

## Becoming a Behavioral Detective



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## When we say “Is it Behavioral?”

*We are really asking “Is it willful”? Willful implies that the child knows what he did and made a conscious decision to act that way, or that the behaviour is within the child's control. Believing a behaviour is willful conjures up emotions and feelings of anger in the person analyzing the behavior because it implies that the child meant to do it.*

Murray-Slutzky & Paris, 2005

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## Behaviors are Learned Coping Strategies

Behaviors are adaptive learned responses in relationship to the environment rather than “willful”. Once a behavior is repeated it is learned (wired in the brain). Behaviors followed by a success or a reward of some form are quickly learned.



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# Arousal and Self-Regulation Drive Behavioral Responses



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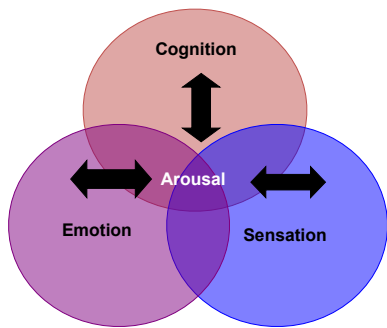
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## Arousal is the Foundation of Behavior



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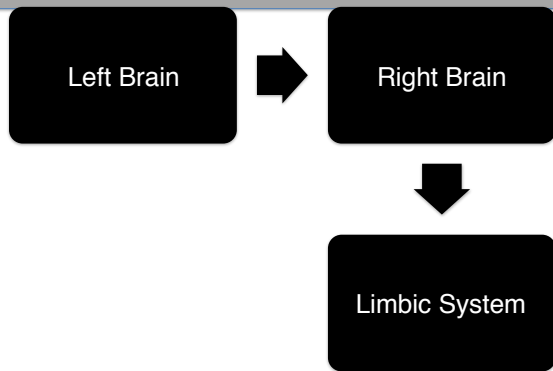
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## Connection between Frontal Cortex and Limbic System



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Self Regulation is an adaptive function enabling us to meet environmental demands behaviorally, emotionally and socially.



## What is Self-Regulation

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## Emotional Dysregulation

- In the states of excessive arousal, the higher processing neocortical circuits shut down and the direction of the energy flow within the brain and especially the orbitofrontal cortex is shunted to lower level processing (emotion).
- When an individual enters a state outside the window of tolerance which is reflexive and less rational base.



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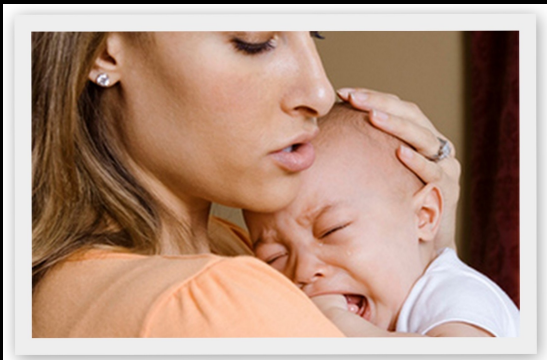
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## Regulation of Arousal through Relationship



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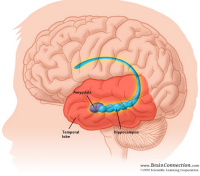
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## Amy's Job



- Make meaning of what is safe or not safe!
- The meaning making amy receives relational overtures from eyes, hands, touch, sound and smell assembling the deepest implicit expectations about the nature of the world. Remember that amy is already operating at birth!

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## Reading the Mind in the Eyes



