



### **The uniquely human social brain**

Insufficiently equipped to compete with other animal taxa (kinds) for survival on an individual basis, early humans evolved to rely on the competitive edge of core patterns of cooperative behavior in groups, leading to the development of the uniquely human social brain (for studies on the uniquely human social brain, see, for example: Adolphs, 2009; Bhanji & Delgado, 2014; Blakemore, 2008 and 2010; Brüne, Ribbert, & Schiefenhövel, 2003; Cozolino, 2006; Frith & Frith, 2010; Grossman & Johnson, 2007; Insel & Fernald, 2004; Kennedy & Adolphs, 2012; Lieberman, 2013; Saxe, 2006).

These core behavioral dispositions evolved as pseudo-fixed action patterns defined as engrained behavioral tendencies, that, rather than fixed action patterns of nonhuman animals – i.e., hardwired, preprogrammed automatic responses (as articulated by Lorenz, 1970, pp. 316-350) – are, in humans, more prone to mediation by genotype (genetic composition) and phenotype (the interaction between genetic composition and environmental and experiential factors), and may even be entirely overridden by experience (as learning outcomes), stressing the flexibility of human behavioral response, with its dependency on learning [the cognitive imprinting in the codifying of all experience from sense-given impressions of environmental stimuli and the interpretation thereof in ideational constructions of meaning through internally configured associations (see Wood, 1942)] and, consequently, the susceptibility of human behavior to molding by environmental influence.

As an evolutionary biological determinant of survival, the uniquely human social brain evolved highly flexible behavior driven by a core of underlying ingrained impulses of pseudo-fixed action patterns, such as the acute stress response (fight-or-flight response), the attachment/bonding response, the mating (procreative) response, the tend-and-befriend response, etc. These pseudo-fixed action patterns maintained core survival impulses while enabling adjustments to changing environmental conditions allowing adaptation to the widest variety of habitats, overcoming the limitations of the fixed action patterns that regulate behavior in nonhuman animal taxa.

Fixed action patterns regulating behavior in nonhuman animals, while eliciting behavior finely tuned to adaptation to a very specific habitat, are unresponsive to environmental changes, whereby the preset behavioral patterns may become ineffective or maladaptive in the changed environment such that even small environmental changes may lead to taxon extinction. Rather than a fixed preadaptation to a specific habitat, humans evolved to *learn* to adapt to the widest variety of habitats by the creative use and manipulation of the resources available within and in the vicinity of their habitat through curiosity, inquisitiveness, imagination, creativity and reasoning. With a critical dependence on 1) learning as the mechanism for adaptation to the widest variety of habitats, and 2) cooperation as the key to human survival, the neurophysiological system of the uniquely human social brain became organized for the optimization of the facility and flexibility of learning and the orientation towards social behavior and structures of community.

By cooperative behavior facilitated by language, which led to both higher-order reasoning and tool-making flexibility to manipulate their environment, humans were able to out-strategize, out-plan, out-maneuver, and simply out-think their taxonomic rivals for survival. Humans organized in groups such as bands or tribes also competed against each other – group against group – in a particular habitat or region, so that social cohesiveness as well as role and skill diversification and skill expertise within a group leading to more specialized supportive social structures became the keys to group survival that pushed evolutionary determinants toward the human tendency for more sophisticated, intricate and complex social organization.

So-called ‘morality’ evolved as a condition of group survivability. Such so-called human ‘virtues’ as courage, love, compassion, forgiveness, charity, mercy, consideration, honesty, honor, selflessness, steadfastness, loyalty, self-sacrifice, etc., that though became instituted in codes of behavior in the formulation of social order and sacred ideals of religious conviction, stem from *natural* tendencies embedded within the pseudo-fixed action patterns and cognitive constructions of the uniquely human social brain that are designed to solidify group cohesiveness and effectiveness in maximization of the competitiveness of a group. The greater these qualities among its members the stronger the group; conversely, the degree to which they are lacking among the members of a group (be it a mating pair, a family, a band, etc.), the less a group is able to work together effectively and benefit from the interrelationships of its members.

