

# Resonance Circuits, Mirror Neurones, and Mindfulness

Please note: this model is based on recent research including the work of Daniel Siegel (Siegel 2007; 2010)

It is sometimes said that couples who have been happily married for decades may come to resemble each other in facial appearance. This may be true in some sense, as our facial expressions tend to mirror those around us: thus, for a couple living together, their facial expressions may begin to mirror each other.

## Mirror Neurones

Some years ago some scientists were researching into the firing of certain neurones within the brains of *monkeys* when *they* ate peanuts. Each time the monkey ate a peanut, these neurones fired. One day, after a tea break, one of the researchers decided first to have a peanut himself: and he was very surprised to find that as he put the peanut into his mouth, the same neurone in the monkey fired.

Subsequent research showed that this is because the monkey – along with primates and humans, have mirror neurones that fire off when an action with a specific intention is watched in another person / monkey. If we are sitting with a friend having coffee, and we lift our coffee cup up to our mouth, the mirror neurones that control the activity of lifting a mug of coffee up to the mouth will fire in the brain of our friend, and vice versa.

Mirror neurones may also be important in the development of empathy (Carr et al 2003).

## Integration

If we are feeling disturbed, we feel out of harmony. In order to restore harmony, we need to allow our neuro-circuits to get back into balance: and this requires integration of these neuro-circuits (Siegel 2010 p 71). In fact, Siegel suggests that Well-Being in humans depends on the integration of eight domains.<sup>1</sup> Such integration can come about through Mindfulness practice, which overlaps with what Siegel calls Mindsight (C2).

## Resonance Circuits

Mirror neurones can help us develop resonance with other human beings, and thus facilitate in Interpersonal Integration. The neural paths from the mirror neurones pass down the brain to the Insular area, and from there to the Limbic System areas (including the Amygdala); then on to the brain stem (embracing the 'Reptilian Brain'), before being relayed to various parts of the body proper (Siegel 2010 pp 59-63).

Return pathways from the various parts of the body trace back up to the brain stem, the limbic system, the insular, and from there to the (middle) Pre-Frontal Cortex (see Figure 1 on next page). These circuits form part of the neuro-physiological basis by which we are able to communicate with, and become attuned to, others:

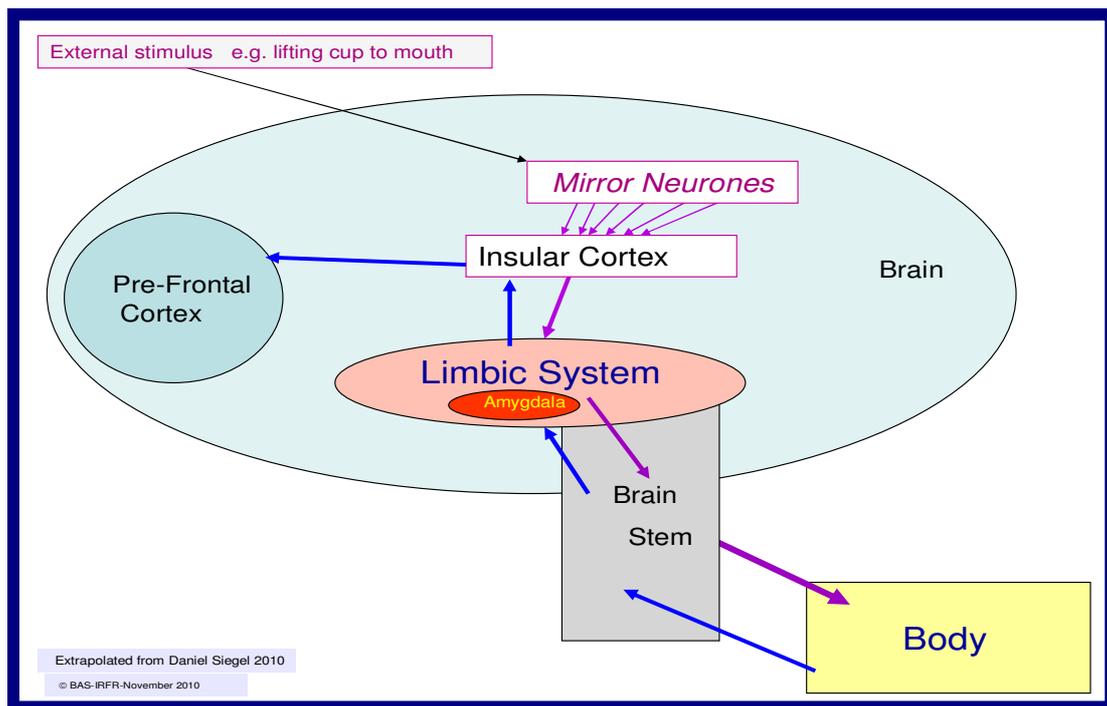
This is how we come to resonate physiologically with others – how our respiration, blood pressure, and heart rate can rise and fall in sync with another's internal state.

