The following work is an annotated partial bibliography of my work entitled *Minding the Social Brain*: Jay E. Harris, M.D. jayevansharris@gmail.com

A Contemporary Annotated Bibliography for Psychoanalysts Who Want to SCAN:

Social Cognitive Affective Neuroscience

Abstract

Following Gerald Edelman's understanding of the formation of consciousness, and using contemporary neuroscience findings about the functional qualities networks add to consciousness when they are included in a distributed top-down network, I have gathered data about how the social brain transforms neural to mental function. I think all social neuroscientists are indebted to Raichle's group's discovery of the default domain, a highly activated set of networks that spend 90% of the brain's metabolism activated together to calculate survival strategies. Many social neuroscientists,--like Anthony Damasio--have accepted the proposition that an extended VMPFC self-domain focused on emotional regulation enters consciousness as the core of a social domain extending to DMPFC otherness. Therefore, I have annotated studies that focus on describing networks that enter the default domain, particularly those networks that carve a social domain—a theory of mind (ToM) -- from the VMPFC and DMPFC arena.

Acronyms

ACH: Acetylcholine: neuromodulator system that helps activate consciousness

ACC: Anterior Cingulate Cortex: Medial Limbic Cortex that detects conflict & error

AIC: Anterior Insular Cortex: Lateral Limbic Cortex that forms salient associations

BA 10: Broadman's Area 10: Highly evolved generalizing anterior-most frontal cortex

BOLD: Blood Oxygen Level Dependent: Oxygen consumption measure of metabolism

DA: Dopamine: neuromodulator system that enhances appetitive processing--libido

DLPFC: Dorsolateral PFC: cognitive domain that monitors working memory

DMPFC: Dorsomedial PFC: social-domain that gathers reflective consciousness

EF: Executive Function: A PFC coordinated distributed network's ego function

fMRI: Functional Magnetic Resonance Imaging: measures network activation

5HT: Serotonin: neuromodulator system that stabilizes data processing—neutral drive

IC: Insular Cortex: Lateral limbic cortex holding core emotional associations

LB: Left Brain: hemisphere organizing verbal, motivational, & pragmatic functions

MPFC: Medial PFC: Reflective social domain including DMPFC and VMPFC

NE: Norepinephrine: neuromodulator system of vigilance & exploration--aggressive drive

NMDA: N Methyl D Aspartate: Transmitter initiating experiential links among neurons

OFC: Orbital Frontal Cortex: Transmits pleasure/pain valenced stimuli to the self-domain

PFC: Prefrontal Cortex: Evolving cortex comprising system-consciousness apperception

PTSD: Post-traumatic-stress-disorder: Chronic failure of VMPFC to inhibit fear conditioning

STL: Superior Temporal Lobe: In networks that evoke social qualities of self & others

STS: Superior Temporal Sulcus: Observes biological motion portraying other's intentions.

ToM: Theory of Mind: From age four a developing belief in self & other mental process

TPJ: Temporal Parietal Junction: Observes embodied salience cues in others

RB: Right Brain: hemisphere that organizes affect and a holistic visual world

VENs: Von Economo Neurons: Fast emotional links among ACC, AIC, and self-domain

VMPFC: Ventral Medial PFC: Self-domain linking embodied emotion to the social world

VLPFC: Ventrolateral PFC: WM's cognitive domain that regulates processing by rules

WM: Working Memory: Task-oriented functions following lateral PFC processing rules

Bibliofile

Addis, DR and Schacter, D.L. (2008). Constructive episodic simulation: temporal distance and detail of past and future events modulate hippocampal engagement. http://www.ncbi.nlm.nih.gov/pubmed/18157862 Using autobiographical data as cues for imagining future events, while monitoring ERP (EEG event-related-potential) in tandem with fMRI, the authors found high activation of left posterior hippocampus; but recent events activated the right parahippocampus. This contrasts the immediacy of RB *episodic memory* with past LB *event memory* (used to extrapolate future prospects). The self-domain determines which form of autobiographical memory to evoke.

Addis, Donna Rose, Wong, Alana T., and Schacter, Daniel L (2008). Age-Related Changes in the Episodic Simulation of Future Events. *Psychological Science* Volume 19, No. 1, PP 33-41. Elaborating Tulving's work about past events being used as a base to construct future events, the authors showed that the older a person the less past detail is used to construct a future event. In tandem activation, the left hippocampus and the left PFC select past event details to construct future events, filling in affect with the right hippocampus. In aging, patterns of future construction become so habitual, the future is so much like the past that fewer details are needed to imagine the future. The authors distinguish two forms of episodic memory: LB event construction and RB emotional reconstruction—learning your

lesson. Embellished episodes provide mythic rationales for social identity. Founding fathers are either heroes of liberation, or moral leaders chosen by god to wield power.

Akirav, Irit and Maroun, Mouna (2007). The Role of the Medial Prefrontal Cortex-Amygdala Circuits in Stress Effects on the Extinction of Fear. *Neural Plasticity* Volume 2007, Article ID 30873, 11 pages. The amygdala's' central basal nuclei and VMPFC are both needed to extinguish conditioned fear responses. Since any severe stress in the aftermath of a first stressor blocks extinction, the authors advocate benzodiazepines to promote extinction. Fear deals with emergency. Evolution prepares us for alternative survival modes: responding to emergencies or controlling our environment.

Extending these thoughts, LeDoux describes the role of the amygdala in conditioning emotional memory (in the October 10, 2009 keynote address to the Social Affective Neuroscience meeting in New York): the lateral amygdala nucleus receives sensory data from direct sensory as well as thalamic feeds, associated with unconditioned stimuli that indicate danger or pain (intensity). Outflow from the central nucleus to the basal ganglia sensitizes the motor system to respond instrumentally to avoid the conditioned stimulus. Reconditioning the sensory stimulus reengages it, so that memory cells in the lateral nucleus can alter their response output. I think the self receives its emotional signals from the amygdala via the amygdala's equilibrium with the medial OFC, which provides valenced data to the VMPFC.

Amadio, David M. and Frith, Chris D. (2006). Meeting of minds: the medial frontal cortex and social cognition. *Nature* 268 (April 2006) vol. 7: 268-276: doi: 10.1038(nrn)1884. The authors review the bifurcated (VMPFC/DMPFC) social domain. The upper dorsal arena deals with cognition, while the lower ventral part deals with emotional life, and includes limbic cortices like the OFC and the ACC in its purview. DMPFC and VMPFC are core networks, each in their own small worlds, but at rest they join for preparing our survival priorities. Perhaps either master network can include the other networks necessary for social attribution of self or other. Adding the temporal poles, TPJ and STS to the VMPFC and DMPFC, the authors describe the generalizations made by the social domain.

A distributed network in its own right, cingulate cortex signals inconsistency; it informs consciousness when pragmatic problem solving has become disturbed. Its mid-portion monitors premotor and pre-supplementary motor association cortex for motor-planning and execution, dorsal ACC monitors perceptual efficacy, rostral ACC checks cognitive decisions for accuracy, paracingulate cortex monitors moral judgment, while the most anterior ACC monitors outcomes of decision-making. These ACC functions are consciously available to the social domain.

The rostral ACC signals interpersonal emotional conflict, which leads to conscious evaluations of the relationship. Thus, ACC-monitored social cognition (mentalizing) is intrinsic to psychoanalytic concepts. Amadio and Frith conclude their review by analyzing the bifurcating divide between self and other that constitutes the essence of social organization. DMPFC networks process our interaction with unfamiliar people (otherness); VMPFC networks process familiars (self and self-extending others).

Arnsten, Amy F.T. (2009). Stress signaling pathways that impair prefrontal cortex structure and function. *Nature Reviews Neuroscience*10, 410-422 (June 2009) doi:10.1038/nrn2648. Arnsten maps ego functions

in relation to brain areas. She reviews the top-down regulatory role of PFC in relation to the bottom-up role of the amygdala, hypothalamus, and neuromodulator centers. Thus, VMPFC regulates emotions; dorsal and lateral PFC regulates thought and action; ventral lateral right PFC inhibits motor responses; and the DMPFC including the dorsal ACC monitors errors and tests reality. I am reminded of a line by Wallace Stevens: "Wakened birds before they fly, test the reality of the misty fields by their sweet questionings." We have to keep in mind that the PFC works as an extended mental unity of synthesized divisions.

Arnsten described two equilibrium cycles. The virtuous stress reducing cycle is a top-down mechanism, whereby the PFC regulates its own activity by economizing the amount of DA and NE modulation it receives, while a vicious, amygdala activated bottom-up stress-increasing cycle maximizes that catecholamine stimulation. It seems to me that these neurobiological summations move us toward a psychoanalytic view of congruent mental and neural organization. Life exigency moves us toward pragmatic ego work that is task-oriented toward problem solving; but high acute stress blocks thought, perception, action, and attention, in favor of instinctual responses.

Arzy, Shahar, Thut, Gregor, Mohr, Christine, Michel, Christopher M. and Blanke, Olaf (2006) Neural Basis of Embodiment: Distinct Contributions of Temporoparietal Junction and Extrastriate Body Area. The Journal of Neuroscience, August 2, 2006, 26(31):8074-8081; doi:10.1523/JNEUROSCI.0745-06.2006. Blanke's group separates two forms of embodiment activated in separate networks. The right TPJ combines multisensory data, including proprioception, vision, and vestibular sense to create a whole body, which embodies self, as an objectified entity. Damage, or even temporary TPJ dysfunction, can lead to an out of body experience—autoscopy-- in which one feels oneself looking down on self. When this quality of the self-domain, joins the other distributed network qualities in the default domain, one senses looking down on oneself--the aspect of reflective consciousness that appraises the self--as if spatially. One's body can become the external focus of one's agency. Think of the football player, who Tarzan-like beats his own chest to show that it was he who scored the touchdown.

Another form of self-identity also represents self as other. Visual images of body parts are activated in the extrastriate body area (posterior temporooccipital cortex). We can think of RB self (and others) as whole self-body or disjunctively as visual parts. These separate representations of one's identity occupy alternative forms of consciousness.

Badre, David, Poldrack, Russell A., Parè-Blagoev, E. Juliana, Insler, Rachel, Z., and Wagner, Anthony D. (2005). Dissociable Controlled Retrieval and Generalized Selection Mechanisms in Ventrolateral Prefrontal Cortex. *Neuron*, Vol. 47, 907-918, September 2005. Freud wondered how infants develop the capacity to distinguish real cues of satisfaction from hallucinated ones. To move from primary to secondary process, we learn to distinguish hallucinations from memory. Freud said the infant's pain of mistaken salience is unbearable, leading to the development of ways to match reality with memory. We now know that OFC conditions cues that make stimuli worth pursuing.

This study clarifies the process through which the Broca's area (VLPFC) engages two processes in making a semantic match during a verbal task. First, the cue engages the search for salience in the anterior part

of the VLPFC, which triggers Wernicke's area, (left middle temporal lobe) to retrieve a menu of semantic possibilities according to features and other sensory aspects of the search, and then the midlevel part of the VLPFC selects the most salient items among the competitor items. I conclude that the sensory qualities (meaning) inherent in words lend salience to the anterior perceptual search for what the cue stimulus has to offer. Memories of the most salient experiences are reinforced; the most painful ones are negatively conditioned. Hebbian memory provides a menu of possibilities that can be sorted by criteria for motoric satisfaction.

Banks, Sarah J., Eddy, Kamryn T., Angstada, Mike, Nathan, Pradeep J., and Phan, Luan K. (2007). http://scan.oxfordjournals.org/cgi/content/abstract/2/4/303. 2/18/2008. The authors discuss how the dorsal prefrontal cortex can suppress affect expression. When DLPFC makes a cognitive appraisal of emotional data, the linked DMPFC-VMPFC can suppress amygdalar activity. I think dorsal PFC provides the cognitive side of emotion, the quality of conscious feeling. Consider the different consequences of feeling upset and feeling angry. Suppressing amygdalar activation protects one from the emotional consequences of too much apprehension--and anger. The dorsal PFC monitors a cognitive social world. In that sense, personal emotion is just one factor in mental life.

Barrett, Lisa Feldman and Wager, Tor D. (2006) The Structure of Emotion: Evidence From Neuroimaging Studies. *Current Directions in Psychological Science* Vol. 15—Number 2: pp.79-84. The authors try to reconcile the question of whether basic emotions like fear sadness, or disgust are specific to brain structures or occupy dimensions of conflict between approach/avoidance, positive/negative, and reward/punishment. I think that what is at stake in this question is whether emotions are seen as part of the shared cognitive life of the community, or whether they are biological givens, genetically determining each organism's experience of the latent markers for those emotions. The latent biological marker theory (James-Lange--Damasio) treats emotions as being organized like a sensory modality, with primary and secondary organizations of the emotion, which gets close to Freud's concept of emotion as an interoceptive sense.

Perhaps both theories are right. All qualities that enter consciousness mix in reflective apperception. From the perspective of our higher mental processes then, survival issues determine how we use emotions as signals to prioritize our mental work. But survival is set in time: immediate, near future, or further out. Given that our needs occur in a context of potential danger, our emotions prioritize motivated appetite (LB) vs. safety (RB). We generalize emotional states in order to plan effectively. Thus, fear and apprehensive anxiety signals join motivated need states and autonomic affects, producing moods. Motivation and affect--LB and RB emotion-- join in the conscious quality of feeling.

Blakemore. Sarah-Jayne and Frith, Chris (2003). Self-awareness and action. *Current Opinions in Neurobiology* 2003, 13:219-224. Agency is prediction. We are only aware of what we are trying to do through predicting the effect of the action, not through the initiation or the control of the movement. Exploring how one turns goals into operative action, the authors provide evidence from many studies that a feed-forward prediction about the sensory consequences of an initiated action provides agency-consciousness —cause. The signal of expected consequences is generated after the actual motor impulse; action feedback is further down stream. Left posterior, inferior parietal cortex tracks the

prediction; right inferior parietal cortex assesses the physical effects of the action. Perhaps imitation is a way of practicing the possible sensory consequences of actions. There is many a slip twixt the cup and the lip.

Blanke, Olaf and Arzy, Shahar (2005). The Out of Body Experience: Disturbed Self-Processing at the Temporo-Parietal Junction. *NEUROSCIENTIST* 11(1):16-24, DOI: 10.1177/1073858404270885. I surmise that the right TPJ is our eye in the sky, the neural source of the quality of seeing ourselves as others see us. Self-observation is the frame of our reflective consciousness. Like most neural network functions, we can see the resulting qualities most clearly in pathological phenomena. Thus, OBE (out of body experience) is commonplace. With my eyes closed I can view myself lying in one orientation on my bed; when I open my eyes the perspective shifts, and I sense my whole body in a different frame. In a related OBE phenomenon, experiencing one's double shows the total objectification of self. After clinically describing a range of OBEs, Blanke concludes that the feeling of being the agent of one's thoughts and actions distinct from others comes from the RB's TPJ network. That neutral knowledge of agency within a social context is the essence of reflection.

Bernston, Gary G., Bechara, Antoine, Damasio, Hannah, Tranel, Daniet, and Cacioppo, John T. (2007). Amygdala contribution to selective dimensions of emotion. *Scan* (2007) 2, 123-29. The amygdalas (either one) activate negative emotion. When one is damaged only positive emotions take hold, because there is a lack of attention to negative affect. Thus, the amygdala works more directly through RB auspices.