The eyes hold the information of affect

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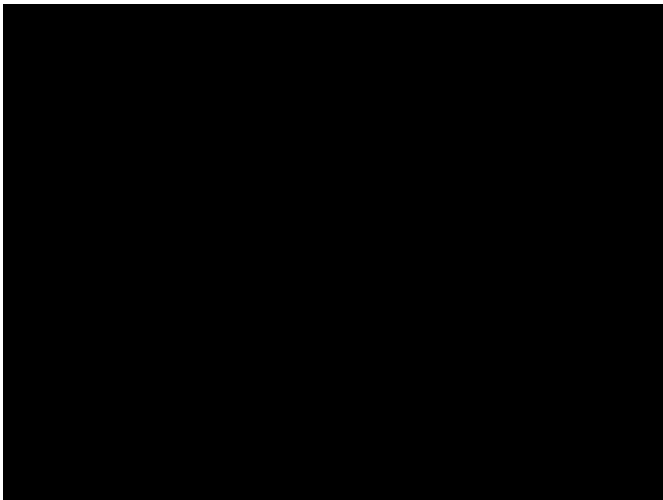
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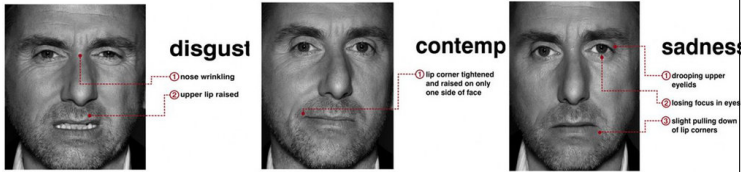
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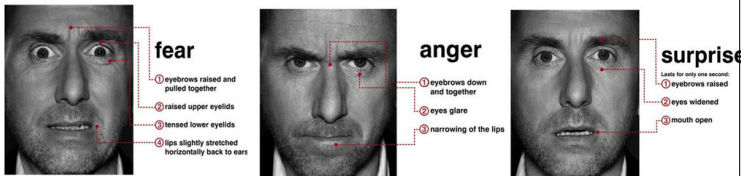
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**Lie to me\***



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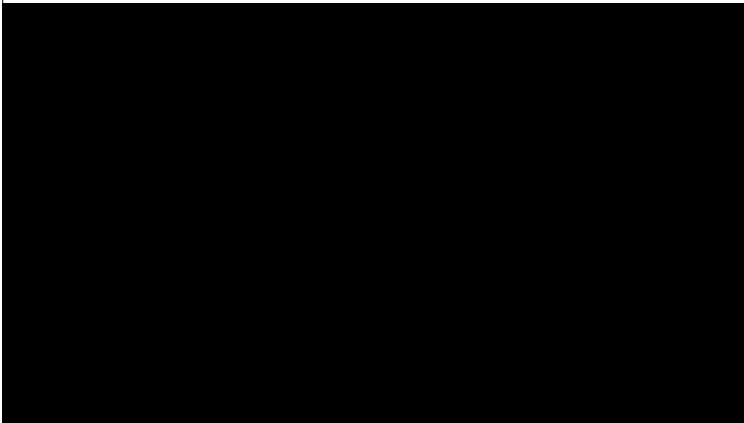
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# Mutual Gaze



- Critical to social development.
- The emergence of the capacity to efficiently process information from faces requires visual input to the right hemisphere during infancy.
- At 2 months of age, synaptic connections in the developing occipital cortex are modified by visual experiences.
- Infants show R hemispheric activation when exposed to a woman's face.

Tzourio-Mazoyer, N., De Schonen, S., Crivello, F., Reutter, B., Aujard, Y., & Mazoyer, B. (2002). Neural correlates of woman face processing by 2-month-old infants. *Neuroimage*, 15(2), 454-461.

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## Attachment is Dependent on Caregiver Eye-Contact and Gaze

- How often and in what contexts the mother and infant *spontaneously look* (and not look) directly at each other is of key importance in the development of and health of the dyadic relationship.

Schore, A. N. (2007). Early interpersonal neurobiological assessment of attachment and autistic spectrum disorders. *Attachment Assessment in treatments, prevention and intervention programs*, 7.

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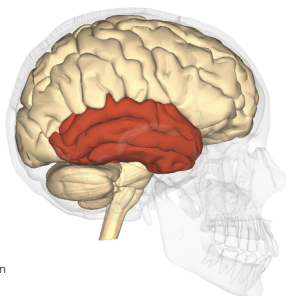
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## 6 Months Old

- Infants show a right-lateralized, left gaze bias when viewing faces, right temporal activation when looking at angry faces, and significantly greater right frontotemporal activation when viewing their own mother's face as opposed to a stranger's face.



Schore, A. N. (2007). Early interpersonal neurobiological assessment of attachment and autistic spectrum disorders. *Attachment Assessment in treatments, prevention and intervention programs*, 7.

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## Seeing Sounds Visual and Auditory Interactions in the Brain

- Objects and events can often be detected by more than one sensory system.
- Interactions between sensory systems can offer numerous benefits for the accuracy and completeness of the perception.
- Recent studies involving visual-auditory interactions have highlighted the perceptual advantages of combining information from these two modalities and have suggested that predominantly unimodal brain regions play a role in multisensory processing.



Knudsen, E. I., & Brainard, M. S. (1995). Creating a unified representation of visual and auditory space in the brain. *Annual review of neuroscience*, 18(1), 19-43.