Siegel 2010 p 61

The more these pathways are used, the stronger their connections become. So if we work on a relationship in a positive way, this will increase the resonance circuits, which will of course be aided by the mirror neurone systems. This will then facilitate attunement between the two people,

<sup>1</sup> These are: Consciousness integration; Horizontal integration (between the Left and the Right Hemispheres); Vertical Integration (between the neo-cortex and more basic and lower aspects of the Brain and Nervous System); Memory integration; Narrative integration; State integration; Interpersonal integration and Temporal integration (Siegel 2010 pp 71-76)

which will be underpinned by the integration of the eight domains<sup>1</sup>, which is a pre-requisite for real Well-Being (A3). These neural pathways are illustrated schematically in Figure 1.



**Figure 1**  
**Mirror Neurons and Resonance Circuits**  
(after Siegel 2010)

In particular, the mirror neurone system is crucial for the wholesome development of the mother-infant (and child) relationship: for this the mother has to be attuned to her child; long term non-attunement in this relationship can be associated with affect dys-regulation in her child (Schore 2003A; 2003B; 2003C; 2009; Ross 2010 pp 173-194: “Affect Regulation, the Infant-Mother Dyad, and Autogenic Therapy”).)

### **Neural pathways become stronger with use**

If we do not use certain neural pathway, they atrophy: on the other hand, those that we use regularly develop strongly through, for example, increased synapses. It is suggested that we can increase our Resonance Circuits with Mindful practices that stimulate their pathways.

In disciplines such as Meditation, Positive Mental Training, and Autogenic Training we are, among other things, training the mind to focus on parts of the body (say the feet during the body scan; the right arm in “Right Arm Heavy” etc). This practice activates the neuro-circuits depicted in Figure 1, illustrated further in Figure 2. By becoming aware of the foot, the limbs, the heart beat etc, we are increasing the neural circuits from the periphery back to the brain, and our conscious experience of them, which will be processed in the Neo-cortex – including, crucially, the Pre-Frontal Cortex.