Bernston, Gary G. and Cacioppo, John T. (2007). The Neuroevolution of Motivation (Chapter 12) in *Handbook of Motivational Science*, Eds. James A Shah and Wendy C. Gardner, 2007, Guilford Press, NY, NY 10012. The authors present a behaviorist template for social neuroscience: approach/avoidance organization from the neural reflex level all the way through development to complex social thinking organized as social promotion versus prevention. Negative bias: avoidance over approach operates from a basic reflex level of flexor avoidance to extensor approach. Approach/avoidance serves as well as a principle of relational psychoanalysis.

Borgers, Christoph and Kopell, Nancy J. (2008). Gamma Oscillations and Stimulus Selection. *Neural Computation,* February 2008, Vol. 20, No. 2, pp 383-414. The authors investigate the role of gamma oscillation—brain waves generated over 60 times per second--during attention regulation, operating through the thalamus. The precuneus regulates attention through a double set of interneuron inhibitions in GABA-A receptor mediated synapses, which produce gamma frequency oscillation in the thalamus, which in turn excites a distributed system of networks to consciousness.

Bunge, Silvia A. and Zelazo, Philip David (2006). A Brain-Based Account of the Development of Rule Use in Childhood. *Current Directions in Psychological Science*, Vol. 15 (No.) 3: 118-121. In the life-long hierarchy of behavioral conditioning each level continues to operate, but overlaid by an inhibitory mechanism so that the hierarchical new rule can be employed as needed. From the mental perspective of conscious control, we can think of this as a mechanism of bound aggression inhibiting more primitive

modes of discharge. Freud posited a similar mechanism of inhibitory neural hierarchies providing developmental maturation and pathways for regression.

The authors consider the development of rule use from the perspective of how WM solves practical problems during stages of development. In the first postnatal year the OFC simply conditions behavior to pleasure or pain. In the second year, cues for pleasure or pain can reverse through new associations maintained in the VLPFC. By age four to five the DLPFC uses a new set of stimulus criteria for behavioral response that inhibits the prior rules. After age five the rostral anterior social-domain (BA 10) uses social language to engage complex situational criteria for behavior. The hierarchical change through adulthood proceeds from ventral to dorsal PFC and from posterior to anterior PFC. The resulting capacity for reflective generalization brings emotion, cognition, and perception into the purview of social language. I conclude that the social domain tempers ambivalence and ambiguity with moral rules.

Cacioppo, John T., Norris, Catherine J., Decety, Jean, Monteleone, George, and Nussbaum, Howard. 2008. In the Eye of the Beholder: Individual Differences in Perceived Social Isolation Predict Regional Brain Activation to Social Stimuli. *Journal of Cognitive Neuroscience*, 21:1, 83-92. Lonely people show less fMRI activation to pleasant social pictures than normals, equal activation to pictures of people in distress. Yet, in their DMPFC social domain, lonely people show little evidence of reflecting on distressed others. These findings indicate emotional bitterness. In *Mourning and Melancholia*, Freud said melancholic people are absorbed in their suffering. He observed that what appeared to be insight into their own character flaws turned out to be egocentric concentration on their own suffering that excludes considering other people's feelings.

Caria, Andrea, Veit, Ralf, Sitaram, Ranganatha, Lotze, Martin, Weiskopf, Nikolaus, Grodd, Wolfgang and Birbaumer, Niels (2007). Regulation of anterior insular cortex activity using real-time fMRI. *NeuroImage* 35 1238-46. Demonstrating that cognition can inhibit emotional pain intensity, subjects easily learned to activate their RB AIC by maintaining thoughts that evade emotional pain. Using onscreen RB AIC activation as a feedback cue, subjects conditioned themselves to suppress emotional pain.

Cavanna, Andrea E. and Trimble, Michael L. (2006) The precuneus: a review of its functional anatomy and behavioral correlates. *Brain*129, 564-83. This comprehensive review shows that precuneus (posterior medial parietal) networks are integral to the social domain of the DMPFC. One mechanism by which the precuneus guides attention is through its regulation of the frontal eye fields that fixate saccades during spatially guided motor behavior. Given the role of the precuneus in mediating between top-down perceptual processing, and posterior bottom-up sensory processing, we can turn out attention to how the social domain uses that mechanism-- elaborated in mental system as deductive verbal reasoning.

The precuneus carries out active attention—apperception that directs top-down process. It seems the precuneus can reach into all the brain's memory networks that are capable of reaching consciousness when they are activated. Shifting between object features [LB], it accesses space bilaterally [RB]. Not only does the precuneus initiate mentally planned movement, it helps us navigate deductive reasoning. Even high and low pitch use visual movement imagery for aural processing. Left precuneus retrieves

autobiographical information semantically; right precuneus mediates context-rich autobiographical memory; anterior precuneus elicits imagery; posterior retrieves organized memory. Moreover, linked with the right TPJ, the anterior precuneus activates during self-representation in first person accounts. A study of yogis during their meditated reflection shows them highly activating their precuneus and medial PFC.

Referring then to the most active part of the default domain, the precuneus, the authors say: "Altogether, the hot spots that characterize the default mode of the resting brain seem to be engaged in such processes as retrieval or consolidation of episodic memory, conscious representation of information in the form of mental images and spontaneous thoughts, and the manipulation of information for problem-solving and planning." [p. 577] This quote could as well allude to the work of dream formation. Since night dreams integrate associations of the preceding day, it is conceivable that daydreams also activate and integrate Hebbian associations from multiple networks.

Ciarimadaro, A., Adenzato, M., Enrici, I., Enrici, S., Pia, L., Bara, B.G. and Walter, H. 2007). The Intentional network: How the brain reads varieties of intentions. *Neuropsychologia* vol. 45, issue13, 2007, pages 3105-3113 doi:10.1016/j.neuropsycholgia.2007.05.011. Formulating and assessing neural networks comprising ToM, the authors distinguish self-intentions from social intentions. Objectifying intentions in top-down reflection activates the right VMPFC and precuneus. The results of one's own past intentions are compared with data assessing the other's biological motion, which is deciphered in the right TPJ while monitoring the other. But reflecting on what the other person has in mind also requires a verbal analysis of their future intent carried out in the left TPJ. Reading others' intentions from the top-down activates the VMPFC and the precuneus.

Intention is framed in future time. In calculating future time in terms of others we see that the LB extends present to future time, while the RB deals with past time turning to present time. The authors note that since temporal lobes process sensory qualities and parietal lobes process motor qualities, the TPJ processes complex social qualities. The extent to which the social domain reaches into one's autobiography shows to what extent we internalize other's life templates (like life coaches do) as our own.

Clark, L., Bechara, A., Damasio, H., Aitken, M.R.F., Sahakian, B.J. and Robbins, T.W. (2008). Differential effects of insular and ventromedial prefrontal cortex lesions on risky decision-making. *Brain*, doi:10.1093/brain/awn066. The authors distinguish two forms of gambling as predictive social exercises: figuring odds and risk-taking. Compared to normals and patients with other lesions, VMPFC-damaged patients gambled more despite knowing the odds. They showed less aversion to gambling because their damaged VMPFC could not access amygdala-linked sources of aversion. Insular damaged patients took more risks because they didn't care about the odds--their capacity to experience aversive *associations* was destroyed. AIC holds associations that trigger highly conditioned behaviors.

The authors supported Anthony Damasio's hypothesis that IC determines aversion on the basis of somatic markers, e.g. activating organ autonomic responses in similar past situations. In his view, organ memory comprises reliable emotional data. I conclude that VMPFC including the medial OFC subserves

bottom-up emotional and fear conditioning, while IC provides lateral PFC cognition with conditioned associations. When the VMPFC rigidifies with stress, we can develop PTSD; when the AIC becomes rigid we can develop anxiety conditions without panic. Psychoanalytically speaking the AIC fixates to repetitive associations that reinforce the same behaviors addictively.

Cohen, Jonathon, D. and Aston-Jones, Gary (2005). Decision and uncertainty. *Nature*/Vol 436/28 July 2005, p 451. Cohen and Aston-Jones show the relevance of neuromodulation to the best behavioral choices. Thus, in situations where the value of cues changes, Cohen and Aston-Jones cite research from Dayan and Yu that shows ACH determines expected uncertainty--readiness to reorganize reflection--while NE determines unexpected uncertainty--promoting vigilance and exploration. DA, the full steam ahead neuromodulator adds to NE and ACH to reorganize reflective-decision making. Moreover, 5HT modulates the other neuromodulators.

From my neuropsychoanalytic vantage, predicting likely behavioral outcomes depends on (drive) modulation of underlying neural systems. Heinz Hartmann, taking an adaptive social view of ego-functions, posited a neutralizing drive that operates outside of conflict. In so far as it mediates between DA (libidinal drive) and NE (aggressive drive) serotonin (5HT—neutral drive) fulfills that role. Serotonin tends to promote the vital state that Damasio cites: self-feeling-- the well-being of apt survival decisions.

Dapretto, Mirella, Davies, Mari S., Pfleffer, Jennifer H., Scott, Ashley A., Sigman, Marian, Bookehimer, Susan Y. and Iacoboni, Marco (2005). Understanding emotions in others: mirror neuron dysfunction in children with autism spectrum disorders. *Nature Neuroscience* http://www.nature.com/natureneuroscience Dec 4, 2005. Children with autism spectrum disorder show a lack of activation in their mirror neuron system when asked to imitate others facial configurations showing angry or fearful emotions, which both groups could perform physically. The RB's ventral motor area was particularly deficient in activation. The authors surmise that the mirror neuron system is normally activated by a sense of action initiation (agency). When this is missing, the autistic child cannot fathom another person's intention. The LB normally activates agency in the ventral motor area, which is close to the area where inner speech promotes intention, while the equivalent area in the RB represents the sense of objectified agency.

Dayan, Peter and Yu, Angela J. (2006) Norepinephrine and Neural Interrupts. www. cogsci.ucs.edu. NE is essential to vigilance and attention during WM tasks. Unexpected contingencies—unfamiliar stimuli--trigger a pause that refreshes or frustrated anger during a task. I think of unexpected flack from my computer. NE's impetus to explore the unknown promotes vigorous bound aggression in behavior.

Decety, Jean and Sommerville, Jessica A (2003). Shared representations between self and other: a social cognitive neuroscience view. *TRENDS in Cognitive Neuroscience* Vol. 7 No. 12, December 2003: 526-33. This article contains early versions of Decety's work on empathy. I find a common neuroscience illusion in it: namely, the concept of self is equated with RB objectivity because the ways of looking at self and other always objectify the self as equivalent to other. Thus, self activation is often measured in terms of traits. Just as the mirror neuron concept may mistake imitation for empathy, I think that representing

agency is a hemisphere away from experiencing agency— initiation. In studies, initiatory cause is often putatively explored by measurement of self, as if it were composed of objectified traits. But, in empathy, we feel other's pain as our own emotional pain and imagine other's needs as our own, in other words an intersubjective bond. In fact when we feel another's emotional pain, we activate the same network we do when we feel our own emotional pain.

Decety, Jean and Jackson, Philip L. (2006). A Social-Neuroscience Perspective on Empathy. *Current Directions in Psychological Science* Vol. 15-number 2 54-58. This article highlights the capacity of the STS and the inferior TPJ to distinguish self from other cognitively. The authors address the question of how MPFC forms cognitive building blocks from sensory and motor qualities of posterior cortex. The left STS makes words from sensory features-- and the right STS distinguishes biological quality, especially of mouth and eye gaze movements. In his works on Neural Darwinism, Gerald Edelman says consciousness is a result of all those qualities on display at any moment because of the more or less simultaneous activation of networks. Social qualities of language suitably generalize the brain's function of reflection. The social domain holds self-other qualities in relationship to one another in sentences that convey social communication.

Decety, Jean and Moriguchi, Yoshiya (2007), The empathic brain and its dysfunction in psychiatric populations: implications for intervention across different clinical conditions. *BioPsychoSocial Medicine* 2007 1:22 http://creative.commons.org/licenses/by/2.0 Describing a hemispheric autonomic divide in which LB mediates parasympathetic stimulation and RB mediates sympathetic stimulation, Decety and Yoshiya provide a comprehensive neural frame for empathy. The behaviorist approach/avoidance system computes safety/danger, which activates the parasympathetic/sympathetic systems in the LB and RB respectively.

Since parasympathetic stimulation is the part of the autonomic system that provides for metabolic repair, and sympathetic stimulation is the part that regulates response to the external world's dangers, the hemispheric divide tends basic survival requirements. Freud saw the increase in pressure to accomplish either needful or pain averting work as the aim of instinctual drive. It is telling in orgasm that the two autonomic systems relax alternately—manifesting Freud's Nirvana principle in drive equilibrium. Chimps show the same autonomic, LB pleasure vs. RB emotional pain distinction that humans do.

The authors point out that becoming self-aware provides psychological continuity. They explore the concept that we begin mentalizing—trying to understand how others think with the development of a ToM. By age four mentalizing is facilitated by the development of medial PFC spindle cells (VENs) that make the translation between self and other seem almost automatic and immediate. While the right medial PFC monitors self-recognition, the right inferior parietal cortex distinguishes self from other as the initiator of communication. Moreover, the posterior insular cortex distinguishes pain in one's own body from that in another person. Eventually, the medial PFC differentiates into a social domain, which operates by a third person perspective--a complete generalization of both self and other without either first person or second person perspective. The neutrality of a third person perspective makes it a refuge from painful feelings attributed to either the self (first person) or the other (second person).

We can distinguish between the DMPFC that processes the social domain cognitively and the VMPFC that processes it emotionally. If the resting state's default domain prioritizes survival requirements through the auspices of self-consciousness (and non-conscious processing), as Raichle believes, it is fitting that one's over-all emotional synthesis is mediated by the VMPFC's linkage to episodic self--to autobiographical resolution. In a social quandary, we turn to autobiography to resolve the issue. When people communicate, they each keep their autobiography percolating beneath the conversation. Joined empathically, mutual feelings link their self-domains. Conversation joins people empathically if they feel what the other feels, know what the other feels, and want to help.

The authors consider top-down shared perspective taking, vs. bottom-up emotional contagion and motor mimicry. Top-down perception uses motor processes to seek salience targets, while bottom-up opportunism seeks novel sensory cues that mix opportunity and memory. Motor mimicry employs both hemispheres—how to get it uses LB volitional mirroring, and mimicry about how to get it—both hemispheres. Mirror neurons fire both during perception of another animal's goals and one's own goals. But mimicry also elicits similar feelings--like watching someone smile. We replicate emotions by reconstructing somatic and motor states.

Decety, Jean, Michalska, Kalina J., Akitsuki, Yuko and Lahey, Benjamin B. (2008). Atypical empathic responses in adolescents with aggressive conduct disorder: A functional MRI investigation. *Biological Psychology*: doi10.1016/j.biopsycho.2008.09.004. Comparing BOLD responses of conduct disordered 16-18 year olds with normals, Decety, et. al. found that both groups activated PFC empathic pain response to pictures of people caught in painful accidents, but the CD group showed higher amygdalar activation to pictures of people being tortured. The CD group was less able to block amygdalar responses to other's pain, which involved enhanced mental aggression and even pleasure responses to another's pain. The CD group showed less activation in their medial self-domain when watching pictures of someone intentionally causing another's pain. Despite their own aversion to pain, they cannot distance themselves from other's pain, responding with some pleasure to another's suffering.

