p. 339). Dodge (1991) states that affect "is the energy that drives, organizes, exemplifies and attenuates cognitive activity and in turn is the experience and expression of this activity" (1991, p. 159) and Izard tells us that the affect system "is the primary motivational system for human beings" (1984, p. 17). Given the state of schooling today, it is imperative that we reconceptualize the field of education and resultant pedagogy. We need to regard affect as being central to being human: not as a detriment nor a folly, not as an accessory nor a bridge to learning, not as gender-based nor politically embedded; but as the

focus of all educational discourse, as the focus of education. We need to shift our curriculum focus from knowledge about things to knowledge about ourselves, for it is only when we comprehend ourselves that we can truly understand the rest of the world. People must know what neuroscientists and neuropsychologists have learned and are learning: that the brain's primary function is not reason, but affect in conjunction with cognition.

Clearly there is a new wealth of research examining the process and function of affect and resultant behaviour based on theoretical frameworks of the neuroscience and psychology of affect. There are steps that must be taken which will lead to legitimate neuropedagogy, including the creation and funding of educational neuroscience laboratories to serve as transdisciplinary forums and collaborative initiatives investigating the neuroscience of learning and teaching. Curriculum theorists, however, should not look to using affect to simply access the cognitive mind, nor should they negate the role of cognition, but rather they should address the affective mind. Building on sound research-based theory and models such as SAMA, new paradigms of education and curriculum must be developed and put to trial in pilot projects with integral accountability and flexibility. As our understanding of the process and function of affect advances, theoretical and pedagogical revision must accommodate this new knowledge. A monumental, but worthwhile task awaits us.

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