Figure 2 /

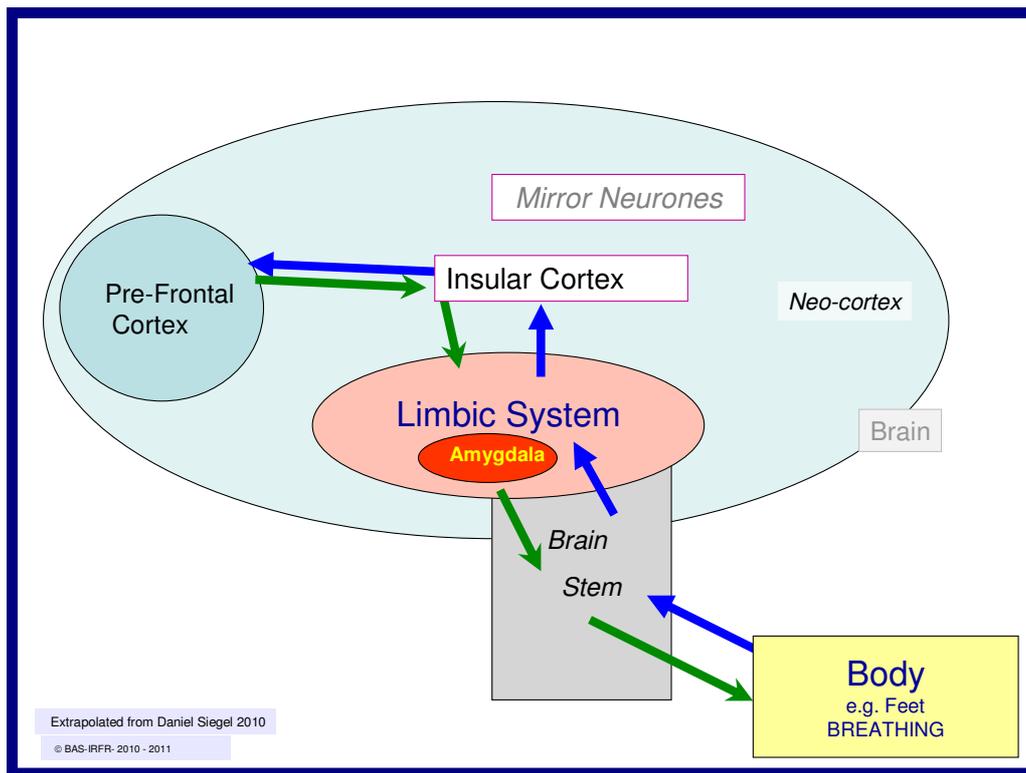


Figure 2  
Suggested pathway by which Mindful-type practices  
improve and consolidate our Resonance Circuits  
(Based on Siegel 2010)

Note:

- i. By focusing on say the feet, we facilitate and boost the neural pathways of incoming signals from the feet to the brain: we thus become more mindful of these signals.
- ii. Actually, in order to focus on the foot or the hear-beat, or a particular emotion / feeling, we have to first focus on it, which is a neo-cortical activity; and especially a Frontal Lobe (Pre-Frontal Cortex) activity.
- iii. This means that mindful practices involve two way communication; from the pre-frontal cortex to the periphery, and back again.
- iv. It is suggested that such focused Mindful Awareness will strengthen the Resonance Circuits, which over time will enable us to become more sensitive to what is going on within ourselves<sup>2</sup>; and also, and equally crucial, what is going on in others. This can thus be a good starting place for the development of empathy and compassion for ourselves and others.

Such mindful practice will thus help us to develop our sensitivity to ourselves and others. It will at the same time facilitate our own Nurturing and CARE-circuits (Panksepp 1998). This will then mean that we are in a better mental state to deal with events that may have had a tendency to set in motion our Threat and Self-Protect system in a negative way (see also B1; B9).

<sup>2</sup> This will embrace not only what is going on in our body (e.g. awareness of foot being warm, awareness of our breathing), but also what is going on in our brains – e.g. awareness of our feelings which will include our emotions (Damasio 1999), and also our thinking.

## A comment on ego-driven modes

It is suggested that the Incentive and Resource Seeking<sup>3</sup> System (Gilbert 2009; and B9 Figure 4) can, if we are not careful, become an Ego-lead system, in which we focus more and more on “what is in it for me”, rather than seeing the whole picture – and the inter-relatedness of all things. Mindful practices will tend to dissipate such ego-based, dopamine hungry, neuro-circuits. We do of course need this Incentive and Resource Seeking system for appropriate drives and motivations – but not for unwholesome cravings (D2).

Appropriate balance and integration of the SEEKING and CARE circuits (Panksepp 1998; B3) will help to keep us mindful, and so lessen the chances of such ego-driven modes. Note also that the SEEKING system embraces man’s search for meaning (Frankl 1946; Ross 2011 pp 281 - 282): ego-driven modes are not compatible with long term meaning or well-being (A3; C6) for the individual or society.

## Conclusion

We have here briefly looked at the mirror neurone system and the associated resonance circuits in the context of mindfulness.