The co-variance of ADHD and CD goes along with an inability to regulate sensory as well as emotional responses to other's pain. The CD group shows sensory response to other's pain, yet lack capacity to bind their physiological or aggressive responses. Decety surmises that their enhanced left TPJ responses accompany a direct route to their hypothalamus, hence to their inability to control their impulses. In the CD group, empathy with another's pain is present, but the capacity to deal with that within the self/other social-domain is impaired. Normals show a higher MPFC activation when others are depicted as tortured. In that regard, I think liberals feel strengthened self as they bind their aggression by empathizing with other's pain. Decety's group shows the way to employing neural circuit understanding to clinical syndromes.

de Greck, M., Rotte, M., Paus, R., Moritz, D., Thiemann, R., Proesch, et. al. and Northoff, G (2008). Is our self based on reward? Self-relatedness recruits neural activity in the reward system). *NeuroImage* 39, 2066-75. The VMPFC activated with the ventral tegmental/nucleus accumbens reward system during risk processing in gambling. Reward/no reward signals motivate necessary life functions, determining self-esteem.

Even when a person is sated, food still has its reward qualities that feed the ego. Thus people talk about food other than what they are eating during social occasions. This data converges with Freud's primary pleasure ego. The value of a repeated stimulus such as food over a longer time frame correlates with its self-activating quality. Even when a person is satiated, food retains its value. The assignment of long-term value also relates to economic value. Because all pleasure processes retain a common element like a biological funnel, the whole social economic system, beginning with barter, extends the basic biology of risk and reward.

Dieterich, M., Bense, S., Lutz, S., Drzezga, A., Stephan, T., Bartenstein, P., and Brandt, T. (2003), Dominance of Vestibular Cortical Function in the Non-dominant Hemisphere. *Cerebral Cortex.* Vol. 13, No. 9, 994-1007. Vestibular dominance is strong in the RB for those who are right handed. That dominance originates in an ancient evolutionary tendency for the construction of space that can be reliable in all three dimensions even with the head rotated. Vestibular function converges on the precuneus and it includes a posterior insular sensory construct of three-dimensional space, which uses frontal eye fields for the construction of saccadic snapshots of objects within a spatial context.

The vestibular sense is always connected multimodally to other senses. Its capacity to make objects appear whole in three-dimensional space depends on the visual sense. It seems that RB objects are more impressionistic, while LB objects are haptic, meaning they are composed from kinesthesia and touch as well as visual details of their features. The LB organization of objects constructs the object's features as extensions of touch and kinesthesia, which then match the RB formation of a visual object within a whole spatial context. The authors posit that vestibular sense lateralizes to the nondominant hemisphere before handedness lateralizes to the opposite hemisphere. Thus, each hemisphere constructs its own version of the same object. In synthesizing self as both agent and representation, the infant creates what Winnicott called transitional objects (self extending objects that are also real...like teddy bears.

Dosenbach, Nico, U.F., Fair, Damien A., Miezin, Francisi M., Cohen, Alexander L., Wenger, Kristin K., Dosenbach, Ronny A.T., Fox, Michael D., Snyder, Avbraham Z., Vincetent, Juston L., Raichle, Marcus E., Schlager, Bradley L. and Petersen Steven E. (2007). Distinct brain networks for adaptive and stable task control in humans. *Proc. Natl ACAD Sci USA* Vol. 104 (26); Jun 26, 2007. Raichle's group at Washington University investigated regions of interest for dissociable control networks, using a resting state BOLD activation paradigm. The authors realized that Hebbian activations of functionally linked networks would show up frequently, even during the resting state. Part of their paradigm is supposing that particular core networks are unique to particular functions. Using graph theory to map separate networks, which indicates the relation of hubs to edges, they distinguished two dissociable control networks, one for initiating tasks and correcting for errors, and a second for maintaining tasks during longer-term goals. The goal-oriented network had a core of dorsal ACC and AIC bilaterally, as well as the medial anterior cortex (social domain), while the task-error component included lateral frontal and inferior parietal regions, and the precuneus-- twin stars in vital equilibrium.

Durston, Sarah, Davidson, Matthew C., Tottenham, Nim, Galvan, Adriana, Spicer, Julie, Fosela, John A. and Casy, B.J. (2006) A shift from diffuse to cortical activity with development. *Developmental Science*

9:1 (2006), pp1-20. Like a universe of elements, the billions of neurons at birth undergo selection by experience. Then, trillions of synaptic connections made throughout childhood are selectively pruned by adult life. Dorsal PFC uses its hierarchical position to set up descending networks that simplify the mental functions we rely on. Thus, the DLPFC gradually gives way to VLPFC as motor skills and selective targets are chosen throughout childhood. Dorsal is always more general and ventral more particular in top-down WM tasks.

Eisenberger, Naomi I. and Lieberman, Matthew D. (2004). Why rejection hurts: a common neural alarm system for physical and social pain. *TRENDS in Cognitive Sciences* Vol. 8 No. 7, July, 2004: 294-300. In this paper as basic to neuropsychoanalysis as it is to social neuroscience, the authors review the findings that the dorsal ACC monitors both physical and emotional pain. As medial cortex of the limbic system, CC (cingulate cortex) mediates between the autonomic system and higher-level sensory motor processes. It monitors our survival by signaling error when discordant data disturbs problem-solving. The ACC provides our core warning system for conflict monitoring.

Throughout its whole extent from anterior to posterior, CC checks the activity of self-regulation for error. The most anterior CC responds to emotion processed in the self's social domain. The emotional pain of social exclusion undermines self-esteem. More posterior in the dorsal ACC, activation acts as a RB warning system in concert with bottom-up signals. Thus, from anterior to posterior the CC error systems extend from a social communication functions, to emotional functions, to motor mistakes, to warning of unusual environmental contexts.

Epley, Nicholas, Waytz, Adam, Akalis, Scott, and Cacioppo, John T. (2008). When We Need a Human: Motivational Determinant of Anthropomorphism. *Social Cognition*, Vol. 26, No. 2, 2008, pp. 143-155. The authors used *sociality motivation* (loneliness) and *effectance motivation* (control and impact) to design a study that would correlate social neuroscience principles with anthropomorphic attribution. They predicted that those who anthropomorphize their pets would score higher on a loneliness scale, and they did. They also predicted that subjects would give anthropomorphic explanations for movie clips of an unpredictable animal's behavior, more than a predictable animal. I question this approach to social cognition. The studies appear to be self-serving; many other qualities than loneliness and control correlate with anthropomorphizing pets. Pets too have a self, a need to be in control (if they are alpha), and treat their masters as part of their pack.

Ermer, Elsa, Guerin, Scott A., Cosmides, Leda, Tooby, John and Miller, Michael B. (2006). Theory of mind broad and narrow: Reasoning about social exchange engages ToM areas, precautionary reasoning does not. *Social Neuroscience*, 2006 1(3-4), 196-219. The authors want to distinguish between reasoning about social contracts based on ToM from reasoning about precautionary rules. The study distinguishes rules for mutually rewarding interactions between people engaged in voluntary social contracts, from the dehumanized rules for avoiding dangerous outcomes. The authors found different rules for pursuing reward than for avoiding danger and pain. Social contract implies a two party system of enhanced reward, while precautionary reasoning deals with safety, which boils down to two basic survival mechanisms. Two sets of reasoning correspond to two neural domains rather than one general

reasoning domain. Safety rules come from a different neural domain than ToM, which regulates interpersonal relationships.

Consider the relevance of the psychoanalytic concept of a superego that regulates our self's relation to the social world. Freud posited two parts: an ego ideal for what one should do and a superego per se for what one should not do. I see these forms of social regulation as partially outside the realm of logic, in so far as they deal with reward and punishment, with LB desire for reward and RB precautions against punishment. The ego ideal is close to the concept of a social contract, in that it generates the desire to perfect the sense of union with others in a way that will be mutually rewarding without hurting any of the parties in contract. Superego per-se protects the self from harmful actions that violate social rules enforced by an authority established for social safety from one another. There is some difference between rules for safety in the physical milieu as opposed to safety in the social world. The authors do not distinguish social exchange as a LB reward interaction; precautionary logic supports RB pain avoidance.

Fair, Damien A., Cohen, Alexander L., Dosenbach, Nico U., Church, Jessica A., Miezin, Francis M., Barch, Deanna M., Raichle, Marcus E., Petersen, Steven E., and Schlaggar, Bradley L. (2008) The maturing architecture of the brain's default network. www.pnas.org/cgi/doi/10.1073/pnas.0800501376105. Contributing this study online. Raichle shows that the default network matures gradually after latency. But, a second top-down neural world also differentiates its neural architecture gradually--the lateral world of cognition that accounts for the pragmatic tasks WM carries out. Perhaps this satellite network has to share one energy source, since the emotional social domain deactivates during goal-oriented cognition. Raichle surmises that the adult's increased default network coherence appeared to be largely a result of the Hebbian frequency of regional coactivation over developmental time, which coincides with development of the second, task-oriented, distributed network.

Fish, Eric W. Shahrokh, Rose Bagot, Caldjl, Christian, Bredy, Timothy, Szyf, Moshe, and Meaney, Michael J. (2004). Epigenetic Programming of Stress Responses through Variations in Maternal Care. *Ann. N.Y. Acad. Sci.* 1036: 167-180. Studying rat maternal behavioral effects on newborn's phenotypic genetic development, Meaney's group extrapolates conclusions about human development. Rat mothers that do more licking, grooming, and arch-backed nursing, profoundly affect genetically determined stress responses of their offspring. High grooming/feeding behaviors elicit a genetic response that makes the glucocorticoids in the hippocampus effective in binding stress. Good enough mothering, as it were, elicits many genetic expressions (phenotypic releasers), which mandate better moderation of stress, more capacity to explore, and fewer tendencies to fear-sensitization. From an evolutionary perspective, offspring with good mothering survive better and longer. Conceivably though, under poor conditions for long-term survival, those offspring that have less mothering may be able to survive better earlier, because they remain more vigilant. This fits in with the basic work of the brain's self-domain—to promote survival.

Frank, Michael J., Loughry, Bryan and O'Reilly, Randall C. (2001). Interactions between frontal cortex and basal ganglia in working memory: A computational model. *Cognitive, Affective, & Behavioral Neuroscience*, 2001, 1 (2), 137-160. This model reflects the work of O'Reilly and Jonathon Cohen on how

basal ganglia modify PFC during WM. In sum, PFC has a hierarchical organization, such that rules of a higher level must be maintained as a context for updating information at a lower level. Encountering error, the basal ganglia promote a bottom-up re-setting mechanism, because to fulfill an action plan new data is necessary. In the model, PFC has zones of intrinsic activation maintained by NMDA mechanisms in a switch mode: (1) maintained or (2) activated. Zones of NMDA receptors have intrinsic capacity to maintain an on state or to become highly activated when their thalamic stimulation activates them. When basal ganglia zones reset a working task, they activate a corresponding working zone by blocking the tonic inhibition of the thalamus to the particular PFC zones requiring updating. The basal ganglia identify where the lack of expected data is coming from so that the PFC can attend new data in the posterior cortex. This is a mechanism for shifting attention to where it is needed for motor activity to effectuate the goals of the WM tasks. Perhaps one encountering a glitch says to oneself, "Wait a second."

Freeman, Jon, Mitchell, Jason, Uleman, Jim, Phelps, Elizabeth and Schiller, Daniela (2007). "Likes Me, Likes Me Not:" amygdala activity predicts first impressions. *Columbia Undergraduate Science Journal* http://cusj.columbia.edu BOLD responses show the DMPFC responded to all social information, whereas the VMPFC, and the amygdala calibrate emotional information for its impact on the self. Dissociable social impressions bring up one aspect of ambivalence. In most psychoanalytic theories of development ambivalence before the age of two remains partitioned between self and other as good and bad affects, whereas after the two-to-three-year-stage, ambivalent feelings begin to coexist in the (DMPFC's) neutral social domain. Dissociable self/other domains coalesce in reflection during later childhood.

Frith, Chris D. and Frith, Uta (2006) The Neural Basis of Mentalizing. *Neuron* 50. 531-534. May 18, 2006. The Friths review research that shows the brain's mirror system regulated by observing other's mental states. By mirror system they mean all the complementary brain networks that establish empathy in social interaction. For instance, using one's STS and TPJ (which tracks another's eye-movements, one can configure their perspective. When we think about others similar to ourselves—say liberals, we activate our VMPFC, while if we think of others as unfamiliar—say conservatives, we activate our DMPFC. When we think about other's intentions we activate our VMPFC. Perspectives on others use the DMPFC, which is the source of reflective consciousness. The anterior social domain (BA 10) helps us know that others want to communicate with us, because we mentalize their actions and emotions, their wish to communicate. In reciprocating reflection, other's intentions engage our LB ("What do you want?"), their affective response to us engages our RB: seeing ourselves through other's eyes.

Goel, Vinod, and Dolan, Raymond J. (2003). Reciprocal neural response within lateral and ventral medial prefrontal cortex during hot and cold reasoning. *NeuroImage* 20 (2003) 2314-2321. Neutral emotional material subject to reasoning activates the DLPFC, while intense emotional material activates the VMPFC. Moreover, there is reciprocal deactivation between these two zones during the task of reasoning—worlds apart.

Goel, Vinod, and Dolan, Raymond J. (2007). Social Regulation of Affective Experience of Humor. *Journal of Cognitive Neuroscience* 2007, 19:1574-80. When humorous jokes were felt to be in bad taste the right hippocampus activated and the VMPFC de-activated, whereas in good taste, the VMPFC activated and

the right hippocampus was suppressed, which means to me that negative affect memories were evoked along with self suppression (dissociation) in bad jokes, while in good ones the self could be involved and there was no need to activate moral memories. Humor plays on our emotional lessons—the episodic self. Today's self responds to affect signals, but when the response is problematic, the episodic self of long-term memory is evoked. The lateralization of affect has profound social consequences. The RB specializes in pain intensity and relief. Pain intensity tends to discharge aggression, relief binds aggression.

Greene, Joshua D. (2007). Why are VMPFC patients more utilitarian? A dual-process theory of moral judgment explains. *TRENDS in Cognitive Sciences* Vol.11 No.8:322 [letter]. Damage to the VMPFC can destroy the capacity for feeling other's pain as self-extension; ironically such patients can more easily make the prosocial judgment to push someone in front of a trolley to save five others. There is less conflict for most people if they make that prosocial judgment in terms of throwing a switch to the same effect, rather than physically pushing a person to their death. The guilt-free case activates the anterior DLPFC's social cognition. Liberals more easily feel other's pain with moral conflict; conservatives more easily reach moral judgment on cognitive grounds alone. To the extent that socially prevailing moral judgment controls individual affect, cognition lateralized to dorsal anterior prefrontal cortex can form a guilt-free, collective base for social judgment. Thinking of mother love as quintessential empathy implies joining another person's pain. Freud said a mother's ambivalence toward her children roots in the pain of childbirth.