For basic human survival:

- 1) learning became the central operating principle of the uniquely human social brain;
- 2) curiosity or inquisitiveness in response to novelty became the driving force of learning;
- 3) logic and reason became the principal method of understanding;
- 4) and affective state (emotive response) became the mechanism mediating the balance between understanding and action.

Affective (emotive) qualities constitute essential components of pseudo-fixed action patterns, such as fear, anger, rage, hate, aggression and violence in the acute stress response and love, compassion, empathy, concern, and selfless, protective loyalty in the attachment/bonding response and the tend-and-befriend response, etc. While the predisposition of affect is an innate biological determinant of human behavior, the individual capacity for and/or particular nature of affective reaction is mediated by genotype and phenotype to the extent that each individual possesses a unique basic affective profile. Individual affective reaction is highly malleable, and is learned or modified through experience such that highly indoctrinated societies can skew mass behavioral tendencies.

### **Cognitive and behavioral disorder**

In human pseudo-fixed action patterns behavioral flexibility and inventiveness can respond as group action while maintaining basic individual core principles of social cohesiveness and harmony in meeting changing environmental demands, but, on the other hand, such behavioral flexibility is equally responsive to pressures of

conformity and pervasive social indoctrination that can mold individual characteristics to such extent that basic natural or core dispositions are altered, subverted or completely overridden, skewing the very nature of individuals, of groups, and even of entire societies, toward mindsets and behavior antithetical to core values, leading to cognitive and behavioral disorder (i.e., so-called ‘mental disorder’) in individuals and/or ‘sick’ (i.e., dysfunctional or non-sustainable) societies.

The brain of the anatomically modern human is a biologically evolved social brain, whereby all voluntary (consciously directed) human behavior, including social interaction, is learned. In the human social brain all learning is grounded in and constructed from a social context (the very basis of self-identity) and all positive learning – i.e., learning consistent with core values and cognitive growth – occurs in a normative positively stimulating environment or, in negative learning – i.e., learning inconsistent with core values and/or cognitive growth – in an impoverished environment (‘impoverished environment’ referring to a dearth of positive stimuli as experienced in a corrosive, threatening, confined, isolating or otherwise psychosocially inhospitable or deprived, barren environment). Impoverished environments as well as different forms of diseases or organic disorders resulting in cognitive neurophysiological disturbance can lead to cognitive and behavioral disorder; i.e., so-called “mental disorder.”

Since our behavior is defined by our learning experiences, in addition to effective treatment for any organic pathology, recovery from cognitive and behavioral disorder requires relearning and more intensive positive stimulation than in normative learning in order to trigger a stronger neurophysiological response to rebuild stagnant cognitive neurocircuitry and/or rewire cognitive connections from negative (i.e., maladaptive or distorted) cognitive constructs to positive cognitive constructs (cognitive constructs = conceptual orientations) and override and transform negative behavioral patterns set through the previous negative experience. The design, content and application of such a more intensive positive stimulation or positive learning environment, is referred to as the ‘enriched environment’ (for studies on the enriched environment and its efficacy in recovery from cognitive and behavioral disorder, see, for example: Alwis & Rajan, 2014; Hannan, 2014; Kleim & Jones, 2008; Kleim, 2011; Sampedro-Piquero & Begega, 2017; Nithianantharajah & Hannan, 2006 and 2009; van Praag, Kempermann, & Gage, 2000; Hebb, 1947; Taubert, Villringer, & Ragert, 2012; Draganski & May, 2008; May, 2011; Pascual-Leone, Amedi, Fregni, & Merabet, 2005; Woo, Donnelly, Steinberg-Epstein, & Leon, 2015; Sweatt, 2016).

