NEUROMYTHOLOGY: BRAINS AND STORIES

by John A. Teske

Abstract. I sketch a synthetic integration of several levels of explanation in addressing how myths, narratives, and stories engage human beings, produce their sense of identity and self-understanding, and shape their intellectual, emotional, and embodied lives. Ultimately it is our engagement with the metanarratives of religious imagination by which we address a set of existentially necessary but ontologically unanswerable metaphysical questions that form the basis of religious belief. I show how a multileveled understanding of evolutionary biology, history, neuroscience, psychology, narrative, and mythology may form a coherent picture of the human spirit. Neuropsychological functions involved in constructing and responding to the narratives by which we form our identities and build meaningful lives include memory, attention, emotional marking, and temporal sequencing. It is the neural substrate, the emotional shaping, and the narrative structuring of higher cognitive function that provide the *sine qua non* for the construction of meaning, relationship, morality, and purpose that extend beyond our personal boundaries, both spatial and temporal. This includes a neural affect system shaped by our developmental dependency, the dynamic narratives of self formed in the development of identity and reconstructed over the life span, drawing on culturally available mythic and storied forms. Narrative constitutes our movement in moral space and may have the potential both for healing and for disruption for us as individuals and as a species, providing a contingent solution to the alienation and fragmentation of personhood, relationship, and community.

Keywords: development; embodiment; emotion; identity; meaning; memory; myth; narrative; neuropsychology; religious naturalism; social construction; spirituality.

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One of the major contemporary challenges for the religion-and-science dialogue comes from the dramatic advances in evolutionary psychology and in cognitive neuroscience. These advances provide not only a deeper understanding of the biological constraints on mind but also an ability to understand the neural substrates of human behavior, including emotional, intellectual, and imaginative life. These advances have largely outrun the understanding of human spirit traditionally provided by religious thought. There remains a powerful tension between seeing freedom, autonomy, personal identity, and moral responsibility as social and historical constructions and our burgeoning scientific (and often materialist) understanding of human nature as constrained, if not determined, by evolution and brain function. In my own work over the last decade (Teske 1996; 2000; 2001a, b; 2002) I have attempted to help reduce the tension between scientific, philosophical, and religious understanding of human nature and spirit by demonstrating how the latter may be generated by, nested within, or supervenient to the former. I believe that a philosophically and historically informed religious view, although potentially at odds with conventional theological understanding, is likely to be enriched by rather than opposed to ongoing scientific developments, their putative metaphysical entailments notwithstanding.

How can we build a more integrated model of how a multileveled understanding of evolutionary biology, history, neuroscience, psychology, narrative, and mythology might actually form a coherent picture of the human spirit? Neuropsychological functions involved in constructing and responding to the narratives by which we sculpt our identities and live meaningful lives include memory, attention, emotional marking, and temporal sequencing. It is the neural substrate, the emotional shaping, and the narrative structuring of higher cognitive function that provide the *sine qua non* for the construction of meaning, relationship, morality, and purpose that extend beyond our personal boundaries, both spatial and temporal. These provide a contingent solution to disunities of mind, the construction of self and identity, and the alienation and fragmentation of personhood, relationship, and community—but a solution that is likely accomplished only with varying degrees of success and may include a range of fictionalization and self-deception in all of us.

The evolutionary and historical background to the emergence of symbolic cognitive processes and the shaping of emotional ones has been presented elsewhere. I summarize this background and then explicitly describe some of the neural components necessary to dramatic emotional experience that undergird our capacities to tell and be shaped by the telling of stories. That substrate may itself be shaped and affected by the participation in such experiences and capacities. I outline the basic emotional components of our nervous systems and how they might be shaped by way of socialization into complex human emotional and relational patterns. This

includes the emergence of self and identity via these socialized emotional patterns and the shaping of consciousness, memory, and identity by developing capacities for autobiographical narrative. I then consider the symbioses of hybrid human minds with the historically and culturally available corpus of mythological forms by looking at some of the themes of these mythological forms and their impact on the processes by which we grasp the human experience, our own and that of others, and the relationships and institutions with which we are interdependent, including the therapeutic, the moral, and the religious.

The neologism *neuromythology* is used here as a self-conscious alternative to *neurotheology*, a term originally used by Aldous Huxley (1962, 144), introduced to the religion-and-science dialogue by James Ashbrook (1984), appropriated by Eugene d'Aquili and Andrew Newberg (1999), and popularized by Newberg, d'Aquili, and Vince Rause (2001). My position is that one cannot make any theological claims from evolutionary or neuroscientific research, because such claims bear on ontological questions that are empirically unanswerable (or begged). Hence, by proposing and developing the alternative *neuromythology*, the position can be made more explicit and articulated in detail, and it becomes clear that these broader issues are ones of mythology. Joyce Carol Oates once said that *Homo sapiens* "is the species that invents symbols in which to invest with passion and authority, then forgets that symbols are inventions" (1999, 27). The use of *mythology* makes the invention clear and allows us to direct our attention explicitly to the investment of these symbols with passion and authority, which is what our deepest meanings are about.

The Natural and Social Genesis of Spirit: Review of Previous Argument

In "The Spiritual Limits of Neuropsychological Life" (Teske 1996) I argued that neuropsychology is necessary but insufficient for understanding spirituality. I systematically examined multileveled spiritual requisites in terms of their neuropsychological constituents and limitations. I addressed the "problem of integrity" posed by the evidence for disunities of self and consciousness and argued that the integrity of self or spirit is a contingent and often fragile achievement. Ending with some integrating possibilities, as the "roads not taken," I turned to the transformations of self-surrender and sacrifice and the need to explicitly step outside the neuropsychology of the individual and include the self in a larger system. It is not so much that our neuropsychology provides constituents of spirit as that spirituality itself is a way of thinking of the role of our consciousness, our minds, our personhood within larger wholes, within which they are constituted as having a particular form and only within which they have any larger meaning or significance, a meaning or significance absent in accounts that rely wholly on the supernatural.

In "The Genesis of Mind and Spirit" (Teske 2001) I fleshed out the "bridging argument" that (1) the evolution of the brain requires a high level of social interdependence, (2) the ontogenesis of individual minds is highly contingent on the form of this interdependence, and (3) the form of this interdependence eventuates in the capacity to construct and live within the symbolic virtual realities that constitute higher intellection, the sociocultural human world, and the worlds of communal, religious, and spiritual life. I drew specifically on neuroscientific research on neuroplasticity and the experiential shaping of neural tissue, the evolutionary consequences of the hypertrophy of the prefrontal cortex in hominids, and the emergence of a supervenient symbolic world interiorized in our subjective and intersubjective lives.

I showed in "The Social Construction of the Human Spirit" (Teske 2000) how spirituality can be a social construction. Building on the idea of "constitutive rules," I argued that our inner subjectivities, and even the boundaries of our individuality, are socially constructed and maintained and that even "internal states" are constituted within a logical space, itself a social product, which, while dependent on individual neurobiology, is not necessarily coterminous with it. In both therapeutic and spiritual discourses the boundaries between this logical space and the world "outside" often is a central issue. I presented evidence for the social construction of emotional life across both development and cultures. I argued for analogous constructions of "spiritual" sentiments and for the social construction and cultural limitations of our particular form of individuality, for the purpose of demonstrating how that individuality might be capable of transformation. This project requires attention to the neuropsychology of individual kenosis, emptying into, identifying with, and interiorizing a larger human and spiritual community. The unraveling of our social fabric may be bound to the same restrictive obsession with unique individuality that turns much spiritual and religious discourse into exercises in narcissism. Nevertheless, there may be viable paths to spiritual regeneration, including "ensembled" selves, polyphonic dialogue, and even the "covenantal" sociality of biblical narrative. The commonality of these paths resides in a belief that spiritual regeneration cannot be an individual project, as shown by historical, cultural, and psychological arguments, but must be a social and open-ended one.