Grimm, Simone, Beck, Johannes, Schuepbach, Daniel, Hell, Daniel, Boesiger, Peter, Bermpohl, Felix, et.al. and Northoff, Georg (2007). Imbalance between Left and Right Dorsolateral Prefrontal Cortex in Major Depression Is linked to Negative Emotional Judgment: An fMRI Study in Severe Major Depressive Disorder. *BIOL PSYCHIATRY* Volume 62, Issue 5, 546-48. DLPFC activates in response to cognitive judgments about emotional matters. The LB judges reward contingencies; the RB judges emotional pain. In major depression the left DLPFC is hypoactive; the right is hyperactive, which correlates with a depressed person's withdrawal--expecting no pleasure, just pain and emotional distress from any relationship. Social interaction and motivational appetite are blocked; wariness increases. Avoidance trumps approach, safety trumps pleasure.

Grimm, Simone, Ernst, Jutta, Boesinger, Peter, Schuepbach, Daniel, Hell, Daniel, Boeker, Heinz and Northoff Georg (2009). Increased Self-Focus in Major Depressive Disorder Is Related to Neural Abnormalities in Subcortical-Cortical Midline Structures. *Human Brain Mapping* 2009. DOI: 10.1102/hbm.20693 (www.interscience.wiley.com). Compared with the high resting activation in the DMPFC and precuneus in both depressives and normals, the response to self-observation of one's emotional inclination to engage in social relationships showed more activation in normals. Thus, major depressives are lost in intense activation of their default position (rumination), as they inhibit cognitive processing of further social interactions. We know there is strong inhibition in the frontal cortex of MDD, which can be lifted with ECT. Thus, depressives maintain an unchanging negativity about social interaction. From a psychoanalytic perspective the depressed person holds the shadow of the painful object over the ego, limiting any wish for further interpersonal interaction or change.

Gusnard, Debra A., Akbudak, Erbil, Shulman, Gordon L., and Raichle, Marcus E. (2001). Medial prefrontal cortex and self-referential activity: Relation to a default mode of brain function. *PNAS*, March 27, 2001, vol. 98, No. 7: 4259-64. This basic paper locates the functional neural domains of self and self-reflection. Exploring how conscious qualities enters ToM, the authors used fMRI to measure their subject's responses to pleasant, unpleasant, and neutral emotional pictures, and to inside, outside and ambiguous pictures. By comparing the results with resting state activation, Raichle's group reliably focused their region of interests' results on the VMPFC and the DMPFC. In the default resting condition the VMPFC is engaged in feeling social emotion, whereas the DMPFC is engaged in social cognition about the experience of the self (reflection).

Raichle's group showed that affective and neutral pictures have different effects on the whole medial PFC—the whole social domain. When subjects appraised affective pictures, their VMPFC was activated beyond the resting state (manifesting emotionally intense experience), but their DMPFC showed less activation than during the resting state. However, when instructed to think about the self-experience in response to the affect pictures the DMPFC activated more than resting, showing the function of the DMPFC in reflecting on the self's experience. The DMPFC and the VMPFC join two neural worlds to form one mental world. The DMPFC is the master network for cognition and planning—for rationality, while the VMPFC is the master network for emotional contact with the unconscious biological and chemical sources of our survival.

The authors realized that in the resting condition individuals immerse themselves in their social experience of emotional relationships. Rumination is a condition of vaguely conscious immersion in emotional relationship, with the focus on the self and its time travel in past, present and future—akin to fantasy or daydreaming. Focusing on those experiences highly activates the DMPFC. Picking up from David Ingvar's work, the authors present their view that the whole medial default-domain is dedicated to predicting the effect of social conditions on one's survival priorities. If the social domain of DMPFC and VMPFC at rest predicts the effect of social conditions on one's plans, so that goal formation can be effective, then actually monitoring the progress of one's goals decreases the activation. Fully conscious reflection inhibits (detaches) the self's emotional experience. But, when actual social conditions vary from expectation, the dorsal ACC activates, signaling conflict in the whole medial PFC social-domain.

The VMPFC self-domain: (1) monitors emotions through its connections with all of the valence and intensity regulating lower centers like the amygdala, hypothalamus, and periaqueductal gray, while it receives reports of intensity and valence of emotional and sensory stimuli from the medial OFC, (2) compares past emotional outcomes with present conditions, (3) compares the emotional state of self with the DMPFC monitoring of the social other, so that both activate in self-referential, autobiographical thought, and (4) (as I have learned elsewhere) responds to survival emergencies with a genetic change (induced by high circulating cortisol) that shuts down experience, in favor of instinctual responses. Then, the DMPFC loses its reflective capacity of self-evaluation—like a dog without its bone.

It seems to me that the MPFC holds the key to psychoanalytic thought. When a person in psychoanalytic treatment suspends the critical faculty of judgment, that person immerses in more highly self-related experience, closer to the basic core of conflict about how best to survive. Mental process

uses a DMPFC sense of reflection, that spreads out to monitor all of our cognitive processes, but its focus on the inside world of metabolic processes is via the VMPFC, which processes internal states as self. VMPFC experiences self; DMPFC reflects on the social other. As Freud knew, there are two levels of consciousness, the experiencing self and the reflective, socially permeated sense of full consciousness. The self is in touch with the sources of our unconscious, and its experience is permeated by bodily and autonomic states. Reflection generalizes experience in abstractions. We evaluate our goals automatically. When we think of others as self-extensions we conflict less with the social world, but when we think of unfamiliar others we have to deal with painful aggressive feelings that we can bind with reflection, which conveys a sense of social truth.

Gusnard, Debra A., Ollinger, John M., Shulman, Gordon, L., Cloninger, Robert C., Price, Joseph L., Van Essen, David C. and Raichle, Marcus E. (2002) Persistence and brain circuitry. *PNAS,* March 18, 2003, vol 100, No. 6, 3479-84. Persistence is a personality quality of a motivational nature that is LB, goal-oriented. It results functionally from a distributed network that includes LB medial OFC, ventral tegmental DA circuits, and basal ganglia. DA pushes motivation, promoting behavioral correlatives of OFC valence—which resist extinction. This means that satisfaction is always addictive through the pleasure associations that are reinforced by DA (libidinal) drive…"If at first you don't succeed, try, try again." This whole topic is relevant to Freudian drive theory.

Habib, Reza, Nyberg, Lars and Tulving, Endel (2003). Hemispheric asymmetries of memory: the HERA model revisited. *TRENDS in Cognitive Sciences* Vol. 7 No.6 June 2003. Tulving's group finds that in WM, HERA (Hemispheric Encoding/Retrieval Asymmetry) separates encoding from retrieval. Thus, encoding is initiated by LB process, retrieval by RB process, regardless of whether WM is processing semantic or image items. Tulving's group entertains a cogent hypothesis about how hemispheric asymmetry developed. They surmise that retrieval is an evolutionary older process—just as spatial construction is older. Perhaps we learned how to deal with predators by collectively developing language for reasoning about how to turn the tables on them. In evolution, we first developed flight as a response to perceiving threat in distant visual space (RB), and then we conceived a social strategy for dealing with threat and need together (LB).

Hagmann, Patric, Cammoun, Leila, Gigandet, Xavier, Meuli, Reto, Honey, Christopher J., Wedeen, Van J., and Sporns, Olaf (2008). Mapping the Structural Core of Human Cerebral Cortex. *PLoS Biology*, July 2008 Vol. 6, Issue 7, 001-0015. The authors use diffusion spectrum imaging to plot axonal connections in hubs and edges, Exploring brain/mind organization as structural/functional small worlds, Hagmann, et. al. map a highly integrated default-domain, formed of almost simultaneously activated networks. Their mapping finds separate continents surrounded by ocean streams. One continent, with its peninsula in the MPFC is densest in posterior precuneus, inferior and medial parietal cortex, STS, and posterior CC, which supports Raichle's group's contention that a resting default domain generates a dense small world that supports consciousness.

Hasson, Uri, Nusbaum, Howard C. and Small, Steven L. (2007). Brain Networks Subserving the Extraction of Sentence Information and Its Encoding to Memory. *Cerebral Cortex* 17(12):2899-2913. The authors studied brain-imaging responses to high vs. low content data in regard to what could be remembered

and activated. Because these were narrated sentences, there is social interaction involved in the processing. Clearly, high content data means new data that provokes processing otherness. In that regard, the DMPFC activated with new data both in subsequent remembering and forgetting conditions. Neutral data of little consequence was more often remembered than data that present the subject with new cause and effect ideation. People divide into two learning styles: those who block versus those who accept new complex data. The DMPFC activated more highly with significant new data, which was also more vulnerable to forgetting. I assume that the ACC signals conflict when data is novel. Left VLPFC--Broca's area--activated with all forms of data, but more anterior it activated highly with causal statements, which shows its agency function. Right temporal networks activated highly with already familiar content, which shows a memory effect.

I will comment on implications of this study to social tendencies toward repression. New data, particularly causal data adds to one's social knowledge. New content always challenges what is socially known. When faced with the uncertainty of unfamiliar or ambiguous material, the DMPFC functions to re-integrates social reasoning. But, some people are reluctant to change their social-domain. Conservatives cling to familiar belief systems, like rejecting any data that confirms biological evolution. A social self reinforced by a belief in the constitution or the bible brings conservatives to resist new data. This highlights difference between liberal beliefs in change and conservative beliefs in no change. Going back to Galileo as an example, we see that those who identify with conservative power use their aggression to maintain a situation where there does not have to be any new data.

This study on a form of repression brings to my mind a hypothesis that the DMPFC can resist adding new data to our store of social knowledge. Perhaps mobilizing aggression against new data prevents a NE novelty response that would require changes in the self-domain. Aggression in the face of novelty is a defense against potential pain. In that case, faced with new causal implications, DMPFC, with signal help from the dorsal ACC signals the VMPFC that affect pain is in the wings.

Hennenlotter, A., Schroeder, U., Erhard, P., Haslinger, B., Stahl, R., Weindl, A., et.al, and Ceballos-Baumann, A.O. (2004). Neural correlates associated with impaired disgust processing in pre-symptomatic Huntington's disease. *Brain*, Vol. 127, No. 6, 1446-53. Premorbid Huntington's patients lack the capacity to see disgust in other's faces. This means that the capacity for experiencing disgust does not develop in these patients. Disgust is an emotion that is processed in the left insula, with other pleasure processes—or their obverse. Because the left insula and the left basal ganglia coordinate disgust, I conclude that LB pleasure coding of stimuli has a mode of pleasure inhibition that is experienced as disgust. Like Freud's concept of primary process giving way to spitting out what is not pleasurable, disgust indicates a whole turn in pleasure conditioning to its opposite. Moreover, that turn relates to perceiving others expressing disgust. I think this exemplifies the role of the LB's self-domain in regulating pleasure process, including the inferences we make about other's experience of pleasure. Those inferences, like mirror neuron inferences, are one aspect of empathy.

Hilz, Max J., Devinsky, Orrin, Szczepanska, Hanna, Borod, Joan C., Marthol, Harald, and Tutaj, Marcin (2006). Right ventromedial prefrontal lesions result in paradoxical cardiovascular activation with emotional stimulation. *Brain* 2006 129(12):3343-3355. The lateralization of autonomic system top-

down regulation between LB parasympathetic and RB sympathetic control has many ramifications for survival strategies. This relates to the LB's pleasure processing, which keeps metabolism in equilibrium and the RB's pain processing, which helps to control over-arousal in response to threatening stimulation. The VMPFC self-domain uses hemispheric lateralization to regulate the autonomic nervous system, dividing parasympathetic metabolic processes, from sympathetic stress responses. Lesions of either side of the VMPFC interfere with these lateralized autonomic functions. This is a major integrative brain process. Since motivational emotions and affective emotions are lateralized, Damasio's biological marker thesis needs to include lateralization in its scope.

Holroyd, Clay B., Nieuwenhuis, Sander, Young, Nick, Nystrom, Leigh, Mars, Rogier B., Coles, Michael, G.H., and Cohen, Jonathan D. (2004). Dorsal anterior cingulate cortex shows fMRI response to internal and external error signals. *Nature Neuroscience* Volume 7, number 5, May 2004. The authors show that the dorsal ACC activates when an expected reward fails to be delivered. The midbrain DA system for pleasure processing heavily modulates that portion of the ACC. Since dorsal ACC regulates motor activity, the authors conclude it is involved in motor conditioning. I relate this to LB conditioning, As a behavioral conditioning template, LB pleasure/displeasure and RB pain/relief can condition behavior just as thoroughly as pleasure/pain. I am mindful that conditioning refers not only to stimuli, but to instrumental motor responses evoked by stimuli. In the interpersonal sphere, unexpected displeasure like betrayal has a quality that is at least as negatively conditioning as frustration or hurt delivered by a stranger. Thus each hemisphere has access to its own form of conditioning.

Hunt, Stephen P. and Mantyh, Patrick W. (2001). The Molecular Dynamics of Pain Control. *Nature Reviews* Volume 2, February 2001, 83-90. Pain has two inputs: sensory pain per se and intensity. Pain intensity tracks to the amygdala and periaqueductal gray as well as the RB's AIC for its affective quality. Opioids relieve the affective quality of pain by reducing intensity. They work not by stimulating pleasure, but by blocking the RB's AIC pain intensity, which also affords relief to the sense of the world's oppression. When a familiar other (or close kin) experiences intense physical or emotional pain, many people find they share the experience of the painful intensity, even activating their own right AIC. That is one reason intense affect pain triggers avoidance behavior. I treated many people who became homeless addicts because they could not stand to experience the pain of their suffering kin. Like a plague, the intense pain of those who are self-extensions elicits personal pain.

Like other modalities of sensation processed in multimodal cortex, pain localization and intensity input are processed in parallel and communicate. Freud was of the opinion that any sensory modality could become overly intense, too painful to bear, without a mechanism of psychic shielding. Indeed, any modality can be too intense, warning affectively of danger and potential damage. Thus, a blind from birth newly sighted person will experience visual stimulation as painful and overly intense. Adding to our perspective on pain mechanisms that promote survival, the authors point out that chronic pain triggers genetic, phenotypic expressions that promote stress responses.

Iacoboni, Marco, Lieberman. Matthew D., Knowlton, Barbara, J., Molnar-Szakacs, Istvan, Moritz, Mark, Throop, Jason C., and Fiske, Alan Page (2004). Watching social interactions produces dorsomedial prefrontal and medial parietal BOLD fMRI signal increases compared to a resting baseline. N*euroImage*

21: 1167-73. This basic article by the UCLA group compares activation in the VMPFC and DMPFC triggered by movie scenes of a social nature vs. scenes that depict a person acting alone. Knowing the resting state default domain is highly activated, the authors compared the movie activations with the resting state baseline. Verifying the assumption that resting state is preoccupied with social concerns, the authors find that social engagement activates default network mainstays: the DMPFC and precuneus, as well as the anterior STS. The DMPFC processes general social interactions, whereas the VMPFC is more emotionally self-activated. This study shows that the default domain is a social domain composed of two miscible parts: emotional self and the socially reflective, cognitive other.