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## Vestibular- Visual Integration



- Because vestibular information reaches the brain at much shorter delays than visual signals, it is fundamental in the neural control of the eye, head and body posture.
- To stabilize gaze in space, the vestibular ocular reflex must counteract changes in the plane of head rotation, separate from the current ocular orientation and gaze direction.
- If there is insufficient processing of vestibular information the efficiency of eye gaze will be compromised affecting all layers of attention.

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## Anxiety

- Anxiety and arousal facilitate the vestibular-ocular reflexes.
- This likely happens through direct neural connections between the vestibular nuclei and the emotional processing areas in the brain.
- When arousal goes up, the eyes move more frequently through space.
- This will increase the amount of visual processing.

Horsten, B. C., Dakin, C. J., Inglis, J. T., Blouin, J. S., & Carpenter, M. G. (2014). Modulation of human vestibular reflexes with increased postural threat. *The Journal of physiology*, 592(16), 3671-3685.

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## Vestibular Stimulation as Regulation

- Individuals exposed to back and forth motion have demonstrated decrease salivary cortisol.

Winter, L., Kruger, T. H., Laurens, J., Engler, H., Schedlowski, M., Straumann, D., & Wollmer, M. A. (2012). Vestibular stimulation on a motion-simulator impacts on mood states. *Frontiers in psychology*, 3, 499

- Vestibular stimulation inhibits both the stress axes (HPA) and sympathetic adrenomedullary (SAM) and decreases cortisol, heart rate and blood pressure within normal limits.

Desai, S. S., & Dua, A. (2014). History of Research in the Vestibular System: A 400-Year-Old Story. *Anatomy & Physiology: Current Research*, 2014.

- Vestibular stimulation relieves pain and promotes sleep and balances stress.

Sailesh Kumar Sai, Jissa George, J.K Mukkadan. Cancer pain relief by vestibular stimulation – A hypothesis. *Health sciences*. 2013;4(2):JS004D.

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## Vestibular Stimulation as Regulation

- Vestibular stimulation improves cognition.

Sailesh Kumar Sai, R Archana, J K Mukkadan. Thinking with your sixth sense. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 2014;5(4):481-85.

- Rocking is soothing and may be due to involvement of brainstem inhibitory mechanisms.

L Winter, et al. Vestibular stimulation on a motion- simulator impacts on mood states. *Frontiers Psychology*. 2012;3:499-515.

- Following controlled vestibular stimulation, a steady and significant decrease in salivary cortisol, blood pressure and blood cell count has been observed.

Sailesh, K. S., R. A., & J. K., M. (2014). Controlled Vestibular Stimulation: A Physiological Method of Stress Relief. *Journal of Clinical and Diagnostic Research: JCDR*, 8(12), BM01-BM02. <http://doi.org/10.7860/JCDR/2014/10312.5298>

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## Self-Regulation

- The key to the delicate undertaking of self-regulation is being able to safely sense both intense and subtle body sensations and feelings.
- It turns out that there is a paired brain structure that appears to do exactly this: wedged between the limbic system and the prefrontal cortex: The INSULA!

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## Insula

- Puts Sensation and Emotion together.
- Receives vestibular input directly from the brainstem.
- This is an area of the brain implicated in mental illness.
- Clinically when vestibular input is poorly processed, it impacts a person's sense of self-regulation.



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## Happy Sounds

- Happy sounds specifically activate the right inferior frontal cortex.
- Emotions differentially modulate voice processing in the right hemisphere.
- Mother-ease is critical for the development of the posterior areas of the right hemisphere that processes prosodic emotional functions.

Grossmann, T., Oberecker, R., Koch, S. P., & Friederici, A. D. (2010). The developmental origins of voice processing in the human brain. *Neuron*, 65(6), 852-858.

- Motherease develops the ventral vagal pathway, regulating heart rate variability.

Porges, S. W., & Furman, S. A. (2011). The early development of the autonomic nervous system provides a neural platform for social behaviour: A polyvagal perspective. *Infant and child development*, 20(1), 106-118.

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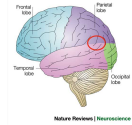
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## Auditory Components

- fMRI in 1-3 day old infants shows that music evokes right hemispheric activation in the auditory cortex.
- Using NIRS with 2-6 day old neonates show responses to slow acoustic modulations in the right hemisphere.
- Prosodic processing of emotional voices in 3 and 4 month olds activates the right temporoparietal region.