James Huchingson's (2004) review of *The Human Person in Science and Theology* (Gregersen, Drees, and Gorman 2000), which includes my chapter just summarized (Teske 2000), refers to the "biocultural paradigm" of the volume as a whole and unfortunately comes to a conclusion that seriously misapprehends the coherence of a multileveled physicalism. I suspect that dualist presuppositions are sufficiently endemic to religious and theological discourse that a nondualistic, but also nonreductive, physicalism must be regularly and more thoroughly spelled out. Too often the

endemic dualism gets disguised as a nature/culture dualism, as if culture were not also a manifestation, however complex and multileveled, of physically real entities and events. This latter dualism can even be institutionalized within the religion-and-science dialogue (as I might argue that it has been at the Center for Theology and the Natural Sciences), ruling out of court what might be necessary scientific bridging work between the two in the "social sciences" (*Geisteswissenschaft)*. It should be no surprise that from a psychologist would come an assertion of the necessity of such bridging work as well as an attempt to articulate what such bridging theory might look like. From Huchingson's review:

> In a final essay, John Teske . . . carries the biocultural paradigm to its logical conclusion. His thesis is that "the human spirit can be understood as a social and historical construction, dependent upon but not determined by human neuropsychology in turn embedded within and emergent from evolutionary processes" (p. 190). Teske uses *spirit* somewhat like others use *person* or *self*. The self is contingent, radically relational, and socially constructed and is best understood through narrative, an approach totally unsuited to physicalist models of mind. (2004, 726)

I do not quibble with the statement about my use of *spirit*, since for most of the history of Western philosophy, theology, and science it has been used this way and, as a committed religious naturalist, I see no reason not to do so and am unclear what, if anything, else it might mean (but see "The Haunting of the Human Spirit" [Teske 1999]). I like most of the rest of what Huchingson wrote, and I thought he "got it." My problem is with the last phrase. The two other articles referred to above, and also summarized in the first pages of the reviewed chapter, provide extensive argument as to precisely why this approach is *perfectly coherent* with physicalist models of mind. It certainly is unsuited to eliminatively reductivist models (at least methodologically individualist ones), although it may be necessarily inclusive of such physicalist models. The point is that the contingencies of selfhood include the biological and the historical, the relationalities are mediated only by biologically embodied human beings with mostly intact nervous systems, and the constructions composed only from real biological and social materials and events, however complex or even disjunctive. Nevertheless, the job here is to begin to better spell out just why and how the constituting narratives are generated by and engaging of biologically and neuropsychologically embodied human persons, the only ones about whom we can make any empirical claims.

I do not doubt that expressions of supernatural selves, angels, and heavens may have important roles as acts of solace or imagination, just as prayer may retain both its psychological and spiritual importance long after we surrender the notion that it is about paranormal intercession. Nevertheless, part of the challenge provided by contemporary research on brains and minds is in the theological questions it suggests: Has death "lost its sting" (1 Corinthians 15) for the faithful because it does not really hap-

pen? Is faith about escaping or defending against our anxieties about death, or about better facing its existential reality, or about taking up our crosses? Is the ultimate goal and meaning of life in the eternal preservation of our individual identities, or are there greater goals for which even their losses, their sacrifices, might be worthwhile? Do we need to get our gifts *back* for them to have value, even the gifts of our thoughts, our memories, our very identities? Or are these functions—including our capacities to experience time, to construct purposes larger than ourselves, to make sense of our lives in terms of stories we construct or larger narratives of which we might be a part, and to give ourselves to greater goods—completely dependent on nervous systems structured and developed in very specific ways?

It probably is little more than good sense to believe that anything going on in the mind or in consciousness involves the brain and cannot therefore float free of it (though science may be able to account for why we might sometimes experience such an illusion). And it may make sense to think of both mental and spiritual life as consisting of attributes, qualities, or functions of a whole person rather than as separate entities or substances, somehow supernaturally injected into human beings, able to affect our brains and bodies through some kind of paranormal activity.

Dictionaries capture the more common dualist image of spirit or soul, defined as both (1) consisting of our mental constitution, the intellectual endowments of the mind, and our moral feeling and (2) being capable of continuing beyond the death of the body. The problem is that this common idea continues to be held when the sciences of mind and brain are growing by leaps and bounds in understanding how our mental lives are dependent on our brain functions, none of which survives our biological death, unlike most of human history when *psyche*, *soul*, and *mind* were interchangeable, their faculties articulated in detail but not tied to brain function. We no longer have a problem understanding that when people die, their breathing, the beating of their hearts, and their brain activities just stop. They don't leave and go somewhere else. We understand them as processes rather than entities. We understand that "losing your mind" is a metaphor. Spiritual life does not exist apart from the rest of us, either, a view that may also be consistent with biblical scholarship as well as a whole range of legitimate theological positions (Barbour 1997; Drees 1996; Hefner 1993; Pannenberg 1993; Peacocke 1993). Dualism may keep us alienated not only from embodiment, from physical understandings of religious ideas like incarnation and resurrection, but from the communal world within which the meaning of our lives is constituted.

I have long held that psychology is not just a natural or social science but also a humanity in that it provides a way to look at values, at human nature, and at the human condition. As such, psychology is not merely a science (though it is necessarily also a science) or merely a form of therapeutic practice (though much of what it does is therapeutic in a broader

sense) but a way of looking at, analyzing, and understanding human beings and human life at individual, social, and institutional levels that goes beyond the understanding of relations limited to mechanical causation, to understandings of function, purpose, and meaning. Psychology as a science has contributed much to our understanding of the proximal causal substrate of what it is like to be human, including that present in our bodies, nervous systems, social relationships, and life spans. It is increasingly sensitive to the distal evolutionary causes and constraints of whatever might represent human nature. But only recently have contemporary thinkers begun to systematically explore the consequences of the social interdependence that has been so much to our evolutionary advantage. First is the individual development so important to a species with a childhood dependency that extends from a quarter to a third of the life span. Second is the historical and cultural variation in the shaping of brains, minds, and conduct by which our experience is thoroughly colonized by our social nexus but also able to be transformed at temporal scales much more rapid than biological evolution. Much of this has occurred historically through the important role of mythological and narrative structures. In the modern era these structures have been increasingly harnessed, modified, and explored by individuals with both literacy and access to a wide range of other media of external symbolization (Donald 2002; Teske 2001a). It therefore becomes more important to be able not only to critically analyze and differentiate these but to integrate and creatively synthesize what might otherwise be cognitively overwhelming enough to produce alienation and fragmentation. Even (and maybe especially) in our postmodern age, narrative and mythology can play crucial synthetic and integrative roles and are central to living meaningful lives.