Iacoboni, Marco, Koski, Lisa M., Brass, Marcel, Bekkeringited, Harold, Woods, Roger P., Dubeau, Marie-Charlotte, Mozziotta, John C., and Rizzolatti, Giacomo (2008). Reaffereent copies of imitated actions in the right superior temporal cortex. *Proceedings of the National Academy of Sciences of the United States of America*, 2/20/2008, pp. 13995-99. The right STS captures biological salience through visualizing it. This study shows that mechanism in operation. The authors show that STS produces a sensory replication of motor-actions useful in perception and memory when one is tracking appetitive or biological data. Thus, perception is motor-focused sensation reception; and mirroring is sensory-focused motor activity. Since STS is stimulated by visualized activity in space, watching someone move (including oneself) produces a sensory replication of the movement. Making RB copies of LB intentional movements (imitation) objectifies agency. Like mirror neurons that respond to another animal's appetitive intentions, STS tracks biological movements.

Iacoboni, Marco and Zaidel, Eran (2004) Interhemispheric visuo-motor integration in humans: The role of the superior parietal cortex. *Neuropsychologia*, Vol. 42, Issue 4: 419-25. The medial superior parietal cortex receives fast inter-callosal motor intentions data, combining premotor with visual motor spatial data necessary for immediate intentional acts. Before we can act, motor intention is quickly transmitted from left to right superior temporal cortex via *motor command neurons*. Intention transmission time corresponds to a lag between intention and bringing both hemispheres into motor coordination (sensory prediction). To maintain the sense of causal action, lag time between initiating movement and the result is necessarily short. Conceivably, an evolving causal sense used medial transmission, which is faster than lateral inter-callosal transmission.

Jackson, Philip L., Rainville, Pierre, and Decety, Jean (2006) To what extent do we share the pain of others? Insight from the neural base of pain empathy. *Pain* (2006), doi:10.1016/j.pain.2006.09.013. Terming resonance an empathic gauge of equivalent experience between two people when their neural networks replicate each other, the authors show that feeling another's pain uses many neural networks the other uses in comparable sites. In pain registration, self and other are represented along an IC continuum, self more caudal (where actual pain registration occurs) other more rostral (where intensity is represented). Dorsal PFC objectifies otherness experience more than ventral PFC. Dorsal AIC (more on the right) is sensitive to pain intensity.

But there is cognitive difference (sources of ambiguity) among dehumanizing qualities: reflection (DMPFC) synthesizes social qualities, generalization (BA 10) synthesizes social, emotional, and physical qualities, representation (RB) integrates reality qualities, and abstraction (LB) categorizes object

features. The detachment we feel in reflection appears to derive from the cognitive quality of taking a distance from emotion. Verbal translation of the whole qualitative spectrum covers most of the neural ground that can become conscious. I wonder if the social domain brings perception (LB) and imitation (RB) together, in the sense of bringing lateralized versions of experience into resonance.

Jenkins, Adrianna C., Macrae, Neil C., and Mitchell, Jason P.(2008). Repetition suppression of ventromedial prefrontal activity during judgments of self and other. www.pnas.org/cgi/doi/10.1073/pnas.0708785105 (march 18, 2008 vol. 105 no. 11 4507-12. The social domain consists of two functional networks: the VMPFC self (and self extension) and the DMPFC otherness domain. A clear distinction was made between these domains using the technique of repetition-suppression. When the same mental judgment is repeated, the second judgment shows suppressed activation--a sign of inhibition in that regulating network. The subjects were monitored with fMRI while they answered questions designed to elicit their own and others' personality traits. A liberal versus a conservative person was characterized and depicted as familiar or unfamiliar to self and used as the prompt for response to questions about which social positions were closer to self and familiar others and which were closer to the unfamiliar other. Then, many situations and character traits were described and monitored by fMRI.

Self followed by familiar self-extending others showed repetition-suppression effects; self followed by an unfamiliar other stimulus did not show suppression. The authors believe this indicates that when we mentalize—try to empathize with another's thoughts, we bias against unfamiliar others--a neural definition of social ambivalence. Self-professed liberals who scored high on liberal vs. conservative measures experienced other liberals as self-extensions (familiar); those with conservative characteristics were judged as unfamiliar others. Perhaps this distinction characterizes contemporary politics. Liberals as empathizers and conservatives as constitutionalists provide an iconic social divide, which is used by some to determine whether a person is qualified to be a Supreme Court justice. Conceivably, loving someone enough to feel their pain makes one a soft-hearted liberal, whereas a conservative position derives from the power of what is right, determined by an eternal, if dehumanized standard of social organization.

Johnson, Marcia K., Raye, Carol L., Mitchell, Sharon R/., Touryan, Erich J. Green, and Nolen-Hoeksema, Susan, Dissociating medial frontal and posterior cingulate activity during self-reflection (2006). *Social Cognitive and Affective Neuroscience* http://scan.oxfordjournals.org/cgi/content/full/1/1/56 6/4/20081-15. The authors discern two basic social self-functions that activate separately: promotion (aspiration) and prevention (responsibility). Promotion manifests what self-psychology call healthy narcissism, e.g. agency. Asked to write a paragraph about their agendas, subject's ambitions, hopes, and long-term goals for the future divided into those dealing with individual wishes, and those with social duties and obligations. This social neuroscience study divides along lines consistent with the hemispheric divide of a LB agent-self and a RB persona, who abides by social regulations.

The VMPFC was more activated in aspirations (closer to agency self); prevention was more activated in posterior precuneus areas, which deal with otherness. In network with the precuneus, the DMPFC responds to qualities of otherness as generalized and further from reward valence. Since one is

ambivalent about duties and obligations—almost by definition-- responsibility should be framed as binding aggression. We sense that social duties derive from an unknown source—an unfamiliar other. From a Freudian view, unfamiliar others elicit the aggressive drive.

Johnson, Mark H. (2003) Development of human brain functions. *Biological Psychiatry*, Vol. 54, Issue 12, 15 December, 2003: 1312-1316. Johnson echoes Edelman's Neural Darwinism, by showing that neural development occurs in two phases of selection. During the prenatal period and the first years of childhood, the numbers of neurons declines sharply as functional ones are selected, while the number and volume of synaptic connections increases. Dendrites branch out, with new regional connections, often more dependent on experience than inherent connectivity. Synaptic selection through life experience becomes the Darwinian bellwether after early childhood. Johnson realized that maturational connectivity is only one general developmental principle. As a second principle, individual life experience in one's ecological niche determines the unfolding of one's phenotypic genetic brain development.

Johnson, Mark H. (2005). Sensitive Periods in Functional Brain Development: Problems and prospects. (www.interscience.wiley.com) DOI 10.1002/dev.20057. Continuing his earlier work with Randall O'Reilly on functional specialization, Johnson studies how networks specialize in processing particular aspects of experience. Functional plasticity in many brain areas ends when Hebbian connections develop such a volume that they become fixed in an area. Once a volume of neurons tends to activate together, they form an associational matrix that becomes fixed by GABA inhibition to repel further inputs outside of the familiar ones. Many areas begin with plasticity and lose that as they process experience, reaching a critical point of experience in which they become specialized. Johnson adds that skill learning is a different process whereby once an area is specialized its function is outsourced to the basal ganglia or cerebellum.

Johnson, Mark J., and Munakata, Yuko (2005). Processes of change in brain and cognitive development. *Trends in Cognitive Sciences* Vol 9 No 3 March 2005 152-58. Johnson outlines four kinds of developmental learning. (1) Hebbian learning is self-organizing; associations that fire together wire together. I think of this as distributed network formation. *Statistical learning* is Hebbian learning confined to categories of features from many objects sharing common qualities. (2) Error-driven learning avoids the discrepancy between target cues and the final result. Mistaken expectations of reward or unexpected pain inhibit behavior previously conditioned by particular cues. (3) Constructive learning seeks perceptual repetition by confirming earlier experience. (4) Representational learning imitates patterns of objects, e.g. visual shape may be replicated in primary visual cortex.

I boil these mechanisms down to LB sequential, causal learning, vs. RB simultaneous, Hebbian learning about the external world. Thinking about LB and RB forms of learning, we must also consider synthesized learning under the rubric of social learning. Thus, in infancy T. Berry Brazelton has shown three physiological states that determine survival: appetitive states, exploratory states, and gaze locked interpersonal states, which I ascribe to LB, RB, and LB/RB-synthesized networks respectively—by adult life. In *Clinical Neuroscience: From Neuroanatomy to Psychodynamics*, I conceived *spiral development,* showing alternation between which hemisphere takes the ontogenetic lead: LB stages of learning

narcissistic appetitive routines alternate with RB stages of learning to represent the real external world. As Piaget concluded in his theory of assimilation (LB) and accommodation (RB) equilibrating, and as Damasio say in *Looking for Spinoza*, we feel self as a synthetic life force joining the internal world of an extending, seeking ego with the external world of reality.

Kédia, Gayanée, Berthoz, Sylvie, Wessa, Michele, Hilton, Denis, and Martinot, Jean-Luc (2008). An Agent Harms a Victim: A Functional Magnetic Resonance Imaging Study on Specific Moral Emotions. *Journal of Cognitive Neuroscience* October 2008, Vol. 20, No. 10, Pages 1788-98. Immorality implies deliberately harming someone. The authors show that in all conditions in which an agent harms someone, even self, DMPFC, precuneus, and TPJ activate-- as judgmental social observation. DMPFC's reflection--placing the blame--is intrinsic to morality. The self's emotional decision to act--when self and other were complicit in harming another, activates the ACC, basal ganglia and amygdala. The self's moral conflict engages instinctual experience. Thus, this study rediscovers psychodynamic structure— but like viewing superego, ego, and id from far away.

Koenigs, Michael, Huey, Edward D., Raymont, Vanessa, Cheon, Bobby, Solomon, Jeffrey, Wasserman, Eric M. and Grafman, Jordan (2007). Focal brain damage protects against post-traumatic stress disorder in combat veterans. *Nature Neuroscience*11, 232-237. Combat veterans with damage to either amygdala or the left or right VMPFC cannot develop PTSD; and children with similar damage also do not develop PTSD. The VMPFC (as self) participates in fear conditioning. Without a functional self we cannot develop fear conditioning. Moreover, either amygdala can trigger fear conditioning because they function outside the corpus callosum via bilateral interaction. Yet, when just one amygdala is nonfunctional it appears fear conditioning cannot be completed.

Kreuger, Frank, Barbey, Aron K., and Grafman, Jordan, (2008). The medial prefrontal cortex mediates social event knowledge. *TRENDS in Cognitive Neuroscience* doi:10.1016/j.tics.2008.12.005. In what they call *string theory* (**s**tructural **t**emporal **r**epresentation bindi**ng**), the authors portray the DMPFC/VMPFC axis forming abstract dynamic *elators*--event simulators— anterior prefrontal schema generalizations. Thus, the DMPFC forms person-schema and maintains social goals as *elator* variants, while VMPFC (and medial OFC) forms self-schema, outcome predictors of emotional rewards and punishments. The social/self domain generalizations sum many excitatory inputs during gamma oscillations. This neuroscience-fiction language sounds true to me.

Kringelbach, Morten L. and Rolls, Edmund T. (2004). The functional neuroanatomy of the human orbitofrontal cortex: evidence from neuroimaging and neuropsychology (2004). *Progress in Neurobiology* 72 (2004) 341-372. Many authors include medial OFC in the default domain. The OFC extends laterally in its function, but we can hardly distinguish its function from that of the self, because the OFC provides feeling to the sense of self. The authors find that the OFC shows a medial to lateral conditioning valence from reward to punishment, and posterior to anterior attribution from concrete to abstract.

I often wonder about the source of intellectual pleasure in conceptual work. Where does the pleasure come from and why does it feel so profound? There are so many incremental steps in forming a new

concept that each step is like ascending to a new height where the perspective is greater. Rolls and Kringelbach, knowing the functions of the OFC from the vantage of life-time study, ascribe feeling quality to the OFC. The more generally relevant one's reflections on life, the higher the OFC assigned reward. Yet, intensity can be suppressed top-down by the dorsal PFC.

It seems intuitively evident that proceeding downstream from dorsal to ventral moves consciousness from the general to the more specific. But what accounts for medial to lateral distinctions in qualities of consciousness? The authors disagree with Damasio's revival of the James-Lange theory, which holds that the quality of feelings comes from the insular cortex's association of somatic networks to past emotional states. Rolls and Kringelbach consider medial motor response as just as core to feeling quality as lateral sensory input. They tentatively see emotional valence as a state of consciousness resulting from medial assigned reward and lateral pain.

Kveraga, Kestutis, Ghuman, Avniel S. and Bar, Moshe (2007). Top-down predictions in the cognitive brain. *Brain Cogn*. 2007 November; 65(2): 145-168. Top-down visual feedback from OFC to inferior temporal cortex (IT) refines visual perception of objects. Top-down perceptual organization of the image modifies it; bottom-up sensory organization specifies it. Large magnocellular retinal M cells input to the OFC early in visual processing. The OFC then feeds back to the IT where small retinal P cells are sending color and feature specific data. Visual data forms a dorsal and a ventral stream. We have to account for the fact that the hemispheres lateralize their visual perception, so that the LB specializes in scrutinizing features for their biological salience, while the RB specializes in quick determinations of where an object is in the context of potentially threatening spatial reality. Lateralization limits the possible object choices that have to be retrieved through combining the 'what is it?' p cells and the context sensitive RB 'where is it?' data formed by the luminosity sensitive M cells. But we also have to account for the emotional and interpersonal quality of objects.

The top-down refinement model produces synchrony in posterior and anterior cortex— agreement between what we look for and what we find. Hebbian learning does this from the top-down; iteration produces neural changes that make similar items familiar. Thus, prediction (what is it?) is part of a task-oriented larger scale process. Perception predicts. As a quick read, we see emotionally stimulating objects earlier and with high activation in the OFC, which equilibrates very fast with the amygdala. Thus, emotional quality is part of the object context. Saccade snapshots at 125 msecs reinforce quick response to danger. TPJ emotional gists of the social world-- biological expressions in other's eyes or mouth become social organizers. Psychoanalytically, emotional gist may be seen as a building block of social transference--bias. Perceptual prediction is just as important in facilitating experience as in facilitating priorities in the self's future goals.

Lieberman, Mattew J., Eisenberger, Naomi I., Crockett, Sabrina M., Pfeifer, Jennifer H., and Way, Baldwin M, (2007). Putting Feelings into Words: Affect Labeling Disrupts Amygdala Activity in Response to Affective Stimuli. *Psychological Science*18 (5), 421-28. The authors report that through a neural network of right VLPFC and MPFC activation, affect labeling suppressed right amygdala release of negative affect. Perhaps the suppression signal arises in the RB's VLPFC, which I think codes for

emotional word qualities. We know that in LB strokes involving language centers, the RB continues to support emotional verbal expression.