Kabat-Zinn states that yoga is a form of meditation (Kabat-Zinn 1990). This at first may seem odd. On the other hand, in the light of the resonance circuits, this is less odd: for as we focus mindfully on say the foot or the neck during yoga practice, we will actually be strengthening the resonance circuits depicted in Figure 2. Thus yoga and practices such as Autogenic Training facilitate in the development of mindfulness (D1), empathy (B8), attunement to others, and the crucial middle pre-frontal cortex functions (C2).

### References and sources include

<b>Carr, Laurie; Iacoboni, Marco; Dubeau, Marie-Charlotte; Mazziotta, John C; and Lenzi, Gian Luigi. 2003.</b> <b>Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas</b> PNAS (Proceedings of the National Academy of Sciences), April 29, 2003 vol. 100 no. 9: 5497–5502 (available via google and <a href="http://www.pnas.org/content/100/9/5497.full.pdf+html">http://www.pnas.org/content/100/9/5497.full.pdf+html</a> )
<b>Frankl, Viktor E.: Man’s Search for Meaning; 1946; 1984; Pocket Books; Simon &amp; Schuster.</b> ISBN 0-671-02337-3
<b>Gilbert, Paul. 2009. The Compassionate Mind. How to use compassion to develop happiness, self-acceptance and well-being.</b> ISBN 978-1-84901-098-6
<b>Kabat-Zinn, Jon 1990 (2006). Full Catastrophe Living: How to cope with stress, pain and illness using mindfulness meditation.</b> ISBN 0-7499-1585-4
<b>Panksepp, Jaak: 1998. Affective Neuroscience: The Foundation of Human and Animal Emotions</b> ISBN 0-19-509673-8
<b>Ross, Ian R.F. 2010. Autogenic Dynamics – Stress, Affect Regulation and Autogenic Therapy.</b> ISBN 978-0-9563993-0-4
<b>Schore; Allan N. 2003A: The Seventh Annual John Bowlby Memorial Lecture: Minds in the making: attachment, the self-organising brain, and developmentally-orientated psychoanalytical psychotherapy.</b> IN: Revolutionary Connections: psychotherapy and neuroscience; Ed. Jenny Corrigan and Heward Wilkinson; Karnac; ISBN 1-85575-941-1
<b>Schore; Allan N. 2003B: Affect Regulation and the Repair of the Self.</b> ISBN 0-393-70406-8
<b>Schore; Allan N. 2003C: Affect Dysregulation and Disorders of the Self.</b> ISBN 0-393-70407-6
<b>Schore; Allan N. 2009. Relational Trauma and the Developing Right Brain - An Interface of Psychoanalytic Self Psychology and Neuroscience.</b> Ann. N.Y. Acad. Sci. 1159: 189–203 (2009)
<b>Schore, Judith R; Schore; Allan N. 2008. Modern Attachment Theory: The Central Role of Affect Regulation in Development and Treatment.</b> Clin Soc Work J (2008) 36:9–20
<b>Siegel, Daniel. 2010. Mindsight - transform your brain with the new science of Kindness</b> ISBN 978-1-85168-761-9

### Linked themes in this Autogenic Dynamics section

A3	<a href="#">Towards a concept of happiness and well-being</a>
B1	<a href="#">Bears, Imagination, and Well-Being</a>
B3	<a href="#">Emotional Operating Neuro Circuits - a brief introduction to Affective Neuroscience and the work of Panksepp</a>
B8	<a href="#">Empathy, Mirror Neurones, and the Pre-Frontal Cortex</a>
B9	<a href="#">Mental Training, the Pre-frontal Cortex, Resilience and Equanimity</a>
C2	<a href="#">Mindsight – our seventh sense and associated pre-frontal cortex functions</a>
C6	<a href="#">Integration and Well Being</a>
D1	<a href="#">Reflections on foundations for Mindful Living</a>
D2	<a href="#">Dana Paramita</a>

<sup>3</sup> Note that this overlaps with Panksepp’s SEEKING-system (Panksepp 1998 and B3)  
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