Neural Components: A Sampler[1]

Our nervous systems are composed primarily of biological cells called neurons, which pick up chemical signals from other cells and then transmit that information down a long, thin arm of the cell, again releasing chemicals into the gap, or synapse, between cells. The neurochemistry of these transmissions is what is behind much of the revolution in the pharmacology of how to affect mental states and emotions, such as the treatment of depression with prozac. But such pharmacological treatments are relatively crude in comparison to the complexity of brain organization, the brain being the most complicated object in the known universe. Paul Churchland (1989) put the issue of its scale into perspective: We each have about 100 billion neurons, each of which has synaptic connections with an average of about 3,000 other neurons, so even an individual neuron can be a fairly complicated processor. This makes for about 100 trillion synaptic connections. If each connection has even as few as ten different activation levels, the total possible number of distinct brain states is on the order

of 10 to the 100 trillionth power. Although this number represents only a realm of logical possibility, it is a very large number, given that the estimates of the total number of elementary particles in the universe is about 10^{87}. Even if only 0.1 percent of those states are functional neural states, and only 0.1 percent of those functional states are conscious, that would still represent $10^{99,999,999,999,994}$ possible conscious states. Such an understanding of scale makes it easier to imagine that this "piece of meat" might actually be what makes mental and spiritual lives possible, what is shaped by and subsequently generates the stories, narratives, and myths by which we make sense out of our lives.

The central nervous system is a huge mass of circuitry providing central control and mediation between sensory input and motor output. It operates at many levels ranging from sensory-motor reflexes to a flexibility of response mediated by prefrontal cortex (the cortex being that convoluted egg of tissues we usually associate with the brain but is only the outermost layer) and memory systems that can include remembering and anticipating decades-distant events. Our capacities make us vast anticipation machines, and most of our relating to the world is done via extensive and interacting cortical maps (Edelman 1989). Sensory information is relayed to the way-station of the thalamus, in the interior of the brain beneath the cortex, then to primary sensory areas in the posterior half of the cortex, and from there to secondary and tertiary areas responsive to (extracting, constructing) increasingly complex and abstract features, including integrations of information from more than one sense. Information from the posterior, sensory half of the brain is transmitted through more primitive midbrain structures to tertiary motor areas in the frontal cortex responsible for our most general plans and intentions and our representations of those cultural virtual realities in which we live. From there information is transmitted to secondary motor cortex for more specific plans and behavior sequences (for example, speaking) and finally to the primary motor cortex for output. This simple circuitry is modified by various kinds of feedback, multiple and parallel mappings of sensory surfaces, and interactions with emotional and motivational structures in subcortical areas. The sensory system, and the brain in general (also responsive to its own patterns), is built to respond to changes in patterns of stimulation, many of which produce arousal, distress, and even ecstasy but are central to the evolution of our sentience. Representations of such patterns can be sustained, produce similar responses in their reactivation, be modified to produce variation, and communicated mimetically, dramatically, or symbolically to others, in the storied forms within which we learn and are socialized.

Neural structures and functions constantly are being shaped by their history of interactions with the outside environment. Cells and their interconnections proliferate, migrate, differentiate, and are pruned directly by experience. Deprivations of certain stimuli can result in the loss of cells

detecting them; enriched environments can increase neuron size, dendritic spread, and even enzyme production. The plasticity of the nervous system extends across the life span—language area maturation depending on prepuberty stimulation, delayed-response maturation on late adolescent pruning of synapses in one of the major convolutions of the frontal cortex (the cingulated gyrus), and aging memories on dendritic growth in one of the dents beneath the temporal cortex (that's the one right over each ear). Day-to-day plasticity may be important to the multiple realizability of mental functions, as even somatosensory maps may change size, and cells may shift specialization.

The unity of mind has been overstated. Our brains operate more like a system of committees whose processing is domain specific and largely nontransferable. Like any complex architecture, it may require autonomous subsystems, which can be selectively damaged. Evidence from selective damage, functional dissociation, and various brain scans has identified many examples of such modularization, such as in vision, face perception, and language. Consider language. Now-classic research indicated that information sent to the right hemisphere of split-brain patients was normally not included in their linguistic accounts (or their declarative awareness) of their experience. Nevertheless, it may be in the form of linguistic or dramatic narrative accounts that we are able to integrate and synthesize a wide range of brain-mediated experience into coherent forms they otherwise would not have.

Our basic emotions and motivations have their roots in a part of the brain that we share with other mammals. Research on self-stimulation of brains in animals of a generation ago showed certain limbic centers in the interior of the brain, in the boundary area between the cortex and the brain stem (the septal area, right above hypothalamus), to produce powerful rewards. A number of areas activate a midbrain system largely using the chemical dopamine for transmission. This system involves a number of midbrain nuclei (bundles of cells), with pathways running through the middle of the brain, that project to the lateral hypothalamus and other limbic and cortical areas. The hypothalamus, a small structure located beneath the thalamus in the middle of the interior of the brain, contains the wiring for the basic mammalian programming of the brain, the so-called four Fs of feeding, fighting, fleeing, and reproductive behavior. This important dopamine pathway, a primary reward system, is affected by a wide range of addictive drugs. The ritual behaviors of obsessive-compulsive disorder implicate this system, and even schizophrenia is likely to involve variations in its sensitivity.

Our memory systems are likely to operate at a number of different levels and include interactions between different modules in the brain. Simple kinds of memory, like sensitization, habituation, perceptual learning, and classical conditioning, are shared with lower animals. Human beings also

have declarative memories, which can be brought to mind and articulated (such as the semantic memory for facts and knowledge or the episodic memory of personally experienced events). Such memories are made possible by a temporal-lobe memory system, rooted in the hippocampus, damage to which produces a severe anterograde amnesia, an inability to store new long-term memories elsewhere in the brain, despite leaving intelligence, working memory, already established long-term memory, and nondeclarative skill learning intact. Patients suffering from such damage, like the protagonist in the film *Memento*, live in a ceaseless present, unable to accumulate new memories through time, able only to continually live out previously remembered stories. Specific memory deficits also can be produced by damage to particular areas of the posterior cortex, resulting in amnesias for color, faces, object names, and object locations. Specific damage can produce a wide range of inabilities to recognize perceived objects, including agnosias for sounds, limb placement, and objects at various scales.

Working memory, our ability to access and activate the stored memories relevant to an ongoing task, depends on the dorsolateral (toward the back and on the side) prefrontal cortex. This can work independently from the hippocampally mediated long-term memory, which one can develop without working memory. Working memory is what makes delayed responses possible, where one needs to keep track of recent responses or events, and there are cells in the lateral prefrontal area that respond only during the cue-response delay interval. Working memory enables performance on Piagetian object-permanence tasks, delayed alteration tasks, dimension shifting in a sorting task, discriminating which of two objects was presented more recently, and picking an unselected but familiar object out of a pair (one needs to keep track of the previous selection). The mechanism seems to involve inhibition of distracting information, the sort of thing that enables one to avoid digressions in a story, or, having entertained them, to return to the plotted sequence.