Lyons, Derek E., Santos, Laurie R. and Keil, Frank C. (2006). Reflections of other minds: how primate social cognition can inform the function of mirror neurons. *Current Opinions in Neurobiology* 2006, 16:1-5. This article can help us distinguish between self-agency and self-representation, a distinction basic to understanding the function of mirror neurons. Agency seeks satisfaction; developing humans learn to perceive other's successful behaviors. Mirror neurons are not necessarily a direct link to empathy. The authors conclude that mirror neurons in the macaque activate with the perceived intention of other animals, and thus are a form of seeking behavior (agency) that is competitive, rather then imitative. But, in the same situation, human children *imitate* actions they see directed toward a perceived goal. Children learn to imitate adult behavior, rather than going for instinctual reward from the get-go--like the macaque. Perhaps humans reproduce or imitate their own seeking behavior to themselves so that the behavior may be stored and repeated as part of a repertoire.

Malhotra, Paresh, Coulthard, Elizabeth, and Husain, Masud (2006). Hemispatial neglect, balance and eye-movement control. *Current Opinion in Neurology*. 19 (1):14-20. RB posterior inferior parietal lobe damage causes a syndrome of inattention to space: hemispatial neglect, imbalance, and incapacity to connect saccades. One loses the capacity to construct space and attend spatial context. Objects disconnect. Our sense of reality embraces a spatial context that frames objects in their relation to our body.

Mechelli, Andrea, Price, Cathy J., Friston, Karl J., and Ishai, Alumit (2004). Where Bottom-up Meets Top-down: Neuronal Interactions during Perception and Imagery. *Cerebral Cortex* November 2004:14:1256-65. Frequently perceived data are repeated so often that they acquire posterior cortical categorical processing sub-networks of their own. During visual perception *category* specific objects processed in occipital temporal cortex activate separately for chairs, houses, and faces. This manifests how parietal cortex integrates the content of consciousness. In repetitive experience, when we repeatedly see familiar objects in their context, Hebbian learning categorizes the objects, so that they are ready to enter consciousness together. When we imagine such an object the same sub-network is located as when we experience the object and recognize it from memory. During imaging then, the prefrontal cortex activates, while the precuneus as the mind's eye of attention locates sensory-activated posterior networks. Perception and imaging use the same posterior networks, but they differ in how functional PFC networks evaluate the data. The PFC always generates top-down perception as words or images that activate attention's categories. As a LB posterior exercise in categorization, how many words can you think of that start with the letter p?

Moll, Jorge and de Oliviera-Souza, Ricardo, (2007). Moral judgments, emotions and the utilitarian brain. *TRENDS in Cognitive Neuroscience*, doi:10.1016/j.tics.2007.06.001. The authors conclude that while prosocial judgments activate dorsal more than ventral PFC, the VMPFC is the site of moral emotions, e.g. a sense of others as self-extensions who must not be hurt. This emotional inclination works within the frontal poles of BA 10 to generalize the morality inherent in sparing self-extensions. Moll and de Oliviera-Souza also conclude that DMPFC, and DLPFC cognize moral choice and dehumanize others.

They suggest that dorsal PFC monitors negative emotions such as the wish to hurt others. In other words, dorsal PFC processes negative ambivalence, so that it can be thought through reflectively to make prosocial choices—'look before you leap'. Patients with bilaterally damaged VMPFC extending anteriorly into BA 10 showed less emotional judgment and more prosocial judgment when encountering another's pain.

In a standard moral protocol, some people cannot stand to make the prosocial choice of simply pushing someone to their death to save five others, whereas they could throw a switch that has the same effect—their ACC intervenes with conflict. People with VMPFC damage found it easier to make the prosocial choice of simply pushing the person. I think the prosocial (DMPFC plus DLPFC) choice is more consistent with people who make choices out of social obedience (which makes social binding of aggression easier). Liberals are more vulnerable than conservatives to conflict over feeling other's pain; VMPFC damage alters their capacity to feel familiar other's intense pain, leaving the cognitive capacity to make moral judgments intact. Permeating the DMPFC with social language, morality operates in a biological, social, political, and media frame.

Monteleone, George T., Phan, Luan K., Nusbaum, Howard C., Fitzgerald, Daniel, IIrick, John-Stockton, Fienberg, Stephen E., and Cacioppo, John T. (2008). Detection of deception using fMRI: Better than chance, but well below perfection. *Social Neuroscience* DOI:10.1080/17470910801903530. Lying is a concept only relevant to brain-imaging when autobiographical information of critical survival significance is at stake for self or other. The CIA knows lying is not a reliable concept. In this study, when subjects were told to lie or tell the truth about card holdings, the most reliable indicator of lying was lateral PFC and VMPFC (71%) activations, but no better than polygraph.

Morin, Alain and Michaud, Jayson. (2007) Self-awareness and the left inferior frontal gyrus: Inner speech use during self-related processing. *Brain Research Bulletin*, volume 74, Issue 6,1November 387-96. Reviewing 59 studies of self-reference, most activated the LB's anterior VLPFC, which processes meaning and speech articulation. Thus, verbal reflection is LB processed (even if observant reflection is RB processed).

Naito, Elichi and Ehrsson, Henrick H. (2006). Somatic Sensations of Hand-Object Interactive Movement Is Associated with Activity in the Left Inferior Parietal Cortex. *The Journal of Neuroscience,* April 5, 2006, 26(14): 3783-90. Using an illusion created by vibrating the bent extensor tendon of the wrist, while a person held an object, the authors show that the haptic illusion of object movement together with flexion of the wrist is lateralized to activate the left inferior parietal cortex. That illusion of initiated movement is the essence of agency: the object is an extension of the reaching hand. Despite the illusion, the subject knew his or her hand was not moving, nor was there a sense of initiating the movement. Speaking of self-extension, familiar other is felt to be an extension of self—a social tool.

Left inferior parietal cortex damage causes a syndrome of ideomotor apraxia. Thus, the haptic perception of an object is intrinsic to the sense of its use as a tool. Frontal motor activity is experienced in object perception. The kinesthetic sense of muscle movement (stretch) plus haptic touch experience of the object gives rise to body extension in a tool. Agency combines the left lateral inferior frontal

sense of purposeful movement with the sensory feel of the object. Whether the illusion of movement was stimulated in the right or the left hand, the left lateral inferior parietal area activated.

In motivational networks that include agency, the LB's inferior parietal haptic sense uses object features to provide perceptual cues of reward; while the RB's inferior parietal area provides a sense of the hands moving in space. LB agency makes the haptic object into a body extension--we fuse with the object; while RB inferior frontal and inferior parietal stimulation represents one's own body parts moving in space. To the extent that LB objects extend our sense of agency, forming part of our mentalization equipment, think of the psychoanalyst's *transitional object* that make s a self-extending teddy bear, or better yet a puppet, into an agency tool objectified in space. Sometimes the term tool is used as a term for the penis as a homunculus.

Nobuhito, Abe, Suzuki, Maki, Mori, Etsuro, Itoh, Masatoshi and Toshikatsu, Fujii (2007). Deceiving Others: Distinct Neural Responses of the Prefrontal Cortex and Amygdala in Simple Fabrication and Deception with Social Interactions. *Journal of Cognitive Neuroscience*. 2007;19:287-295. Communicating deceptively activates the VMPFC (self-motivated reward), the left DLPFC (behavioral intention), the right anterior PFC (social iconography) and the amygdala (controlled aggression). The inveterate lying peculiar to political systems brings these networks into consonant use. Hebbian associations of deception, reinforced by social policy makes deception a way of life that loses its capacity to elicit ACC judgment of conflict or error-- like hitting home runs on steroids.

Northoff, Georg, Heinzel, Alexander, Bempohl, Felix, Niese, Robert, Pfennig, Andrea, Pascual-Leone, Alvaro, and Schlaug, Gottfried. (2004) Reciprocal modulation and attenuation in the prefrontal cortex: An fMRI study on emotional-cognitive interaction. Published online, http://www3.interscien107061919ce.wiley.com/journal. During cognitive/emotional interaction, cognition activates VLPFC and DLPFC; emotion activates VMPFC (weakly) and DMPFC (strongly). Cognizing emotion lateralizes and weakens it. We might say that when cognition is prominent in the distributed system of consciousness, feeling has less effect on the experience of consciousness.

Northoff, Georg (2005) Is emotion regulation self-regulation*? TRENDS in Cognitive Sciences,* Letter—June 5, 2005. Continuing his study of evaluating what determines the experience of consciousness, Northoff points out that VMPFC makes emotion the core organizer of consciousness. The more activation in VMPFC, the more self-related an emotional stimulus, leading to increased personal involvement with stronger feelings.

Northoff, Georg, Heinzel, Alexander, de Greck, Moritz, Bermpohl, Felix, Dobrowolny, Henrik and Panksepp, Jaak (2006) Self-referential processing in our brain—A meta-analysis of imaging studies on the self. *NeuroImage* 31, 440-57. Northoff, Panksepp, et al. make a good case for cortical medial structures coalescing into social networks that distinguish self from other. Examining brain-imaging studies from the literature, which take the whole brain into account when researching self-process, Northoff's group attempts to reconcile the default mode of midline networks, with specific functions.

Reading this article, I wondered if Panksepp was the one who best understood the subcortical midline structures that provide a core base for a proto-self; and whether Northoff provided a consistent

philosophical base for the mental side of the self. In that sense of how one actually reads articles written by a group, the others represent a whole social enterprise working collaboratively. I beg the question whether self is a concept that can provide mind/brain congruence to social neuroscientists. The authors posit self as a distributed set of midline brain networks that include ancient subcortical networks as well. The PAG (periaqueductal gray), bed nucleus of stria terminalis, superior colliculi, and dorsomedial thalamus connect emotional centers with external and internal body senses. Superabundant connections between visceral reports and the VMPFC show the connection between core experiencing self and a proto-body's metabolic and chemical core, signaling what the body needs for survival.

Northoff, et al. question how much functional self resides in experience, how much in reflection. They conclude that the DMPFC regulates reflection and cognitive processes that spread through copious connections to lateral prefrontal cortex. The DMPFC also maintain copious connections through the precuneus with hippocampal sources of long-term biographical memory. Using psychoanalytic theory without calling it that they wonder whether the self concept includes potentially conscious, but unconscious experience. I suggest that lateralization answers this question. LB agency (subjectivity) cannot be known without a RB objectified referent. Indeed, the RB quality of reflection arises like an eye in the sky from the right TPJ. The subject, "I" can not know its own agency without a "me" representation as the object of experience. Self-agency uses objects as tools extending the self, objects that exist like the psychoanalytically defined transitional objects, which are owned by the self, like pseudopods from amoebas.

An equally important question in this vein is whether interoceptive medial subcortical organizers of a protoself are themselves lateralized. If higher cortical lateralization of needs and dangers segregate survival necessities, is the same distinction made at the subcortical level? The authors distinguish subcortical emotional processors like the amygdala that process the external world from subcortical medial processors dealing with the internal milieu; and the body's inner orienting vestibular and proprioceptive senses coalesce with interoceptive emotional processors. It seems to me the subcortical distinction between survival mechanisms for metabolism migrate to the LB and those concerned with the external world migrate to the RB. Perhaps that is a determinant of the distinction between LB parasympathetic processes and RB Sympathetic processes.

Northoff, Georg and Panksepp, Jaak (2008). The trans-species concept of self and the subcortical-cortical midline system. *Trends in Cognitive Sciences* Vol. 12 No. 7. This fine conceptual article presents a compelling thesis for seeing that mammals have as much a core self as people do. In mammals, including Homo sapiens, VMPFC and the rest of the default domain activate highly because they process vital, body-based emotional, motivational, and attention processes. When we think of our social world, other animals play a role in its holistic constitution.

Surmising that lateral cognitive processing evolved later than medial networks, Northoff and Panksepp posit that the default domain has diverging social functions: mine (core-self) and belonging (social otherness). Since all mammals have similar medial networks to Homo sapiens they must share the

capacity for planning as active agents pursuing their needs and goals. We know that we share our social world with the animals.

The authors see core self at the regulating hub of interoceptive/exteroceptive subjective/affective, and motor/sensory dualities. Without relating this to lateralization of pleasure and pain, they relate conditioning valence to neuromodulators. Not seeing neuromodulation as the equivalent of the psychoanalytic concept of drive, as I do, they note that: NE facilitates sensory stimulation binding, 5HT facilitates multisensory binding, DA facilitates motivational binding, Ach facilitates arousal and attention, and neuropeptides modulate stress (down-regulated by endorphins, up-regulated by corticotrophin releasing factor). If self is a transitional concept between mind, brain, and society, it is time to bring psychoanalysis to bear.

Ochsner, Kevin N. and Gross, James J. (2008) Cognitive Emotion Regulation: Insights from Social Cognitive and Affective Neuroscience [SCAN]. *Current Directions in Psychological Science*, Volume 17, number 2, 153-58. SCAN here refers to the effect of cognition on emotion: forming interpersonal feelings. In the complex relation between emotion and cognition, cognitive reappraisal—imagining different outcomes—has an early processing effect that inhibits the amygdala, whereas deliberate suppression of a feeling state activates the amygdala. For better clinical technique in reappraisal then, instead of saying "don't be disgusted," one could ask "what is it about the situation that is disgusting and is there a way it could change?" The authors found that the dorsal PFC appraises emotion, while the ventral PFC, in reciprocal alliance with the amygdala, suppresses emotion. The cingulate cortex mediates these two functions as it regulates ongoing goals. I propose that in the formation of one's ToM, otherness develops as a control and regulation of our emotional life, while self develops to control and monitor emotions instrumental in the formation of one's narrative autobiography.

Olds, Sharon, *The Borders* http://www.poemhunter.com/poem/theborders. Reading Old's poem shows the effect of psychoanalysis on helping one perceive their deepest ambivalence to their closest self-extending kin—mother and daughter rolled together into a single transference. There are moments in every relationship when the closest union turns into the opposite— relationship with a stranger who may bear malice.

Olson, Andreas and Ochsner, Kevin N. (2007. The role of social cognition in emotion. *Trends in Cognitive Sciences*, Volume 12, number 2, 65-71. Social control is exerted on emotional regulation, which is why social cognition and social affect are one discipline. Using attribution theory, social cognitive neuroscientists infer why someone acts as they do. That inference depends on the dorsal networks of the PFC and its underlying ACC and posterior insular cortex. The most anterior reflection (of BA 10) joins ventral self and dorsal other attribution. Perhaps social cognitive neuroscientists have not made apt conceptual use of the superego, because they lack a contextual framework for making use of some psychoanalytic concepts when they cannot use them all.

Panzer, A., Viljoen, M., and Roos, J.L. (2007) The neurobiological basis of fear: a concise review. *S Afr Psychiatry Rev* 2007:10:71-75. Panzer and her colleagues present a cogent review of what is tantamount to the relationship between unconscious processing and fully conscious processing, which

can provide a backstop to psychoanalytic thinkers. A thorough understanding of fear conditioning shows how bottom-up behaviorism and top-down neuropsychoanalysis are merging disciplines. Fear signals the association of a painful conditioned stimulus (CS) with an unconditioned stimulus (UCS). The CS is carried from the thalamic sensory nuclei to the amygdala directly-- or indirectly after first being processed by the prefrontal cortex. Thus the external world has first crack at joining the UCS and CS in the lateral amygdala. However, the MPFC through the auspices of the ACC, and VMPFC (including the medial OFC) has second crack—which may suppress the fear response if preliminary perception shows little to fear.