### **Cognitive Neuroeducation (CNE) and the enriched environment**

An enriched environment is the primary foundation of Cognitive Neuroeducation (CNE), a rigorously researched cutting-edge, neuroscience-informed modality for the prevention of and recovery from cognitive and behavioral disorder. The CNE enriched environment is one that has constancy, creates a bonding group dynamic, provides fun, engaging and challenging eclectic learning experiences and is positive, reinforcing, stimulating, rewarding, encouraging, supportive, and full of possibilities. In the CNE program we explore together conceptualizations, beliefs, modes of social interaction and interpersonal relationships, reactions to situations, emotive contours,

flights of imagination, aesthetic visions, creative artistry and nuance, duty, purpose, loyalty, love, spirituality, sense of destiny and myriad other products of the mind that define the true essence of being human in understanding others and discovering or rediscovering ourselves through games (emphasizing teamwork), stories, group outings (museums, hiking trails, camping, etc.), listening to music, performing skits and plays, watching motion picture films, dancing, study sessions in a wide variety of subjects, and emergent discussions, debates, etc.

We are normally born with a pseudo-fixed action pattern of curiosity about our environment and the world we live in. This curiosity or inquisitiveness, this fascination for the answers to the mysterious and the unknown, this striving to know and understand, this questioning and great wonder and delight of discovery is an inherent part of being human manifest from infancy, becoming the dominant preoccupation of early childhood. This innate curiosity was the spark that ignited exploration, discovery and creative manipulation of natural resources that enabled humankind to adapt to diverse habitats, an essential feature of our evolutionary survival. In the modern formula-driven, staid curriculum of education reinforcing the artificiality of the modal socialization of mass consumerism, our innate curiosity is suppressed and largely overridden by force-fed narrow concepts, empty sound bites, dissociated ‘facts’ and rote stereotyped surface role-playing by the time we reach adulthood in the impersonal, hype-infused, small-minded, electronic-media-inundated anonymity of modern urbanized daily life. If, however, our natural curiosity and questioning is nurtured it may be maintained throughout life, and through CNE can be regenerated in adulthood, fostering creativity; an open, receptive mind; critical thinking; and an ongoing love of learning.

### **Learning and the CNE curriculum**

The CNE curriculum is based on learning as the mechanism for the remediation of and recovery from cognitive and behavioral disorder and sees the accumulation of learning, that is, knowledge itself, as composed of relative truths, as all things may be understood from many different starting points, frames of reference and personal perspectives. Being relative does not make these ‘truths’ any less real to the frames of reference in which they reside. The full recognition of this relativity leads to the undeniable, stirring realization that there are so many more, endless things to discover, so many more, endless ways by which to view all phenomena, so many more, endless ways to think about life and all its mysteries and so many more, endless contributions to knowledge waiting for eager, imaginative, curious, probing, questioning minds to reveal.

The CNE activities, related materials and group dialog explore the different realms of understanding and knowledge from the widest possible perspectives, stimulating each of the group members with the awe of the vast potentials of discovery, of endless paths on the journey through life, and the eager anticipation of the possibilities waiting beyond the bend in the road on the great adventure of being. While invisible to the CNE participants, this exploration seamlessly blends hermeneutic techniques and exegetic principles in the group dialogs and interchanges between the CNE participants in questioning, probing and debating in the quest for understanding the

various scenarios, situations and responses encountered in the CNE activities, thus realizing the many considerations, nuances and different sides that may reside in any question. We live within our mind and the journey of life continues on in elderhood and even in infirmity of body through a healthy, active mind and an environment arousing our innate curiosity and deep human need to communicate, share experiences, exchange ideas, work through challenges and involve ourselves with others.

### **The basic features and composition of the CNE enriched environment**

When cognitive growth is forestalled or one's core disposition is threatened and compromised past a cognitive/neurophysiological threshold by a negative environment, or distorted by organic pathology, cognitive and behavioral disorder emerges. To restart stagnant cognitive processes or reconfigure deleterious cognitive constructs in rewiring cognitive connections from negative (i.e., deficient or distorted) to positive cognitive constructs in cognitive and behavioral disorder requires a more intensive stimulation than the normal incidental experiences of pure chance and life choices. This dedicated, more stimulating learning environment is referred to as the *enriched environment*. In recovery from cognitive and behavioral disorder, the modality of Cognitive Neuroeducation (CNE) restores the individual's core disposition through an *enriched environment* of learning framed within an engaged group dynamic revolving around a central theme of perspective taking.