Much of our emotional life, being mediated largely by subcortical structures of the limbic system, is shared with the rest of the mammalian kingdom. This includes a set of nuclei and pathways in the basal forebrain (at the base of the front part of the brain), including the amygdala, mediating fearful and aggressive responses; the septum, mediating rewarding, pleasurable emotions; and the hypothalamus, containing a number of well-defined nuclei and pathways that are involved in mediating rage, aggression, intense pleasure, and sexual response as well as directing the autonomic nervous system. The amygdala in particular plays an important role in fear, appeasement, and rage; while it may produce the slower fear responses from processing of information via the visual cortex, there also appears to be a "quick and dirty" pathway direct from the thalamus that may mediate some of the phobias and unconscious fear-based responses that are so hard to eliminate. Human emotional response involves a wide range of neocor-

tical responses as well—for example, the portion of the posterior right hemisphere that mediates the matching of emotional tone to language. Given the evolutionary value of memory for emotionally compelling events, it should come as no surprise that the hippocampus, a limbic structure nestled bilaterally beneath the temporal cortex, should play an essential role in memory.

It is the tie between the ventromedial prefrontal cortex (the underneath part, right in the middle of the most frontal part of the cortex) and the limbic system (especially the amygdala) that connects emotion and reason (Damasio 1995). It is largely the hypertrophy of the prefrontal cortex that provides the characteristic flexibility of thought, especially in planning and coordinating complex behavior, and patients with damage here tend to be dominated by perceptual information, lacking the inhibitions necessary to accomplish their own plans or respond to social constraints. With lateral prefrontal cortex intact, patients (like Phineas Gage) with ventromedial damage can still exhibit high intelligence and normal working memory, but in the real world of complex behavior, such patients lack the link between the prefrontal cortex and the limbic system that can narrow options automatically via the "somatic marking" of their potential affective consequences. They lose the ability to keep to a schedule, organize higher-order hierarchies of action, or even feel a sense of personal involvement. Such patients do not exhibit a normal galvanic skin response to emotional stimuli, and their risk-taking is not tempered by emotional response to the possibility of severe penalties. Lacking the affective ties for evaluating consequences, they have lost the ability to prioritize so necessary for complex reasoning, especially important for tasks with temporal constraints but also for moral decision making, and the overall organization of a meaningful life. Depressives may have the opposite problem.

The evolutionary hypertrophy of the prefrontal cortex, and the resulting colonization of much of the rest of higher brain function, is behind most human cognitive ability (Deacon 1997; Donald 2002). The flexibility of this neural tissue also gives us the capacity to be shaped by socialization, thus rendering human beings necessarily and deeply interdependent with each other and therefore products as much of historical change as of prehistorical evolution. I mentioned some of the important roles of the dorsolateral prefrontal cortex in working memory and the role of the ventromedial prefrontal cortex in experiencing emotion and bestowing meaning. Two other areas deserve further mention. The orbital prefrontal cortex (the area right above the eyes) is likely to be involved in error detection and alerting, in the mismatch of expectations that tell us everything is not quite right, and that is behind our fretting about social behavior or about "being good" in the sense of properly ordered ritual, religious strictures, or rule structures. It certainly would also have bearing on the "conflict" or "trouble" around which narrative plots are built. Finally, the anterior

cingulate gyrus, the front part of the bump right inside the midline split of the cortex into right and left hemispheres, is likely to mediate much of our capacity for self-consciousness. It is the gradual maturation of this area that probably is behind abilities to recognize ourselves in the mirror, focus our attention and tune in to particular stimuli, ignore irrelevancies, focus on internal patterns, and delay gratification.

The frontal lobe takes up 28 percent of the cortex. It is responsible for motor control, including the generation of language, the premotor rehearsal of acts and simulation of potential action, and the generation of ideas and plans, the thoughts and associations by which we build new meanings. It is the place where otherwise fleeting perceptions can be held and manipulated and the home of consciousness, where unconsciously assemblies can be scrutinized and selectively acted upon. The prefrontal cortex in particular is behind much of what we call conscious experience, including our awareness of emotion and our abilities to attend and focus, mark and prioritize, and construct meanings and purposes. It has two-way connections to many other areas, including subcortical ones, making it possible for sudden emotions to preclude other thoughts or for cognitive tasks to suppress emotion. Sad or anxious? Do something intellectually engaging.

The prefrontal cortex is also slow to mature, however, suggesting that self-control is something only gradually learned and developed over time, without which our will is less free—more responsive to information from the emotional centers, more likely to be captured by external distractions. But greater control, greater capacity for delayed gratification, of being able to inhibit our impulses, also make us dangerous and savvy manipulators. Present a choice to a chimp between two boxes, and the chimp will pick the one containing the reward, even if the reward is always given to another chimp (Deacon 1997). Any four-year-old human quickly learns to pick the nonreward box for his sister. No wonder that the prefrontal cortex is thought of as the seat of the self, of the will, and of morality, the consciousness so generated more sensibly understood as a product of brain activity rather than as the transcendent nonmaterial spirit of dualism. It is rooted in the flesh of the brain, is shaped developmentally, and can be hurt by damage to real neural tissue.

The Neural Substrate of Narrative Selves

The contributions of the neural components overviewed above to our building representations of who we are and what we are up to, the stories we tell ourselves about ourselves, should be readily apparent. The input, the content of such stories and the simulation of experience that they provide, include sensory-motor activity, our memories and images of perceptions and actions, and our memories and anticipations of both internal and external events. The subcortical mediation of motivational and emotional experience gives the stories we tell ourselves and others their felt

significance, that move us. Multitasking is made possible by the dorsolateral components of working memory that allow us to hold some things in mind while operating on other contents. The ventromedial connections between high-level executive function and the emotional systems are the means by which we prioritize, evaluate, and mark somatic significance. The orbital prefrontal error detection of mismatches with expectation is essential to taking corrective action (and may signify the "trouble" so central to narrative plots). The cingulate gyrus mediates self-consciousness and internal focus. These provide the raw materials from which narrative is fashioned, which may provide understood and experienced integration into meaningful, coherent, and comprehensible structures. These narratives always are representations of one's own experience even when they are putatively accounts of external events; not only are the boundaries not always clear, but stories of external events tend to be far less interesting without some reference to the interior landscape. However, these narrative self-representations are selected and therefore are a limited sample, abstracted, and separated from the experienced particulars. They also are constructed, and therefore perspectival, egocentric, and always in some sense fabricated (and potentially self-deceptive, even in motivated ways) (Teske 1996). They also are likely to be interpretive and structural impositions.

Events certainly occur in our interactions with the world and also with experiences generated from our interiors, and, although we certainly hear and recount these events in storied form (and in some sense need to), they do not occur, nor are they likely to be processed, at least in their early stages, in storied form; nor do these stories have any clear direct causal impact on governing our own subsequent behavior. Nevertheless, given the relationship between limbic system emotional mediation and arousal, and especially hippocampally generated "replay" of sequenced events, our formulation of events into narrative form may be an important part of not only our declarative memory of those events but any ability we might have of synthesizing them into more coherent diachronic representations of self, of others, and of their relationships and interactions. These pieces of a broader neuromythological account are of necessity speculative, but there is empirical evidence for the construction of temporal orderings, the reconstructive character of memory, the dissociation of inner speech from the executive functions of the prefrontal cortex, and the constructed character of our experience of free will, of the self in control.

