Affective reflections and refractions within the BrainMind

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The characteristic affects such as anger, fear, loneliness, desire, love and playful joy make emotions so important in our lives, and perhaps the lives of many other animals. Still, affect is such a slippery brain process, more easily discussed from first than third person perspectives, that there is little agreement on how to create a solid science of affective experience. Science is much better positioned to study objective entities of the world as opposed to subjective entities of the brain. Only because of advances in brain research, as highlighted in this issue, is progress finally being made on that slippery topic. (*Netherlands Journal of Psychology*, 64, 128-131.)

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Emotion science has been flourishing in psychology for almost a quarter of a century. Affect science is gradually catching up. Why make the distinction? Because affects, the valenced feeling aspects of certain brain states, are just a subset of the neurophysiological and psychological complexities that accompany all emotional and motivational states. It is common for emotions to be parsed into behavioural, physiological, cognitive and affective components, with the affective components being most difficult to clarify in any scientific depth. Indeed, without affective feelings, there would be little of substance left to the concept of emotions—the behavioural, physiological and cognitive components can never hang together as a coherent description of emotions. However, affect science remains burdened by sterile controversy (Ortony & Turner, 1990; Panksepp, 1992). Many remain excessively committed to the classic Wundtian dimensions of valence and arousal as being the most coherent ways to talk about affects (Barrett, 2006). Others do not deny the empirical utility of such approaches, but advocate evidence-based visions of the brain being an evolved bee-hive of many distinct affects, ranging from anger to hunger, from fear to thirst, from joy to disgust, from grief to love (Denton, 2006; Panksepp, 1998, 2007a). How is one to make sense of such divergent views? Clearly, controversy currently outweighs agreement (Barrett et al., 2007; Izard, 2007; Panksepp, 2007b, 2008a).

Perhaps some clarity can be had through conceptual analyses (Ekman & Davidson, 1994). Affects come in various flavours: Some are strictly sensory, such as the delight of honey on the tongue and the excruciating ache of gouty joints. Some are clearly linked to very specific visceral

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bodily states, from hunger pangs to the dreadful dehydration that can fill the mind with excruciating thirst; others are of a more nebulous variety, not well understood, such as bodily exhilaration and fatigue. Yet others, although modulated by bodily states, appear to be affects that arise largely from within intrinsic BrainMind dynamics, such as our capacity to experience various emotional arousals and the associated feelings (Panksepp, 2008b). Clearly, the menagerie of basic emotional feelings is smaller than the full complement of valenced affects that the brain can engender from bodily dynamics operating in highly variable worlds.

There are also levels of control within each affective neural system. The foundational, primary-process levels of control are built into the MindBrain as genetically provided tools for living. Others are derived from secondary and tertiary processes, ranging from simple forms of learning (classical conditioning) to culture (based on our capacity to think about our place in complex social groups). Superb brain-body mechanistic work can be done at subcortical primary and secondary process levels, while the tertiary process levels, concentrated in neocortex, are so much more variable that mechanistic work on general principles is much harder to pursue, almost impossible in animal models. Indeed, such emotional complexities emerge as organism mature, making developmental landscapes and epigenetic processes critical dimensions for the eventual emergence of our higher affective complexities.

Those higher levels of emotionality, where interactions with cognitive processes abound, will be harder to understand than the foundational issues that are more tightly tethered to our evolutionary heritage. This self-evident hierarchical view may be troublesome for purely psychological approaches that have little interest in and access to the lower, subcortical, initially objectless' affective foundations of the mind. Psychology has traditionally been more comfortable discussing the firmament of the cognitive mind, whose complexity is tethered to the availability of neocortex—brain tissue that is as close to a general-purpose *tabula rasa* as one can find in the BrainMind. And the more of this random-access, pluripotent brain tissue organisms have, the more perceptually acute, cognitively intelligent, emotionally sophisticated, and affectively variable will organisms become.

Despite the opinions of many evolutionary psychologists, there are no genetically predetermined functional modules up there in the neocortical stratosphere. Please note that young mice whose future visual cortex is removed before birth still develop totally functional visual systems in the cortex (Sur & Rubenstein, 2005). Early damage to subcortical regions is not followed by comparable plasticity, leading to lasting changes in mental abilities (Merker, 2007). Indeed, all of the neocortical cognitive functions can only operate if they remain connected to the functionally dedicated subcortical circuits that decisively mediate our basic attentional, emotional and motivational abilities.

