

# Empathy, Mirror Neurones, and Pre-Frontal Cortex

## Preamble

Recent research indicates that our ability to be attuned to others, and to be able to empathise with them, is dependent upon: the mirror neurone system (MNS), the insular, and the pre-frontal cortex. These “Resonance Circuits” can be developed through mental training.

## Mirror Neurones

Some years ago researchers were studying the firing of neurones in the brains of monkeys when they ate nuts. One researcher was very surprised to find that when he ate a nut himself just before a session with a monkey, the neurones in the monkey’s brain became active and fired. Subsequent research confirmed the presence of mirror neurones in monkeys and humans.

These mirror neurones appear to fire off in two distinct situations. Firstly, if an intentional act by another is being watched. [In the above incident, the monkey’s mirror neurones fired when the monkey perceived the movement of the researcher’s hand with a nut move up towards his – the researcher’s – mouth; that is, the (brain of the) monkey realised that the intention of the man’s action was to eat the nut.] And secondly, mirror neurones fire off in us humans when we become mentally attuned to the mental intentions of another human – i.e. when we imagine what is going on in the mind of another. So the evidence suggests that mirror neurones are involved in empathy and being attuned to others (Carr et al 2003).

## In Empathy, our emotions and bodily states begin to match that of the other person through the Mirror Neurone System

We detect what is going on in the outside world – and thus with other people – with our five senses. This gives us the raw data of what is happening, but in itself it does not mean we understand or feel what is happening for the other person.

The neural mechanisms by which we are able to do this seem to work something like this. Information from the five senses is relayed to the Mirror Neurone System (MNS) in the cortex. From here, it passes on to the insular (part of the limbic system), which then transforms the incoming signals so that our own bodily state (emotions / background feelings) begin to mirror those of the other person. This is then relayed to our pre-frontal cortex, and we become consciously aware of these background feelings which are mirroring the emotional and feeling state of the other: thus we have direct access to what the other is feeling and this means that we can become attuned to their state.

Note that this involves two processes. Firstly, we become aware of what is going on within ourselves – this is sometimes called interoception, our sixth sense (Siegel 2007; C2) – it embraces our ability to be aware of what is going on within ourselves including our Background Feelings (Damasio 1999 pp 286-287; C3). The middle pre-frontal cortex then carries out a second process in which it is realised that it is these background feelings that are actually mirroring the present state of the other person.

This also means that our ability to be in tune with the other is dependent upon our own neuro-physiology matching theirs – and this is initially at an unconscious (or pre-conscious) level; only when it is relayed to the middle pre-frontal cortex do we become consciously aware of the state of the other. Thus, if our own MNS is not working optimally, or for some reason is bypassed, then we will not be neuro-physiologically capable of becoming attuned to the other.

This model is depicted in simplified form in Figure 1.

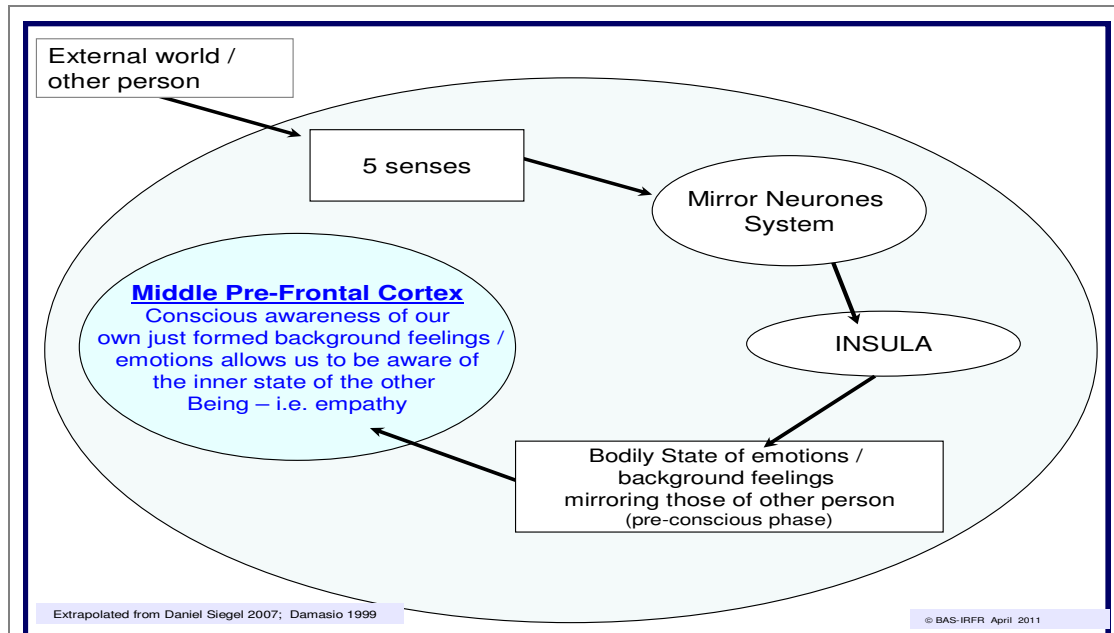


Figure 1  
A neuro-physiological model for the development of empathy  
(The Resonance Circuits; extrapolated from Siegel 2007; Damasio 1999)