The experienced temporal ordering of events is likely to be produced by neural interpretation of events, which may not reflect the order of these events (see Dennett 1991 and Flanagan 1992 for overviews). Daniel C. Dennett and Marcel Kinsbourne (1992) summarize some of the phenomena that provide evidence, including color-change induced apparent motion, a "bunny hop" illusion in which touches along a line are experienced

as sequential, a number of cases of "backward referral" in time, and commonly experienced delays in the consciousness of intent. The serial stream of conscious experience is likely to be a kind of virtual temporality imposed upon a massively parallel stream of conflicting and continually revised events. The cross-cultural variation in temporal experience also suggests that this virtual temporality may be produced or at least affected by processes of socialization. This produces what Dennett (1991) calls a multiple-drafts model of consciousness, in which we constitute our sense of ourselves through time via a regularly revised set of "drafts," organized from the more fragmentary information provided by simpler neural components. This capacity to organize memory (and anticipation) into a serially ordered hierarchy of actions extending backward and forward in time also makes it possible to tell stories, organize more coherent and meaningful lives, connect our pasts with our futures, and, in all likelihood, draw on or integrate our own stories with the broader, perhaps more archetypal, ideological, and mythical narratives and metanarratives provided by our culture, our history, and our literature.

At least a generation of cognitive psychologists has collected evidence for the reconstructive character of memory, its omissions, elaborations, distortions, and changes over time, its transformation through the recall of previous recollections and imaginings, and the repetitions of events over time (for example, Loftus 1979; Neisser 1981). Gerald Edelman (1989) even described our consciousness of ourselves as a kind of "remembered present," our memories of ourselves and our circumstances being regularly reconstructed, as anyone who awakes confused about his immediate circumstances can attest. Our grasp of the meaning of any sequence of actions may require some reconstruction of intent, which can then be fed back into ongoing actions and plans. Such reconstructions also can be done during or even after a relevant action, as when our own intentions become clear only while accomplishing an action or, let's admit it, even subsequent to it. Psychotherapeutic constructions of unconscious intents, or the construction of an identity by "owning" or taking responsibility for some events in our lives and denying or relocating others, involves accounting for actions in terms of directions or purposes, often "as if" they were formulated in advance, though we often do not recognize or acknowledge that this is a constructive process (Teske 2000). People are notorious for confusing what they thought at the time and what they think now that they must have thought, all the way back to Augustine's *Confessions* (Teske 2001b).

Our narrative sense of ourselves, in its active operation, is constituted by our continuous "inner speech," occupying much of our waking consciousness, by which a self "answers questions about who a person is, what that person aims at and cares about" (Flanagan 1996, 69–79). Alan Baddeley (1993) provided evidence from neuroimaging that activity in

classic language areas (Broca's area, Brodman's areas 44 and 45) is specific to inner speech, which also includes activation of a more posterior area (the left supramarginal gyrus, Brodman's area 40), normally active only when we listen to spoken words, suggesting that we are both producing and comprehending our own quiet inner speech, some of which may eventuate in verbal expression but most of which is limited to internal comprehension. As John Bickle (2003) has pointed out, this is empirical evidence, in combination with Bernard Baars's (1997) claim about the ubiquity of inner speech, for a narrative concept of self. Nevertheless, this self-construction also produces an image of a "causally efficacious," decision-making self-in-control. Unfortunately, there is evidence about how limited this self-control is for the vast majority of our actions, which are more "ballistic" than this experienced self-control would suggest, about the time pressures and differences in order of magnitude between these narrative representations and actual activity-vector representations (Churchland 1995), about the limited access these language areas have to the neural networks that actually produce particular tasks (both cognitive and behavioral), about the double dissociations between the narratives of self-in-control and the functions of planning and motor sequence execution, and clear examples of clinical confabulation under other frontal damage—all of which suggests that the experience of self-control that is part of the felt content of these narratives may have no direct relationship to the actual control of action. Our awareness of mismatches between these narratives, while it does alert us to this possibility, may underestimate the frequency with which the control actually occurs prior to the production of the narrative (Bickle 2003).

There is an extensive research program, detailed by Daniel Wegner (2002), providing extensive empirical evidence about the illusion of conscious will. This experience arises from processes distinct from those by which the mind generates action. It arises from inferences about the relationship between conscious intention and voluntary action, though both intention and action arise from processes that we do not experience as willed. There are conditions that can reduce the experience of will, that result in our experiencing voluntary, purposive, and complex actions as automatisms. The authorship of action can also be lost, resulting in projections of such authorship to other people or even animals. Actions also can be projected to imaginary virtual agents, a process that underlies experiences of spirit possession and dissociative identity disorder as well as the formation of a virtual "agent self." The illusion of will can be sufficiently compelling as to produce beliefs in the intended production of acts that could not have been so intended. This suggests that, although the experience and narrative account of consciously willing an action cannot be taken as prima facie evidence for mental causation (such that any such causation is likely to be indirect at best, though still a causal product of component

brain functions), and the sources of this experience in brain function and external circumstance can be empirically investigated, such experiences do powerfully represent personal authorship to an individual and affect both our sense of efficacy and achievement and our acceptance of moral responsibility. Despite the slippage between our experience of conscious will and the processes that are directly involved in causing an action, these are all parts of biologically bounded individuals; we are still performing the actions, and we learn something valuable by better understanding the processes by which we take, and feel, responsibility for them. Moreover, regardless of the fact that our self-representations may never do justice to what Owen Flanagan (1992) calls our "Full Actual Selves," they are what we tell ourselves (and, with further modifications, others) what we are, our personal myths of self, and the relationship between these kinds of "public relations" functions and actual executive control, while it may be indirect, does have real effects on what we may subsequently do and on how we are taken by others, including the relationships between our actions and our words. It may sometimes be true, as Pirandello so famously said, that someone else is living my life, and I don't know anything about him. But we can learn.

The neural processes by which we constitute "what I meant" or "what I intended" are the processes that provide the material support for the constitution of any meaning at all. The narrative selves of our conscious experience may be better understood as emergents with higher-order effects and with indirect rather than direct determination of actions. The structuring of our life into meaningful experience, its ordering in time, and its connection to other people's stories and to culturally available narratives are also likely to be learned and internalized from other human beings with whom we have physical and emotional interdependency, whose lives have in turn been structured and ordered by particular historical and cultural practices and institutions. This is especially true and even foundational to the emotional forms that shape our personal myths of self, in how these structuring capacities are developed ion the first place. Our consciousness and representations of ourselves are likely to depend heavily on the "somatic marking" (to use Antonio Damasio's apt phrase [1995, 165]) of our self-representations (cf. also Thomas Metzinger's more sophisticated "self-model theory of subjectivity" [2003]), which emotionally prioritizes particular events and outcomes, itself scaffolded by our early life experiences with particular socializing agents (by whatever rearing practices, social rituals, or life-changing events). Our sense of both the meaning and moral significance of events depends on such neurally mediated emotional and narrative structuring. As Charles Taylor (1989) indicated, connections between events, how they cohere and show continuity, and the integrity or disintegration of our lives through time are constituted in narrative. Understanding oneself requires an account both of how one got here and

of where one is going, which provides a location in a "moral space" (1989, 51). These accounts are, as we have seen, causally dependent on the neural structures and functions by which they are produced, the unpacking of which may give us a better understanding not only of that production but also of the dissociations between those accounts and our actions.