Humankind has been evolutionarily directed to live in a social environment, with a principal tendency toward complex social structures consisting of societies composed of a hierarchy of overlapping nested groups, each containing specific cultural and social norms under the umbrella of the general cultural and social norms of the encapsulating society. Not only pure survival, but basic psychological needs and the well-being and quality of life of the individual depend on the cognitive skills to effectively negotiate social interaction in meeting the demands of the individual's social environments.

The regulation of affect is pivotal to the formation and maintenance of social relationships. Affect not only informs and directs reasoning, but may also block it, as even the pillars of morality can become immoral and destructive once they become extremes, such that, loving kindness taken to mindless obsession can lead to both sexual depravity and lack of justice in failing to properly punish wrongdoing and thereby insufficiently protecting the innocent, and, when justice itself becomes overzealous, it can lead to unfair punishment and even to torture and the murder of innocents. With this understanding, 'emotional intelligence' – the maintenance of balance between emotion, rationality and morality – has been recognized as an integral component of social integration in the fields of psychology and psychiatry (see, for example: Mayer, Salovey, & Caruso, 2004; Mayer, Roberts, & Barsade, 2008; Mayer & Salovey, 1997; Izard, Fine, Schultz, Mostow, Ackerman, & Youngstrom, 2001; Lopes, Brackett, Nezlek, Schütz, Sellin, & Salovey, 2004; Keefer,

Parker, & Saklofske, 2009; Lopes, Grewal, Kadis, Gall, & Salovey, 2006; Lam & Kirby, 2002; Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Emmerling, Shanwal, & Mandal, 2008; Di Fabio, 2015; Payne, 1986; Zeidner & Matthews, 2016; Schutte, Malouff, Bobik, Coston, Greeson, Jedlicka, Rhodes, & Wendorf, 2001; Sánchez-Álvarez, Extremera, & Fernández-Berrocal, 2015).

Although normatively conforming to the general rules and behavioral expectations of the larger umbrellas of civilization, culture, society, nation, state, city and community, social relations are actually experienced more directly, intensely, consistently and personally in small group settings, as outside of small groups person-to-person encounters are more random, fleeting and superficial, hence social rules and regulations are more directly defined and reinforced in interpersonal interactions within the group dynamic in small group settings. Since social relations are defined by groups, social integration is developed through the individual's interaction within each distinct group to which the individual belongs, particularly through the formulation of a shared understanding regarding common themes. It is the group dynamic in the participation of social/learning activities in small groups that forms the vehicle by which both social integration and learning is enhanced in CNE with its emphasis on perspective taking.

Perspective taking is an essential component of bonding and genuine, meaningful connection with another, consisting of the ability and custom to go beyond spontaneous, initial surface impressions and apply a thoughtful appraisal and a honed proficiency in recognizing and interpreting social cues that explain another person's thinking, feeling and behavior from that person's perception of her or his own situation in a particular social encounter.

Perspective taking involves the development of respect for, understanding of, and empathy with, other individuals by putting oneself in the other person's place and reflecting how one would feel and act in that place. An important process of perspective taking is social context appraisal – the balanced assessment of social contexts and circumstances which account for an individual's behavior in a particular social encounter.

While the context of the individual is always essential for understanding individual behavior, in the CNE group dynamic social context appraisal transcends individual behavior, extending to the culturally transmitted 'norms' of the group. In the CNE group dynamic, perspective taking integrates both the personal context and the social context defined by the group 'norms.'

An essential element of perspective taking is affective engagement. It is precisely one's own emotional state that influences one's perception of another's emotional state and determines the selection and processing of individually relevant social information that determines the degree to which one effectively picks out the essentials of a situation relevant to the individual or individuals concerned and the implications thereof within the particular social encounter. However, it is impossible to understand the affective state of another unless one's own affective response is

appropriately well harmonized with one's own personal situation relative to the context of any particular experience. In order to correctly understand another's feelings, one has to consistently experience one's own *appropriate* emotional reactions. A major part of perspective taking then, is the realization of one's own emotional capacity by learning to engage experiences deeply through commitment and the full giving of oneself to the experience with introspection, reflection, sharing and attachment. By putting oneself totally into the experience as an integral part of the experience, the individual learns involvement and concern; and learns to fully relate to the experience and to others – to feel, to empathize, and to bond.