The authors report that an excitatory inflow to the lateral and basolateral amygdala disinhibits the central amygdala output to the hypothalamic-pituitary-adrenal (HPA) axis, which triggers instinctual fear responses, and a chain of hormonal stress responses that promote a full-fledged emergency unless hippocampal feedback intervenes. The disinhibition overcomes the normal inhibitory tone surrounding the central amygdala, as AMPA receptors facilitate NMDA receptors, setting off an intracellular cascade leading to permanent long-term potentiation (LTP) of the fear experience. Such activation is protected by intercalated inhibitory GABA neurons, a fail-safe mechanism; strong inhibition can only be overcome by multiple neural triggers activated in precise order.

Continuing stress and fear with no seeming escape depletes the available metabolic sugar in hippocampal cells; stress effects magnify throughout the whole mental system, permanently conditioning the experience, exhausting one's sense of conscious control, and impairing one's faith in the self's continuity. Thus, LTP in the lateral and central amygdala can trigger LTP in hippocampal circuits that cause those circuits to lose their plasticity, becoming dedicated instead to purveying signals of imminent chaos. As I see it, permanently conditioned unconscious circuits are produced, unavailable to declarative narrative memory—disassociated from the self's ongoing autobiography. The degree to which more hippocampal circuits become dedicated to unconscious processing determines how flexible one can feel in dealing with survival threats. Warning imagery and anxiety protect one from the reactivation of the whole central amygdalar emergency response system.

With a high level of underlying readiness for anxiety, acute stress stimulates the locus ceruleus' NE system to trigger further vigilance and aversion. Once experience has been conditioned to evade autobiographical memory, it is permanently active—although it can be overlaid with new experience that alters its role in decision-making. The authors realize that the more often one becomes fear conditioned, and the earlier the experience in prenatal and natal life, the more vulnerable one becomes to the effects of further stress. But, good enough early mothering subdues stress responses and produces more flexibility, with a greater tendency to explore the world when novelty appears, rather than resorting to anxious aversion. Vacations are like that.

Here is my psychoanalytic overview: to preserve calm in the social domain, the twin amygdala's are like two sentries guarding the entrance to the dynamic unconscious. When fear-conditioned hippocampal circuits are stimulated by warning imagery, the ACC signals the bed nucleus of the stria terminalis (BNST) in the hypothalamus; anxiety signals are generated indicating a violation of fear conditioned avoidance. In this way the hippocampus maintains a set of life experiences that are emotionally too hot to handle,

providing a safe context for one's narrative autobiography. The AIC maintain a set of associations that are directly available to the conscious self-domain, the basis for rationalizing behavior. In this way, fear conditioning bypasses consciousness. Consider Freud's theories of repression: by inhibiting impulses and data associated with past wishes and disruptive outcomes, the dynamic unconscious manifests a bottom-up repression, at the same time that ongoing experience is repressed from the top-down.

Pelphrey, Kevin A. and Morris, James, P. (2006). Brain Mechanisms for Interpreting the Actions of Others From Biological-Motion Cues. *Curr Dir Psychol Sci.* 2006 June; 15(3): 136-140. In multiple studies of the posterior STS,Pelphrey and Morris show that activation, particularly on the right, accompanies visual detection of other's biological motion. The detection includes mouth, eye-gaze direction, facial muscular expression, and even the pacing of the other's gait. This mechanism helps one judge other's social intentions. The authors tie this to help in calculating approach/avoidance tendencies in others.

The fact that this observation of biological salience in other's intentions activates in a network that is contiguous to the TPJ, which holistically embodies biological motion points to a critical human function. We have to keep in mind Edelman's thesis that consciousness combines qualities from all of the linked distributed systems. When the DMPFC, which provides social reflection, links with STS and TPJ (all part of the default domain) the resulting contribution of social qualities to reflection provides an observant social quality–-exactly the functional aspect of observant reflection contributed by the RB. I infer that the LB's STS and TPJ provide the verbal accompaniment to reflection.

Perani, Daniella, The neural basis of language talent in bilinguals. *Trends in Cognitive Sciences,* vol 9 Issue 5, May 2005 pp 211-13. The DLPFC enhances language proficiency as it develops more gray matter, which accompanies articulatory proficiency in verbal sequencing. The left AIC enhances this proficiency further by coupling word sound with articulation. Perani speculates that the left DLPFC/insular network uses mirror neurons. In her view, one masters languages more easily when the imitative language capacity engages the mirror neuron system. She found that people unable to master a second language activate their ACC and medial PFC, when challenged with a second language --which manifests conflict-- the second language feels like dissonant error.

Phan, Luan K., Liberzon, Israel, Welsh, Robert C., Britton, Jennifer C., and Taylor, Stephan F. (2003). Habituation of Rostral Anterior Cingulate Cortex to Repeatedly Emotionally Salient Pictures. *Neuropsychopharmacology*, 28, 1344-1350. When an fMRI subject is shown pictures depicting painful affect, activation encompasses the right ACC, the amygdala, medial PFC, and the hippocampus on first exposure, but not the second. Finding a situation socially harmless, we habituate to intense affect without becoming conditioned by the experience. Habituating to painful affect maintains composure; perhaps this is also how we become socially inured to other people who bear starvation and terror in their short and brutal lives.

Phelps, Elizabeth A., Delgado, Mauricio R., Nearing, Katherine I. and LeDoux, Joseph E. (2004). Extinction Learning in Humans: Role of the Amygdala and vmPFC. *Neuron,* Vol. 43, 897-905, September 16, 2004. Extinction learning is activated in the subgenual part of the ACC and in the VMPFC. That portion of the ACC works with the VMPFC to signal potential danger whenever the CS recurs. A CS can be re-

contextualized in situations that are not fearful, even pleasurable, which accounts for the capacity to extinguish fear responses; yet, if the CS recurs in association with the UCS, the response is greater and closer to triggering stress responses. The authors call the new context experience-- relearning. On a collective scale, think of Americans learning to live with stimuli that remind the public of terrorists. Gradually, if trauma cues are repeated without incident, we can undergo social relearning. In another format, comprehensive transference analysis in psychoanalysis, replete with reflection and different emotional outcomes may be considered the basis of "cure".

Pierno, Andrea C., Becchio, Cristina, Turella, Luca, Tubaldi,, Federico and Castiello, Umberto (2008). Observing social interactions: The effect of gaze. *Social Neuroscience,* 2008, 3 (1), 51-59. In this fMRI study using photos, the authors found that when two people are depicted acting collaboratively, their picture activates the subject's DMPFC. Moreover, when their gaze seemed united on the same object, the subject's right STS was also highly activated-- perceiving biologically active parts of the face like the mouth and eyes stimulates the right STS. The authors concluded that observing social gaze indicates the intention of social others in the context of their collaboration; this empathic function is already present in the three month old infant. Our brains have evolved as social instruments, with multiple forms of social communication.

Raichle, Marcus, E. and Snyder, Abraham Z. (2007). A Default Mode of Brain Function: A Brief History of an Evolving Idea. *NeuroImage*:doi:10.1016/j.neuroimage.2007,02.O41. Every brain network has its own intrinsic activation energy from which its functional activity under particular circumstances can be measured, The PET scan best measures the resting mode because the difference between blood oxygen level entering a network and leaving it (BOLD) correlates with activation. The authors related the high resting activation of the medial cortex to its critical function of prioritizing the body's survival requirements. Raichle originally called the linked resting network the *default mode*, because it showed high activation at rest. Then he called it the *self-domain* because its medial functions were involved in preserving the self and maintaining autobiographical continuity. When the DMPFC was functionally analyzed within the default domain (it responds highly to otherness) some called it the *self-other domain*. I suggest we now term anterior medial prefrontal cortex *medial social-domain*, because it brings social reflection into consonance with self-reflection. From the vantage of developmental ego-psychology, the social-domain mediates symbiotic self/other junction and disjunction. How many times in a minute do we merge and separate from the one with whom we communicate?

Rameson, Lian and Lieberman, Matthew D. (2008). Thinking about the Self from a Social Cognitive Neuroscience Perspective. *Psychological Inquiry*, Volume 18, Issue 2 June 2007, pages 117-122. Considering self from three perspectives: self vs. other, inner vs. outer experience, and regulated vs. automatic processing, the authors posit two separate distributed systems: a VMPFC self-system that functions automatically to process emotional experience associated with pleasure, pain, and anxiety; and a cognitive, externally-oriented system that is controlled, conscious, and regulated, which activates the DMPFC. The dorsal social system for dealing with external reality jibes with Freud's proposal in his *Project for a Scientific Psychology* in which one perceptual system deals with pragmatic reality problems and a second perceives emotions.

Ramnani, Narender and Owen, Adrian M. (2004). Anterior Prefrontal Cortex: Insight into Function from Anatomy and Neuroimaging. *Nature Reviews: Neuroscience* Vol.5, March 2004: 184-94. The authors believe that BA 10 operates by combining multiple cognitive processes into one general behavioral function. They adduce this partly because BA 10, the most anterior generalizing cortex, has more gray matter and fewer cells than other PFC areas, which indicates its hierarchical abstraction process. But, I think they miss the distinction between self and other that organizes our sense of the social world. That distinction has repercussions in the dissociation between emotion and cognition that is glossed over in unifying a perspective for social behavior. Ethics, for instance, cannot unify a cognitive and emotional basis for prosocial behavior.

Ranganath, Charan, Cohen, Michael X., Dam, Catherine, and D'Esposito, Mark (2004) Inferior Temporal, Prefrontal, and Hippocampal Contributions to Visual Working Memory Maintenance and Associative Memory Retrieval. *The Journal of Neuroscience,* April 21, 2004, 24 (16): 3917-25. To buy a sweater at a good price, we have to distinguish a visual cue: a loose thread. Will the fabric unravel if we cut it? The authors tell which networks activate during that decision. Associative, top-down, goal-directed visual memory activates our anterior PFC for framing the task, inferior temporal cortex for establishing the salience of the sweater's features in the sale context, and medial temporal lobes (including the hippocampus) for referencing past visual experience (one sweater unraveled, one was fine). Using Hebbian distributed networks to supply just those qualities to consciousness that inform further processing, perceptual prediction guides task-oriented WM. We perceive what we need to complete our pragmatic tasks.

Rauch, Scott L., Shin, Lisa M., and Phelps, Elizabeth A. (2006) Neurocircuitry Models of Posttraumatic Stress and Extinction: Neuroimaging Research--Past, Present, and Future. *BIOL. PSYCHIATRY*, 2006.06: 376-82. The authors establish that the right amygdala undergoes fear conditioning in PTSD, secondary to a failure of the VMPFC to extinguish a whole set of fear associations. Moreover, the ACC no longer signals error, when the fear response begins. They examine implications of this mechanism for cognitive and behavioral therapy, but the connection with a failure of self is not made. The fact that the *right* amygdala triggers fear conditioning shows that the *right* VMPFC normally inhibits the response to the aversive stimulus-- as part of the self's function of evaluating novelty before coming to affective decisions about what course of response to take. We know that high circulating levels of cortisol block the VMPFC's response to affective stimuli— short-circuiting the role of the self in mediating survival.

Rilling, James K., Dagenais, Julien E., Goldsmith, David R., Glenn, Andrea L. and Pagnoni, Giuseppe (2008). Social cognitive neural networks during in-group and out-group interactions. NeuroImage: doi:10.1016/j.neuroimage.2008.03.044. The authors explored which networks activate when people know they are collaborating on a task that is rewarding for all the participants: the whole default domain activated—even beyond its high resting state activation. Knowing social rumination occurs during rest, the authors concluded that higher activation argues for conceiving of the default domain as necessary for calculating future social involvement. Parsing the social domain, the authors discuss functional regions of interest: AIC evaluates social salience, DMPFC processes social communication, and DLPFC performs executive control.

Rosenfeld, Israel, and Ziff, Edward, How the Mind Works: Revelations (2008). *The New York Review of Books*, June 26, 2008. This article provides one window into how the intellectual world responds to modern neuroscience. The distinction between brains as blank slates versus prefigured modes of processing has a lot to do with social theories of education and governance. David Brooks, who presented a keynote address to the October, 2009 Affective Neuroscience Conference suggested that brain imaging research will provide a better scientific basis for governing ourselves communally.

Schirmer, Annett and Kotz, Sonja J. (2006). Beyond the right hemisphere: brain mechanisms mediating vocal emotional processing. *TRENDS in Cognitive Sciences* Vol. 10, No. 1, January 2006: 24-30. Event related potentials [ERP] EEGs measure within .001 seconds when particular brain networks show inhibitory [N-negativity] or activating [P-positive] waves. Combining ERP with simultaneous brain imaging reveals the sequence of network engagements in data processing. Correlating ERP with fMRI during speech processing, the authors found that at N. 100 the LB processes aural speech frequency; at P. 200 the RB processes aural intensity variations, at 400 msec the LB processes semantic hearing, and the RB judges emotional qualities of the utterance. Over-all, the LB identifies the sound sequence of particular words; the RB analyzes the spectral qualities of prosody (pitch and intensity) to judge the emotional content. Listening to speech, whether or not I hear it accurately, I make sense of it. Like a computer filling in consonants to make words when the spelling is wrong, I hear the wrong words at times.

Schneider, F., Bempohl, A., Heinzel, Rotte, M., Walter, M., Templemann, C., et. al. and Northoff, G. (2009). The resting brain and our self: Self-relatedness modulates resting state neural activity in cortical midline structures. *Neuroscience*, volume 157, Issue 1, 120-131. FMRI shows the self-domain activating when a stimulus provokes meditation on the self. This is separate from emotional provocation or self/other communication that enters into problem solving. I think that we first parse the relevance of our social communication and if there is conflict we resort to autobiographical meditation. Resting state, like meditation may be voluntarily entered as a form of problem-solving oriented toward processing one's episodic memory. Like psychoanalysis, fantasy states or rumination are sometimes entered for the purpose of evaluating one's relationships.

The fact that the default state is a social state of rumination, and that the purpose of the rumination is insuring survival by predicting the consequences of action, puts the social brain into perspective. There is always a social homunculus in fantasy; a general characterization of the social world that godlike deliberates on one's survival. Prayer balances our social needs and responsibilities. Freud was right, I think, in his dying aperçus that in our ids we reach out to a world that seems to barely notice. He sensed his archaic interoceptive proto-self still seeking the self's intervention with consciousness.

Shamay-Tsoory, Simone G., Tibi-Elhanany, Yasmin and Aharon-Peretz, Judith (2007). The green-eyed monster and malicious joy: the neuroanatomical bases of envy and gloating (schadenfreude*). Brain* 2007 130(6):1663-1678; doi:10.1093/vbrain/awm093. Patients with RB, VMPFC lesions could not recognize envy; those with LB, VMPFC lesions did not recognize gloating. Envy is a RB feeling of being deprived of what the other has and gloating is pleasure in having what the other does not, showing that RB affect is painful, LB emotion is pleasurable. Like two sides of a self-coin, "mine" asserts ownership and

deprivation. This study places object-relations psychoanalysis on the mind-brain map. Envy and jealousy develop in the 2-3 year-old stage when "mine" becomes the self's byword, opposed by the parental or sibling "No!" Self/other ambivalence shows the development of an integrated affective self. Self and other differentiate in the pre-oedipal prelude to reflection.