The Development of Emotions, Scripts, and Life Stories

The emergence of storytelling and narrative form in human evolution and prehistory is beyond our present scope (see Deacon 1997; Donald 2002). However, the shaping of narrative content over the course of development is central to constructing a neuromythology that can account for our emotional engagement in narrative, our own development of a narrative self, and the embedding of human meaning and identity in broader narratives, metanarratives, and mythologies. Jerome Bruner (1986; 1990) distinguishes between the "paradigmatic," synchronic understanding of logical proof, empirical observation, theories, and causality and the "narrative," diachronic understanding of the "vicissitude of human intention" (1990, 14) organized in time, of human actors striving to do things over time, which requires believable accounts (by virtue of their fit to available folk psychologies) about motivational acts and meaningful ends. Theories of cognitive development, like that of Piaget, have focused largely on the paradigmatic understanding of scientific reasoning, which culminates in early adolescence (at least in schooled cultures) with the capacity to entertain counterfactuals and evaluate hypothetical claims. Storytelling is learned earlier, and even children are aware that stories are about people (or peoplelike characters) trying to do things over time, that they have a beginning, a middle, and an end (a "how it's going to turn out"), and that what makes it a story is some kind of narrative tension—a protagonist who could be defeated or a conflict needing resolution.

This narrative tension is what I believe is central to a narrative self, the understanding of which is likely to be crucial for a fully developed neuromythology. Research on "story grammars" (Mandler 1984, for example) lays out standard components such as setting, character, and the cycle of motivating event, attempt at goal, consequence, reaction, and motivating event. This reminds me of the teaching of scientific method that describes the formal steps but forgets that the crucial center is some kind of comparison or test. Similarly, while the "story grammar" components are necessary, it is the tension/climax/denouement that makes a story compelling. *G*-rated movies tend to be unsatisfying for older children and adults because, in the interest of protecting small children, narrative tension is sacrificed. Some moviemakers and storytellers are good at setting up and maintaining suspense, curiosity, and tension, and some are not. Given phenomena like infantile amnesia (the difficulty of accessing prelinguistic

memory), the difficulty of remembering dreams that are not put into storied form, and the ease with which students remember a good illustrative story, I suspect that we encode events into story form in order to remember them. Indeed, given the evidence of the role of long-term potentiation in the hippocampus and the reactivation of hippocampal ensembled memories during sleep (McNaughton et al. 1994), and the relationship of arousal to memory (Dudai 1989), as well as common experiences of rehearsals and retellings of stories over time (Loftus 1979), it may well be that human memory (at least episodic memory) depends upon narrative form, particularly the arousal-producing qualities of narrative tension, conflict, and resolution. Events in the world do not occur in storied form, and the same set of events can be put together into quite different stories, but the storied form may provide not only a structure that aids memory but also the emotional activation that results in longer potentiation and deeper encoding. Remembering dreams, unattended disjoint events, and even traumatic event sequences may be difficult because they have not been put in meaningful narrative structures (Bruner's "vicissitude of human intentions") that have plot sequences including tension, climax, and denouement and that involve end states or resolutions—the goals, meaning, and purposes around which our intentional lives are constructed. The relevance of these structures to the narratives of identity formation, including the identity "crisis" of conflict and choice, should be obvious.

Out of what do we build the emotional sequences that are requisite to the dramatics of narrative? A neural affect system is shaped into emotional patterns by the social scripts laid down during our long period of developmental dependency, including second-order emotions and the development of independence, autonomy, and relations of intimacy and power. Personal identity is made possible by the evolution of a human neuropsychology that requires social interdependency for its development. Our neuroplasticity requires shaping over a lifetime, socially scaffolding our neuroregulation, including emotional attachments and dynamics. The evolutionary hypertrophy of our prefrontal cortex leads to a colonization of brain function making possible the social construction of virtual realities, novel forms of socially constituted experience, and the transforming effects of mythic, ideological, and religious systems (Teske 2001a).

There are about ten primary human affects, rooted in biology and evolution, each of which is linked to particular facial expressions that are species-wide and recognizable across disparate cultures (Ekman 1972; Izard 1977). Silvan Tomkins (1979) elaborated a "script theory" that was extended by Donald Nathanson (1992) into a fuller theory of how the self emerges from the storied structure of affect and emotion. According to Tomkins, the role of primary affects is to provide the amplification that gives our basic biological drives their motivating power, their urgency. These are innate, biologically differentiated and specialized; each feels different

by virtue of the varied biological systems involved, including their neural pathways, and by virtue of links to specific facial responses, which provide both sensory feedback and social information to others (part of the right amygdala may even respond to the fearful facial expressions of others very early in development). There is a developmental sequence for their emergence, from the distress responses of newborns to the enjoyment-related emotions relevant to early attachment, the subsequent expressions of interest, the fear and sadness related to object permanence and the ability to respond to separation, loss, and novelty, and finally, with the development of self-consciousness and the initial consolidation of a self-image, the second-order emotions of shame and guilt. Shame, guilt, and pride are generally thought to be emotions *about* other emotions and involve experienced contractions and expansions of self-boundaries, respectively ("swelling with pride," for example). The basic affects are strictly biological equipment, including sites of action (voice, circulation, respiration, posture, face), neural effectors, chemical mediators, and our own set of receptors by which we experience the associated sensations. These are organized by specific programming that can move from mild to intense levels (surprise–startle, interest–excitement, shame–humiliation), the affect system producing urgency, a particular profile of response (the quickness of startle responses, the arousal of anger), but provide no information about the environmental source (sobbing may be the result of hunger or loneliness), and the affect also can produce alterations in other sensory reception (tumescent genitals expose more receptive surface). Although the affect systems are strictly biological, feeling states involve an affect plus awareness of it, and emotions involve the combination of affect and feeling with remembered experiences that can trigger additional affect.

The production of regular patterns of emotion, and their recall, produce the organizing scenes and scripts that are the basis of our personal dramas. These patterns will not only be heavily dependent upon the domestic or family dynamics of a particular moment in history and culture but are likely to shape our extremely plastic and immature nervous systems during the course of development in ways that may often be irrevocable or difficult to countercondition (such as basic amygdalic fear responses, experiential preferences, or foundational emotional and relational scenarios upon which all subsequent ones will be built).

A *scene* is the combination of at least one affect and one object, which may include persons, places, times, actions, or feelings. These are learned, formed from repeated experience, as affects themselves can come to be connected to variant objects and situations depending on the patterns available, particularly in the early environment, given the long period of social dependency in human growth to adulthood.

Scripts involve a learned set of rules for interpreting, creating, enhancing, or defending against a family or grouping of particular scenes. The

short-term importance of a particular scene will depend on the biological organization provided by the affect system, but its long-term importance in a life drama or narrative will be a function of the psychological magnification produced by the similarities and differences between a scripted pattern of scenes and those that this pattern activates in memory. Similarities produce a magnification by analog, tend to activate state-specific scenes and scripts, and tend to produce the negative amplification often experienced as a kind of "here we go again." Variations around a stable core tend to produce the magnification of novelty (curiosity, enjoyment, interest), with differences being magnified as "special." The basic affects consist of a finite, biologically universal set, but there is no such definitive set of scene and scripts, although a developed neurotheology might articulate a taxonomy of available variations on the model of Tzvetan Todorov's (1973) analysis of folklore or Joseph Campbell's (1988) of mythology. As a first pass, at least for a Western audience, a catalog of plots from classical mythology might be a good place to start, especially given the preliminary work done by Dan McAdams (1988) in his theory of *imagoes*, but Northrop Frye's (1957) mythic archetypes, Lawrence Elsbree's (1982) generic plots, or Agnes Hankiss's (1981) ontological narratives also would suffice.