Though functioning as a powerful modality for the prevention of and recovery from cognitive and behavioral disorder, effective in even profound cognitive dysfunction, CNE is presented as a fun, engaging program of activities conducted through a group dynamic emphasizing shared engagement through teamwork, problem solving challenges, discussion, dialog, debate, critical thinking, and personal reflection. CNE participants experience the program as a recreational, social and educational curriculum promoting health and well-being for mind and body through exercise, social relations, and learning activities. There are no references of any kind to the stigma and negative connotations of therapy, pathology, disability, mental abnormality or diagnostic labels.

As new thought patterns and cognitive constructs emerge from engaged, affirmative, self-fulfilling learning experiences within the enriched environment, both the depth and breadth of the individual's cognitive core is exercised, strengthened and continually expanded through the introduction of new ideas, ways of thinking, frameworks of knowledge and understanding that open up ever-multiplying doors of possibilities. The richness of experience of 1) discovery in learning activities, 2) bonding with and developing respect for and appreciation of others, 3) the joy of belonging and acceptance in group identity, and 4) the sharing of discoveries and feelings, opens up the individual's self-conceptualization and the possibilities of being.

### **The CNE enriched environment in a scientific context**

Putting this into a scientific context, we define the neurophysiological correlates of the processes at work in the CNE curriculum through the agency of neuroplasticity, fundamentally understood as constantly changing patterns of neuronal interconnectivity ('neuronal' referring to *neurons*, herein defined as nerve cells of the brain) through 1] the modulation of channels of neuronal connectivity by a) synaptogenesis (the generation of new synapses; a synapse = the connective medium between one neuron and another) and b) pruning (the elimination of superfluous or ineffective synapses); and through 2] synaptic strength modulation involving the mechanisms of long-term potentiation (LTP) and long-term depression (LTD). LTP is defined as the development of a long-lasting synaptic strength between a presynaptic-postsynaptic neuron pair as a product of the interactivity (reverberatory interaction) of the pair and LTD is defined as the long-term persistence of the depression of synaptic action (i.e., inhibition of connection) between a presynaptic-postsynaptic neuron pair.

The CNE enriched environment contains strong, affirmative, stimulating, deep, constantly expanding learning experiences that trigger persistent reverberatory interaction in neuronal connections, and through such continual associative action effecting a change of thought patterns, weakens [in the lack of excitatory (connective) synaptic action] both the reverberatory interaction of neuronal interconnections representing previous faulty learning from negative experiences in addition to the attendant ineffectual or detrimental cognitive constructs, as excitatory action is dominated by the new, affirmative learning and newly configured thought patterns constantly deepened and broadened by the positive-directed learning.

The cognitive constructs formed from the new learning within the CNE enriched environment are continually strengthened by LTP and become dominant cognitive constructs undermining the relevance of the previously formed detrimental or negative cognitive constructs, whereby the presynaptic-postsynaptic connection between neuron pairs comprising the pattern of neuronal interconnections representing a negative cognitive construct are less activated as the negative cognitive construct more and more fades from ongoing thought patterns, the related less active synaptic connections continually weakening to a threshold point triggering LTD that, in turn, triggers the elimination of the synaptic connection between the neuron pairs comprising the pattern of neuronal interconnections representing the negative cognitive construct, purging it from the behavioral repertoire of the individual's cognitive schema ('cognitive schema' refers to the continuously interacting 'combinations' and 'permutations' of the individual components of the full complement of one's cognitive constructs and the behavior induced therefrom).

These neurophysiological processes stimulated through CNE promote growth of mind and spirit, casting off negative traits in the revamping of deficient, dysfunctional or dormant cognitive constructs, whereby one reengages with oneself, with others and with life itself in awakening to a new and meaningful life.

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