Simons, Jon S., Henson, Richard, N.A., Gilbert, Sam J. and Fletcher, Paul C. (2008). Separable Forms of Reality Monitoring Supported by Anterior Frontal Cortex. *Journal of Cognitive Neuroscience* Vol. 20:447-57. Using fMRI, the authors monitored the subject's recent memory of who performed a particular action before the start of the fMRI, experimenter or subject: when subject, the medial PFC activated, when experimenter, the right lateral PFC activated. This study shows our VMPFC self-domain processing self-awareness (the agent who acts), while our DMPFC (or its RB proxy) processes the other. When self acted, the subject remembered both self-agency and self-representation, when the experimenter acted the subject remembered only the other acting. Our social-domain uses VMPFC and DMPFC; our social cognitive domain uses DMPFC for reflecting on the social other and the right DLPFC for perceiving the physical other.

Straube, Thomas, Mentzel, Hans-Joachim and Miltner, Wolfgang H.R. (2007) Waiting for spiders: Brain activation during anticipatory anxiety in spider phobics. *NeuroImage* 37 (2007)1427-36. Spider phobics as exemplars of anticipatory anxiety were compared with controls in an fMRI study in which spider photos and mushroom photos were presented unpredictably in equal numbers. The spider phobics showed anticipatory activation of the DMPFC, the rostral and dorsal ACC (especially on the right), the bed nucleus of the stria terminalis (BNST) (rather than the amygdala), and the anterior insula (more on the right). Thus, the RB's DMPFC (otherness), ACC ("watch out!"), and AIC (scary associations) gang up to convey anticipatory anxiety. Freudian theory holds that anxiety is a warning signal that wards off danger by altering behavior.

Instinctual sources are recruited as the ACC triggers response anxiety in the BNST. Yet, only outright fear activates the amygdala per se. From a neuropsychoanalytic view then, spider phobia is associated with emotional conflict, which stimulates anxiety and avoidance so that outright bottom-up emergency fear need not be generated. I think that as an evolutionary protective mechanism, it may be that phobia prevents PTSD.

Symonds, Laura L., Gordon, Nakia S., Bixby, Jonathon C., and Mande, Margarete M. (2006). Right-lateralized Pain Processing in the Human Cortex: an fMRI study. *J. Neurophysiol* 95: 3823-30. Studying subjects with fMRI monitored response to bilaterally induced pain, the authors found a RB top-down pain-processing bias activating the ACC, AIC, VMPFC, DMPFC, and precuneus. Parsing the network responses to the pain, the authors posited that ACC signals a problem, AIC associates the problem with past experience, OFC judges the intensity of the pain, the VMPFC self-domain predicts the outcome, and precuneus attention brings the brain to follow-up mode.

Tallon-Baudry, Catherine (2009). The role of gamma-band oscillatory synchrony in human visual cognition. *Frontiers in Bioscience* 14, 321-332, January 1, 2009. Edelman posits that the quality of consciousness results from the sum total of distributed networks activated at any moment. Tallon-

Baudry's measurements of gamma frequencies tend to support Edelman's position. Thus, oscillatory synchrony in gamma (30-120 Hz) range favors the selective transmission of synchronized information. Neuromodulatory data also show that acetylcholine transmission activates gamma frequencies. Gamma wave activations, stimulated by Ach, show a portal to consciousness: network co-activation.

Taylor, Shelley E., Burklund, Lisa J., Eisenberger, Naomi I., Lehman. Barbara J. Hilmert, Clayton J. and Lieberman, Matthew D. (2008). Neural Bases of Moderation of Cortisol Stress Responses by Psychosocial Resources. Journal of *Personality and Social Psychology*, 2008. DOI: 10.1037/0022-3514. Using fMRI the authors conclude that less cortisol response to stressful situation indicates better psychosocial regulation. Good regulation involves right VLPFC activation, which obviates right amygdala actifvation. The amygdala participates strongly in the perceived threat, but optimism and good psychosocial involvement ameliorates the whole stress response. This study highlights the fact that stressed people who have less social support are more vulnerable to developing PTSD. Unpopular wars, for instance, generate that lack of social support.

Tulving, Endel, Episodic Memory and Autonoiesis: Uniquely Human? In *The Missing Link in Cognition,* Ed. Herbert S. Terrace and Janet Metcalf*, Oxford University Press,* 2005. Tulving's concept of episodic memory-- mental time travel-- places social geist in its proper context. By social geist, I mean the sense that the social world is alive. Our sense of mythology and of building a sense of the future is based on a shared fantasy of social *geist*. Perhaps we know cognitively that like most projections of god, social spirit is just an animation of how the brain works in moving us to mental life. The sense of prediction, of free will to manipulate our fate, is all too real in our survival.

Conceivably, the social domain generalizes autobiographical time, forming building blocks for social process. Socially extending the self's capacity to makes a context of events and emotional episodes empowers social evolution. Joining forces we make a social contract to expand civilization. Tulving's point that there has to be an agent who remembers and a knower who knows is a good answer to those post-modernists who want to make social life a mechanical contrivance. To reiterate, it is the capacity to generalize episodic memory, as both semantic and emotional, as both future oriented and past oriented, that gives rise to mental time travel. Mental time travel launches meditation on survival: whether it is more important to search for need satisfaction or to avoid danger. We configure these twin challenges in our uniquely human way.

Urry, Heather L., van Reekum, Carien M., Johnstone, Tom, Kalin, Ned H., Thurow, Marchell E., Schaeffer, Hillary S., et. al. and Davidson, Richard J. (2006), Amygdala and Ventromedial Prefrontal Cortex Are Inversely Coupled during Regulation of Negative Affect and Predict the Diurnal pattern of Cortisol Secretion among Older Adults. *The Journal of Neuroscience*, April 19, 2006.26(16):4415-4425. Does the VMPFC just respond to emotion, or does it also evaluate emotional consequences? Perhaps the VMPFC kick starts the DMPFC cognitive process. The authors explore whether cognition mediated by DLPFC and DMPFC can deactivate amygdalar response to unpleasant affect. They conclude that this happens only if the VMPFC is also activated. When self experiences unpleasant affect it can ameliorate the experience by linking with its DMPFC social domain. In this way an effective self subdues unpleasant affect below its stress point.

Vanderwal, Tamara, Hunyadi, Elinora, Grupe, Daniel W., Connors, Caitlin M. and Schultz, Robert T. (2008). Self, mother, and abstract other: An fMRI study of reflective social processing. *NeuroImage* Volume 41, Issue 4, 15 July 2008:1437-48. They found BOLD activation in response to verbal qualities attributed to self or mother was essentially the same. This study shows that self and self-extension activate the same self-domain.

Van Leijenhorst, Linda, Crone, Eveline A., and Bunge, Silvia, A. (2006) Neural correlates of developmental differences in risk estimation and feedback processing. *Neuropsychologia* vol. 44, Issue 11, 2006: 2158-2170. Using a modified Iowa gambling test to compare 9-12 year old children with young adults on risk estimation feedback, the authors found that children were as competent as adults in evaluating risk by using their VLPFC and medial PFC; but their right ACC was more activated--showing more conflict in the high risk situations. Children are not inured to small punishments in their decision-making. They also showed that the lateral OFC continues to calculate risk, even though its effect can be more easily inhibited after childhood.

Vasudevi Reddy (2003). On being the object of attention: implications for self-other consciousness. *TRENDS in Cognitive Sciences* Vol. 7 No. 9 Sept 2003: 397-402. Beginning with mutual gaze in infancy, the author points out that in I-you relationship, the earliest experience may be that of otherness as well as self. To see ourselves as other's see us then is as natural as having a self. Objectifying symbiosis in this way is another crucible out of which self and other both can emerge. Perhaps this is why we are absolutely vulnerable to the vicissitudes of our reputation and to our sense of social acceptance.

Vogt. Brent A. (2005). Pain and Emotion Interactions in Subregions of the Cingulate Gyrus. *Nature Review : Neuroscience* Vol. 6/July 2005:533-544. Cingulate cortex (CC) activates in such divergent domains as emotional conflict, dissonant perceptions of reality, and performance errors that bring unexpected consequences. Monitoring for disparity implies a hierarchical or redundant system. From the perspective of mental regulation we can see that reflective consciousness can monitor experience, using verbal interventions to reset the experiencing system. Language itself has built in knowledge of its own structure, which provides for its own rules for use. Self-reflective structures can account for building mental from neural structure. Moreover, the ACC functions during social communication as a rapid fire measuring device for dissonance.

Vogt maps the CC monitoring function from anterior to posterior: motor to visceral to affective data. This medial limbic cortex unifies motor, sensory, and emotional data to modify behavior that is moving toward pain rather than satisfaction. Needing to make mid-course corrections toward solving our survival problems, involves monitoring our motor and sensory responses, as well as our interpersonal communications.

Wallentin, Mikkel, Roepstorff, Andreas, Glover, Rebecca, and Burgess, Neil (2006). Parallel memory systems for talking about location and age in precuneus, caudate and Broca's region. *NeuroImage* 32 (2006) 1850-1864 doi:101016/j.neuroimage.2006.05.002. How do we know where we are going, and whether we want to go there in the first place? During WM, several separate systems link up to provide data to declarative memory (for verbal self-instruction). The dorsal posterior precuneus activates words

for spatial location, the caudate reinforces language that locates stimuli when cues are rewarding, and the amygdala processes emotional cues. The hippocampus maps landmark locations globally and in words. Showing a cognitive verbal effect, sustained effort to verbalize location suppresses the amygdala.

Walter, Martin, Matthiä, Christian, Wiebking, Christine, Rotte, Michael, Tempelmann, Clause, Bogerts, Bernhard, Heinze, Hans-Jochen, and Northoff, Georg (2007) Preceding Attention and the Dorsomedial Prefrontal Cortex: Process Specificity Versus Domain Dependence. *Human Brain Mapping*, Wiley Ed. Ref. No: 07-0067.R2, 20 October-07:1-14. Northoff's group investigated a basic aspect of DMPFC functioning--whether it operates closer to the mental or neural realm. They distinguished whether DMPFC activates with any expected perception or to particular domains of stimuli, namely sexual, emotional, or neutral stimuli. They found a functional gradient between anterior and posterior DMPFC: posterior responded to process--expected perception. When the subject was told to expect a picture depicting sexual, emotional, or neutral stimuli, the DMPFC activated more highly when the stimulus was presented, and did not activate at all when there was no expectation. However, anterior DMPFC activated more highly to domain specific sexual and emotional pictures. Familiar emotions wake up our mind.

Familiar situations have gathered associations that form a domain of interest—a readiness for apperception—"I know that!" Northoff's group concluded that expecting perception is akin to mentalization. Because apperception is a form of reflection, I want to draw a distinction between perception and apperception. Perception is activated by sensory signals (directed by the motor process), whereas apperception (perception of perception) is a form of mental activity using motoric predictions of sensory results, e.g. closer to reasoning or cognitive process. We know that DMPFC is involved in reflective cognitive processing, helping us integrate mental processes about reality.

The authors state that VMPFC activates in response to emotional signals alone, without a need to be prompted. Thus, we may say about the social domain, that the VMPFC is activated by emotional signals and the DMPFC helps to reason about the effect of the emotional or sexual data, evoking memory. The posterior DMPFC uses the precuneus to find emotional memories categorized in familiar domains. Thus, domain specificity uses language or iconography to distinguish emotion that needs reflective processing.

Wang, Qi (2008). Where Does Our Past Begin? A Sociocultural Perspective on the Phenomenon of Childhood Amnesia. *APA Psychological Science Agenda*/Vol 22:No. 3, March 2008. European and American (Western) culture encourage individual memory at an earlier age than Eastern Asian peoples who put more emphasis on others. The difference is socio-cultural, not biological. Think of the Western teacher asking her first-graders to tell the class "What did you do this summer?" When psychoanalysts unearth the organizing memory that contains a person's essential emotional transference, they assume that individual self determines one's life transferences. Perhaps we should pay more attention to social and cultural transference.

Watson, K.K., Jones, T.K. and Allman, J.M. (2006) Dendritic Architecture of the Von Economo Neurons. *Neuroscience* !4 (1) (2006):107-1112. Allman's group examined a young man's VENs postmortem.

These layer five outflow spindle neurons relay axonal data fast between ACC, AIC, and MPFC. Allman's group emphasized that VENs activate during interpersonal emotional intensity: e.g. guilt, dissonance, humor, and lying. VENs manifest our evolution as social creatures who survive better when they connect their social experience and associated feelings very fast.

Wikipedia-- Spindle Neuron (2008). http://en.wikipedia.org/wiki/Spindle_neuron. This article highlights Allman's contribution to understanding VENs: a recent evolutionary advance in human emotional processing. These spindle neurons with few dendrites make fast emotional communication between the ACC, AIC and PFC about the emotional relevance of experience to one's behavior. They respond to cognitive dissonance—disambiguation. VENs are vulnerable to Alzheimer's disease.

Young, Liane and Saxe, Rebecca (2009). An fMRI Investigation of Spontaneous Mental State Inference for Moral Judgment. *Journal of Cognitive Neuroscience* 21:7, pp1396-1405. The right TPJ activated the most during attribution of belief about a putative agent's state of mind when carrying out a possibly immoral act, such as serving tainted meat to day-care children. The authors think this network is essential to understanding the motive for another agent's action—a ToM for that agent. The TPJ forms the base of objectified states of a person's social reality. Most of us behave as if there were a social spirit monitoring our moral behavior. That governing persona projects into our social domain, I think, from the right TPJ, which we also use to cognize another person's reality.

Morality is implicit in every social interaction. We impose our social belief systems, our categorical domains of types of people onto others in many biased ways. Many beliefs are consolidated in *isms*; liberalism or conservatism is highly resistant to change. By adult life we attribute goal-oriented agency to others using social-concept qualities stored in our right TPJ. In judging the morality of another agent's actions, DMPFC activates more than VMPFC. But, liberals rely more on their VMPFC in sustaining their belief that knowing the pain one causes is the basis for morality; while conservatives rely on their right TPJ as the qualitative basis for moral judgments. Considering health-care legislation, for instance, the facts can be so obscured that political positions determine one's beliefs.

Zahn, Roland, Moll, Jorge, Kreuger, Frank, Huey, Edward D., Garrido, Griselda and Grafman, Jordan (2006). Social concepts are represented in the superior anterior temporal cortex. www.pnas.org/cgi/doi/10.1073/pnas.0607061104. *PNAS* April 10, 2007, vol. 104, no. 15:6430-6435. Anterior temporal (AT) networks activate with social concepts whether or not they imply emotionally positive or negative social attributes. Social concepts also activate the DMPFC, and the TPJ. The right AT networks process iconic social meaning, the left process verbal meanings. The multimodal nature of AT cortex indicates these social qualities are sensory in nature. I distinguish conceptual meanings, which contain motoric or causal elements from iconic representation, which deals with social relevance, not cause. Social concepts like honesty or integrity are mere qualities, not a basis for ethical morality, because they are words attached to self and others,

derived from particular contexts. Honesty has different meaning to an eight-year-old and an adult. Concepts change valence and applicability in different life stages.