Tomkins (1979) begins with a distinction between two basic types of scripts: (1) A "commitment" script, resembling romantic or comedic narrative forms, includes a program or goal that anticipates positive affect and a long-term investment in improvement. In such scripts, goals are clear, ambivalence is minimal, and the magnification involves variations on the theme of obstacles being overcome. (2) A "nuclear" script, resembling tragic or ironic narrative forms, is marked by confusion or ambivalence about goals, the magnification by analogy to positive scenes that turned into negative affect, where the scripted form involves attempts at reversal of limited success, and an expectation of fated repetition. No claim is made that these forms *cause* a particular sequence of events to occur, only that these scripts and their accumulated magnifications have the effect of organizing scenes into coherent and meaningful stories. No doubt the formulation of such accounts can have self-fulfilling effects, but they also can produce motivational magnifications. Rae Carlson (1981) provides a sample case study of the role of a nuclear script and its attendant variations in a young woman making sense out of repeated experiences of disorientation, withdrawal, and shame.

Drawing on Erik Erikson's work on the modern Western "identity crisis," McAdams (1988) suggests that identity itself can be understood as a life story, initially composed in late adolescence and early adulthood, which gathers remembered events, current circumstances, and future anticipations into an internalized, integrated personal myth.

To be an adult means among other things to see one's own life in continuous perspective, both in retrospect and prospect. By accepting some

definition as to who he is, usually on the basis of a function in an economy, a place in the sequence of generations, and a status in the structure of society, the adult is able to selectively reconstruct his past in such a way that, step for step, it seems to have planned him, or, better, he seems to have planned it (Erikson 1958, 111–12).

Clearly, one can raise historical questions about the extent to which the notion of finding or constructing a unique identity might be a peculiarly recent (Baumeister 1986) or culturally odd (Geertz 1973) idea, and a more fully developed neuromythology would need to include an account of historical and cultural variations in personal narratives (including an examination of when and how they are used at all), and even in our understanding of self/world boundaries (Teske 2005). Moreover, initial typologies of "crisis and commitment" in identity formation (Marcia 1980) may not only be limited to Western males in surplus economies but may refer not so much to underlying processes as to a narrative form that organizes our actions in ways that are rational and narratable (Slugoski and Ginsberg 1989).

Becoming an adult at this particular point of culture and history may mean simply being able to present one's accumulated actions according to certain "criteria of intelligibility," that is, accounting for them in terms of reasons rather than mere causes or simply in terms of their sequence or their outcomes. The stories we tell ourselves and others about our lives are going to be told in terms of intents (and usually conscious ones rather than the reasons and intents about which we can say "I didn't know it at the time, but here's what I was up to," although these would not be ruled out); this is part of what makes such accounts, and our actions, *intelligible*, regardless of when the intents were formulated and irrespective of what role any consciousness of intents might actually have played in bringing about the relevant actions and decisions. Moreover, our historical and cultural understanding of identity as an individual achievement implies both intrapsychic conflict and the overcoming of prior deficits. The stories of identity crisis produced by college students in late adolescence, however, may be seen in later adulthood not as crises but as inevitabilities, just as any one of us can reframe what appeared to be a crisis at an earlier point in development in quite different terms. I suggest that the dynamics of narrative plotting, and our capacity to encode our experiences in memorable terms, also requires that events be *framed as* conflicts, crises, and climaxes in order for them be remembered at all, at least with any facility or without extensive situational or mnemonic support. Thus, some sort of storied or narrative form, regardless of its constructed character, would be a *sine qua non* of the memorability of events, imagined or otherwise.

The life-story model of identity developed by McAdams (1988) provides a detailed account of the origins of such stories, which a full neuromythology would link both to brain development and function and to the

broader mythological corpus available in any culture. In his model, narrative tone is tied to basic attachments of infancy, producing the variations of security/insecurity behind the overall sense of optimism/pessimism that drives comedy and romance on one end, tragedy and irony on the other; from this comes the legacy of security in the hope that things can turn out, the enduring belief in the attainability of wishes, or, alternatively, the insecurity of failed intentions, of a capricious world where things do not work out. Because this may well be tied to the very early shaping or conditioning of subcortical structures (amygdalic fears, for example), it is likely to be subdoxastic, or below the level of belief, and may in some sense ultimately drive the emergence of beliefs (as well as life narratives) with quite different tones, from reactionary and authoritarian religious systems to ones more liberational and full of joy (cf. Lerner 2000), but this argument will need further development. McAdams's model suggests that early childhood may include a stockpile of emotionally charged images from entertainment media, fairy tales, and even mythical and religious stories and iconography. The era of formal schooling may include the development of basic story themes, goal-oriented sequences modeled by socializing agents, composed of images as well as recurring motivational dispositions. McAdams elaborates basic thematic dimensions of agency (separation from and mastery of the environment) and communion (connections and intimacies in relationships and larger social projects) as central to narrative content. Basic life stories are likely to vary in complexity, but a central feature of identity for the adolescent includes the development of foundational beliefs and values, which are likely to be necessary prior to the construction of life narratives (though one can see potential plot crisis events in how these are established) and are not likely to change much after young adulthood. McAdams proposes that a life story is constructed out of crucial scenes—concrete events that either affirm central truths or represent episodes of change.

Drawing on research on the multiplicity of possible selves (for example, Markus and Nurius 1986) and the role of particular kinds of self-discrepancies in the production of different classes of motivation and emotion (Higgins 1987), McAdams's theory of *imagoes* posits a pattern of internalized objects or models that are incorporated as semiautonomous agents whose actions and interactions are the story plots. Using classical mythological figures as mnemonic aids, or personifications of foundational goals, McAdams provides a classification across the dimensions of agency and communion: Zeus as a representative of high agency, Aphrodite of high communion, Apollo as high on both dimensions, Dionysus perhaps low on both. He argues that identity is not composed of a simple imago, but by the story itself, and provides empirical evidence from adult samples, of correlations with imagoes and their classification with scores on power and intimacy motivation from projective tests. His notion of a *generativity*

script, a predicted legacy in which the story can be extended beyond one's life span, seems to be especially important in middle and later adulthood.

McAdams's life-story model of identity is an important contribution to the linking of several levels of explanation as we move from the neuropsychology of emotion to broader accounts of personality and life story, especially in his understanding central conflicts in terms of conflicting and interacting imagoes, the organizing of a multiplicity of roles into a manageable cast of characters. Certainly the conflicts, crises, and climaxes necessary for the emotional anchoring of narrative that provides its memorability, and hence a narrative self, can be understood in terms of these kinds of interactions. Nevertheless, there is more work to do on how we account for our engagement with and movement through a world and a history and how we make sense of our lives more broadly. Much of how we make sense and meaning out of our lives and form identities has to do with our roles or functions within larger systems, from relationships and families to larger social units of community, of nation, of peoples, and to longer-term events, from those of longer projects, of relationship development and dissolution, to historical events, from the building of a neighborhood playground to the building or defending of a nation, the preservation of a watershed, or the resolution of a global crisis. This requires a focus not just on conflicting internal imagoes but also on real transactions with the nexus of events and persons of which we are interdependent parts. The power of our stories has to do with the dramatics of these transactions. In the terms of Kenneth Burke's (1945) *Grammar of Motives,* it is the action, not the agent or the patient, that provides the dramatics. As such, it may be necessary to develop a vocabulary of dramatic transaction to understand more fully how our identities are not only constituted by stories but also, within the larger stories of our history and culture, the only way by which our relationality can be integrated into a broader context of human understanding.