Perani, D. (2012). Functional and structural connectivity for language and music processing at birth. *Rendiconti Lincei*, 23(3), 305-314.

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Rhythm provides structure for movement telling us how to move through time and space



- Speed of the rhythm can help either up-regulate or down-regulate dependent upon what is needed.

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## Effects of Music on the Brain

- Drives attention, initiation and motor responses.
- Two to three day old babies can detect a beat of music.
- Rhythm integrates many different parts of the brain.
- Rhythm improves auditory cueing; perception and production of temporal patterns.
- Predictability creates anticipation.



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- ◆ Slower rhythms generally work best to sooth.
- ◆ Our body works on rhythm; from the pattern to which we breathe and walk to the rate our hearts beat and brain waves move.
- ◆ Music affects our body's rhythms.
- ◆ Not only does our heart beat more slowly, but our breathing becomes deeper and our brain waves become smoother with fewer spikes.
- ◆ Activity in the left and right hemispheres of the brain becomes more synchronous, an effect with profound ramifications.
- ◆ Levels of synchrony in the brain has been found in Buddhist monks who meditate for long periods of time, suggesting that synchrony plays a large role in calm and clear behavior.

<http://serendip.brynmawr.edu/exchange/simone-shane/calming-effect-music>

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## Tactile Gestural Attachment

- Research shows that the emotional impact of touch is more direct and immediate if an infant is held to the left side of the body (“left sided cradling”)

Schore, A. N. (2007). Early interpersonal neurobiological assessment of attachment and autistic spectrum disorders. Attachment Assessment in treatments, prevention and intervention programs, 7.

- Affective touch is critical for life in the first year.

Bennett, R. H., Bolling, D. Z., Anderson, L. C., Pelphrey, K. A., & Kaiser, M. D. (2014). fNIRS detects temporal lobe response to affective touch. Social cognitive and affective neuroscience, 9(4), 470-476.

- Touch synchrony – alters vagal tone and cortical reactivity.

Schore, A. N. (2014). Early interpersonal neurobiological assessment of attachment and autistic spectrum disorders. Frontiers in Psychology, 5, 1049. <http://dx.doi.org/10.3389/fpsyg.2014.01049>

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## Deep Pressure Touch

When in doubt,  
use deep  
pressure!



Deep pressure increases alertness and decreases alpha and beta EEG waves.

Inhibits Sympathetic Arousal

Vanderbilt, S. Originally published in Massage Bodywork magazine, April/May 2005. Copyright 2005. Associated Bodywork and Professionals. All rights reserved.

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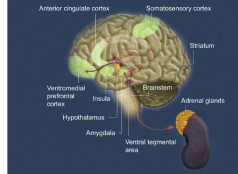
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## Attunement is the Regulation of Stress

- When a threat requires action, the sympathetic system is activated to rouse the body into fight or flight.
- This is a very vigilant and activated state of being.
- Through repeated soothing a child learns to predict that their arousal will become regulated, a skill that requires the activation of higher order brain circuits (orbital frontal cortex, amygdala, anterior cingulate and other interconnected regions).



## Amygdala and Oxytocin


- The amygdala (especially the central nucleus) and the paraventricular areas of the hypothalamus produce stress reducing oxytocin as well as stress intensifying corticotropin releasing factor.
- Amygdala produces its own supply of oxytocin.

Kirsch, P., Esslinger, C., Chen, Q., Mier, D., Lis, S., Siddhanti, S., ... & Meyer-Lindenberg, A. (2005). Oxytocin modulates neural circuitry for social cognition and fear in humans. *The Journal of neuroscience*, 25(49), 11489-11493.



## How to Be Attuned

- Bring conscious intention to being attuned
- This intention activates the prefrontal cortex to orient you to the situation, focus your intentions, prime empathy-related neural networks and warms up your limbic system to get your brain headed toward the rewards of empathy.
- Relax your body and mind and open to the other person as much as feels right to you.
- Keep paying attention to the other person; be with him.
- This kind of attention will stimulate your anterior cingulate cortex which pays attention to attention.
- In this way, attunement is a form of mindfulness meditation focused on someone else's inner world.



Attachment theorists suggest that signals of kindness and compassion from another person (especially a therapist) will reactivate the attachment system.

Mikulincer, M., & Shaver, P. R. (2007). Attachment in adulthood: Structure, dynamics, and change. Guilford Press.

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It's never about **what** you do but **how** you do it!

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