Indeed, the neocortex alone does not have the right stuff to sustain consciousness (Watt & Pincus, 2004). The sub-neocortical regions are quite adept at supporting primitive affective forms of consciousness. Even human children born anencephalic—essentially without any neocortex—retain the capacity of simple perceptual and affective experiences (Shewmon, Holmse, & Byrne, 1999). And when we surgically decorticate young animals, they retain emotional 'normalcy'. They eat, drink, fight, fornicate and take adequate care of their offspring (albeit in untidy nests). To our surprise, they also retain ludic urges, playing as effectively as their neurologically intact littermates (Panksepp et al., 1994).

This may lead to a troublesome conclusion for many psychologists interested in emotions. Even though emotional feelings and cognitive strategies seem inextricably entangled in the higher reaches of the MindBrain, they are sufficiently distinct entities that it is wise to envision cognitions and affects as mental capacities that can be scientifically distinguished within the lowest, primary-process regions of the brain. Even at higher levels, where affects and cognitions highly interpenetrate, they probably remain as physiologically distinct, and as functionally intertwined, as kidneys and heart. Thus, affects and cognitions can be teased apart despite their intimate interactions within the intact MindBrain. If we are not willing to dissect the dissectible, we may never understand what emotional feelings and cognitions really are.

Of course, such dissections do a great injustice to the whole BrainMind. But as we come to understand the critical dimensional parts of emotional wholes, we can develop better visions of how to diminish needless disagreements (e.g., Barrett, 2006; Barrett et al., 2007; Panksepp, 2007b, 2008a). Many distinct levels of control exist within intact BrainMinds. With better clarity about one's own level of analysis, we can better recognise what our favoured strategies can solve and what they cannot. Thereby sterile controversy can be minimised, and the various levels of control within the MindBrain can be better integrated.

My own strategic aspiration has been to understand the *primary-process* affects of basic emotional arousals. Although I remain most interested in the nature of basic emotional feelings in humans, I surmised early in my career that cogent experimental tactics did not exist if I restricted my research to human beings. I needed access to the lower reaches of the brain. Thus, I took Darwin's evolutionary lessons to heart. We humans are inheritors of many basic animalian processes, including a variety of basic emotions (certainly primal forms of anger, fear, desire, loving care and playfulness). I accepted that such emotional, instinctual networks are built into every mammalian species, and that the anatomical and neurochemical *principles* learned from other animals would also apply to human beings and our emotional disorders (Panksepp, 1998, 2004).

However, the study of animals would not tell us much about the way basic emotions interpenetrate with human capacities for complex emotional information-processing, for deep thoughts and complex cultures. Those abilities are permitted by expansive neocortical dynamics that achieve their cognitive power partly by inhibiting the primary-process power of the basic emotional and motivational urges (Liotti & Panksepp, 2004). Might it not be useful for all investigators to envision how their research efforts fit in within hierarchically layered Mind-Brain complexities? At the lowest levels of control, there are *primary-process* emotional networks, encoded by genes about which little is known. This perspective is based on the robust fact that we can artificially evoke instinctual emotional actions and various positive and negative feeling states by stimulating, either electrically or chemically, the same subcortical locations in every species of mammal so far studied. The modest amount of evidence in our own species only confirms the general principle that raw emotional affects arise from homologous subcortical networks.

As a result of animal brain research, it is now well known how basic emotions interact with primal learning mechanisms such as classical and instrumental conditioning. The best-studied network mediates learned fearfulness within lateral and central zones of amygdala (LeDoux, 1996). However, such studies of *secondary-process* emotions tell us little about the *primary-process* of fear. The 'unconditioned instinctual responses' continue to be neglected in preference for the easier study of 'conditioned responses.' This is regrettable since raw affective experiences, primitive forms of sentience, arise from the primary-process substrates as variants of affective consciousness (Panksepp, 2007c).

Animal models are largely impotent for revealing how *tertiary-process* cognition-emotion interactions operate. Most of this work must be done in humans, where the subtlety of mentation can be monitored in the context of varying environmental and cultural dynamics. Only in humans can we monitor how affects promote complex cognitive plans and ruminations, where the focus of attention can turn inward toward the neuro-psychodynamics of the mind. Such work cannot be done in animals. However, to understand the whole, we must integrate all levels of analysis, and dispense with the hubris that one level of analysis can prevail over another (Barrett et al., 2007).

And so, how shall we construct a lasting Mind-Brain science from the affective experiences of humans and our mammalian relatives? The edifice of scientific understanding must be created one experimental brick at a time. An understanding of the 'whole' can only be obtained by a scientific understanding of the 'parts'. The fine contributions of this special issue, focusing on both higher and lower processes, highlight rigorous efforts from which a thorough understanding of emotional-affective processes and the nature of personality must eventually arise.

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