#### Comments on Figure 1

- This model implies that we can empathise with another person to the extent that our own background feelings are resonating with their's: this process is mediated by the Mirror Neurone System<sup>1</sup>.
- In order to develop this ability (to empathise) it is helpful if we can become attuned to our own internal state. If we are not on the same wavelength as our own internal state, it is unlikely that we can become attuned (empathic) towards another.
- Becoming more attuned to our own inner states is thus crucial for empathy: and this is discussed further below (Mental Training and Resonance Circuits.)

#### Hindrances to Resonating with others

As human beings we are often influenced by “top down” cortical processing which results in us not really paying attention to what is happening in the present moment (B6: Perceptions, Flowers and Reality). So we may not be aware of the wondrous flower in front of us because our top down processes discount the beauty before us with a mental construct such as “just a flower” – and so we hurriedly move on.

If someone makes a comment, we may not really listen to what they are saying: with practice, we can begin to see that this may be because our “judging mind” is at work: so a good practice is to simply label this “Judging Mind”. Such labelling is important in developing mindfulness / mindfulness (see for example Creswell 2007; C7).

When we become angry, or fearful, or upset, or irritated by what another is saying, it is unlikely that we will be able to really hear what they are saying. In this situation, our Mirror Neurone System tends to be eclipsed by the FEAR / RAGE circuits (Panksepp 1998) that are set in motion. Note that fears and angers are often associated with (unconscious) judgements of others.

Mental Training /

<sup>1</sup> It may be that when we fall in love with another being, what is happening is that we are resonating with them – but probably on a fairly narrow band of frequencies. The secret of developing a long lasting wholesome relationship on this model would be to expand this narrow band to all ten thousand frequencies!

## Mental Training and Resonance Circuits

Mental Training – in the form, for example, of Meditation, Autogenic Training, or Positive Mental Training – helps us to be in the present moment. This will then reduce the dismissive top down influences that are often our automatic default position (“Judging mind”, “self-critical mind”, “dismissive mind” etc – see B6).

Note that Kabat-Zinn embraces Yoga in his approach to Meditation (Kabat-Zinn 1990). If we practice Yoga mindfully, this can help us get in touch with all parts of our body; that is, we become more attuned to our own internal states. In both yoga and Autogenic Training we focus on parts (or processes) of the body, and this specific attention seems to reinforce our Resonance Circuits – see Figure 2 in C3: “Resonance Circuits, Mirror Neurons, and Mindfulness.”

Negative / destructive emotions are associated with increased right frontal lobe activity on EEG (B5). They tend to result in us responding on “automatic pilot” – and thus mindlessly<sup>2</sup>. Meditation, on the other hand, is associated with positive / nurturing type emotions and increased activity of the left frontal lobe. Positive emotions and CARE circuits act as anti-dotes to negative and destructive emotions (Goleman 2003; Davidson 2003B & 2005; Panksepp 1998; B5).

Thus appropriate mental training can greatly facilitate the development of our resonance circuits – and hence empathy.

### Sources and References

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### [Linked themes in this Autogenic Dynamics section](#)

B3	<a href="#">Emotional Operating Neuro Circuits (or Systems – EONS)</a>
B5	<a href="#">Emotions, Frontal Lobe Dynamics, and Meditation</a>
B6	<a href="#">Perceptions, Flowers, and Reality</a>
C2	<a href="#">Mindsight – our seventh sense and associated pre-frontal cortex functions</a>
C3	<a href="#">Resonance Circuits, Mirror Neurons, and Mindfulness</a>
C7	<a href="#">Being in Touch with Feelings – Hemispheric Integration</a>
D1	<a href="#">Reflections on foundations for mindful living</a>

<sup>2</sup> For example, anxieties and FEAR circuits often operate at an unconscious level; they are mediated through the amygdala which sets in motion the automatic responses such as flight (FEAR) or fight (RAGE). When these FEAR and RAGE circuits are activated, the Mirror Neurone System will tend to be bypassed.

- The middle prefrontal circuits that are activated in mental training inhibit amygdala activity, and so this can result in a significant reduction in our fears / anxieties.