Transactional Dramatics, Healing, and Myth

A broad theory of the effects of story and narrative is beyond the scope of this essay. Nevertheless, I conclude with some attention to the transactional dynamics that provide the engaging emotional power of stories, both in the formation of our identities and in the identification with the available narratives of folk traditions, literature, history, and mythology. In addition to a potential cast of imagoes that can be drawn from culturally available narratives, motivational themes of agency and communion, and broad plot classes such as those provided by scripts of commitment and nucleation, we also can point to a broad vocabulary of transactional dramatics. While as yet speculative and hypothetical, it is possible that we can best account for the engaging emotional power of narratives in terms of such dramatics. What remains to be done here is to suggest some broad

examples of historically emergent and developmentally internalized transactional dramatics and summarize some of the empirical research bearing on the primary psychological functions of integration and healing that stories can provide

Joseph Campbell's classic work on mythology, *The Hero with a Thousand Faces* (1990), captures at least one of the central dramatics of agency, that of the heroic. Myths and stories provide models of the accomplishment of valuable goals under duress and in the face of obstacles. The heroic form provides both identifiable heroes and a broad catalog of the form of their accomplishments, and the dynamics of their overcoming of obstacles can be used to metaphorically read our own actions in their emotional terms. This includes stories like the ordeals of Hercules, the quest of Jason, or the homecoming of Ulysses. Campbell's work illustrates how a wide variety of stories can be read as expressions of the basic heroic dynamic. There may be ways of taxonomizing such variations as those involving defeat and victory, contamination and redemption, exile and homecoming, which trace these variations all the way to the emotional substrate and neural events out of which our engagement is constructed, though that engagement be narratively constituted.

A second crucial dramatic is certainly that of the *romantic*. Stephen Mitchell puts it this way:

> For most of us, our romantic fate, the account of our romantic life, is a central, recurrent narrative within the stories we tell others about ourselves and the stories we tell ourselves about ourselves to maintain a sense of who we are. And no romantic narrative, if it is to avoid degenerating into a fairly tale (and they lived happily ever after), is without pain, hurt, and loss. That is why the blues is such a popular musical genre. (2002, 146)

Mitchell points out that there are few better ways to determine one's identity, represent one's uniqueness, than to provide an account of our scars, our old wounds, and the damage we have sustained. He argues that such accounts fall along an axis of self-pity and guilt, of damage inflicted ("she done me wrong"), and of damage that one has brought upon oneself and others ("I was a fool"), and that this emotional content organizes stories of past as well as present relationships. One might argue that the violation of the fairy-tale normativity learned over countless repetitions in childhood is what makes for the real drama of the narrative, the "trouble" out of which any story is built, and by which it is likely to be remembered. Mythology also provides exemplars here. There are always two characters, though we may see ourselves in either role, such as the stories of Psyche and Eros, Pygmalion and Galatea, Orpheus and Eurydice. As with the heroic, so too there are romantic emotional variations, in alienation and reunion, betrayal and forgiveness, or sacrifice and bliss, that are traceable in some detail to their neuropsychological components. Their meaning still resides in the narrative context.

Rollo May's *The Cry for Myth* (1991) provides another valuable model for drawing out the psychological functioning of mythology. He argues that the denial of myth is behind much of the current cultural malaise and presents a number of cases whereby myths may provide unifying contexts for surviving personal crises, finding our roots, fixing our memories, and even engaging in psychotherapeutic self-discovery. He examines myths specifically relevant to the American condition: the Protean myths of frontiers and loneliness, the Horatio Alger myth of individualism and narcissism, and the Sysiphean myth of the American dream and tragic success. He uses Dante's *Divine Comedy* to address the journey through hell of therapy, *Peer Gynt* to understand the value of despair in love, and *Briar Rose* to understand creative waiting. His account of historical variations across three versions of *Faust* traces the myth of patriarchal power from Marlowe's tragedy through Goethe's enlightenment response to Thomas Mann's twentieth-century lamentation, and he discusses catharsis in the struggle with evil in *Moby Dick*. He concludes with a discussion of myths that may have value for human survival in this era, including ones bearing on the relationship between liberation and responsibility, mortality and passion, planetary consciousness and humanity.

On the individual level, the level of engagement with human neuropsychology that is central to a neuromythology, there is both clinical and empirical research evidence about the healing effects of narrative approaches to traumatic events. "Stories may bring our lives together when we feel shattered, mend us when we are broken, heal us when we are sick, help us cope with stress, and even move us toward psychological fulfillment and maturity" (McAdams 2001, 780). Jonathan Shay's *Achilles in Vietnam* (1994) suggests that only in the telling of stories of trauma to a receptive audience, the meaningful integrating of scattered, dissociated, painful, and uncontrolled images and emotional responses into a coherent story, can there be any real healing of post-traumatic stress in Vietnam veterans. James Pennebaker (1989; 1997) has shown that, even in college students, the narrative disclosure of trauma, where it combines facts and feeling, produces measurable improvements in physical health (down to the level of immunological functioning), depending upon the degree of emotion expressed and the extent to which it is a well-formed story.

An understanding of Joan Didion's claim that "We tell stories in order to live" (1979, 11) can be obtained by looking carefully at the dynamic narratives of self developed in the formation of identity, seeing how they are rooted in our neuropsychology and how they draw from the available cultural corpus. These mythic sagas include gods and goddesses, heroes, villains, and tales of love and power, stories of creation, demise, rise, fall, rebirth, and the adventures of the self. These are constructed and reconstructed over the life span, along with ego development, the choices and commitments of identity and intimacy, and the maturity and generativity

that can come with age. There are cultural, social, and personal functions of myths, including their role in understanding human crisis and transformation, love, heroism, family life, and even the demonic. Our construction of ourselves via such mythic and storied forms, whether comedic, romantic, tragic, or even ironic, enables our participation in the historical moment, in epistemically objective, socioculturally constituted realities as well as in the timeless and eternal. Finally, not only does narrative constitute our movement in moral space (Taylor 1989), but it may have the potential both for healing and for disruption for us as individuals and as a species. A fuller and multileveled account linking the evolution, history, and development of human nervous systems through several explanatory levels to the emergence of a narrative self, and the ties to and shaping of such narratives within a cultural history of mythic and religious forms, will provide a neuromythology with broad explanatory and meaning-engendering purpose that could be of vital importance to the bridge between scientific and religious understandings of human lives.

NOTES

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1. Although the information in this sample can be found in any standard textbook on neuroscience (Gazzaniga, Ivry, and Mangum 1998, for example), I recommend Rita Carter's lavishly illustrated and easy to follow *Mapping the Mind* (1998) for a wealth of accessible and insightful discussion on a wider range of issues.

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