Contents

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1. Introduction

Emotions are set in motion by external events, internal events (physiological changes) within the body, and by our imagination. In one sense, if we become angry or afraid, it is not our fault (Gilbert 2009), but the consequence of our inherited brains that have evolved to have RAGE and FEAR circuits. However, what we do with such fear or anger is a different matter, and is related to the development or otherwise of our Pre Frontal Cortex.

Figure 1 illustrates the consequences of certain external events on ancient (in an evolutionary sense) parts of our brain – here simplified into the "Emotional Brain"[1].

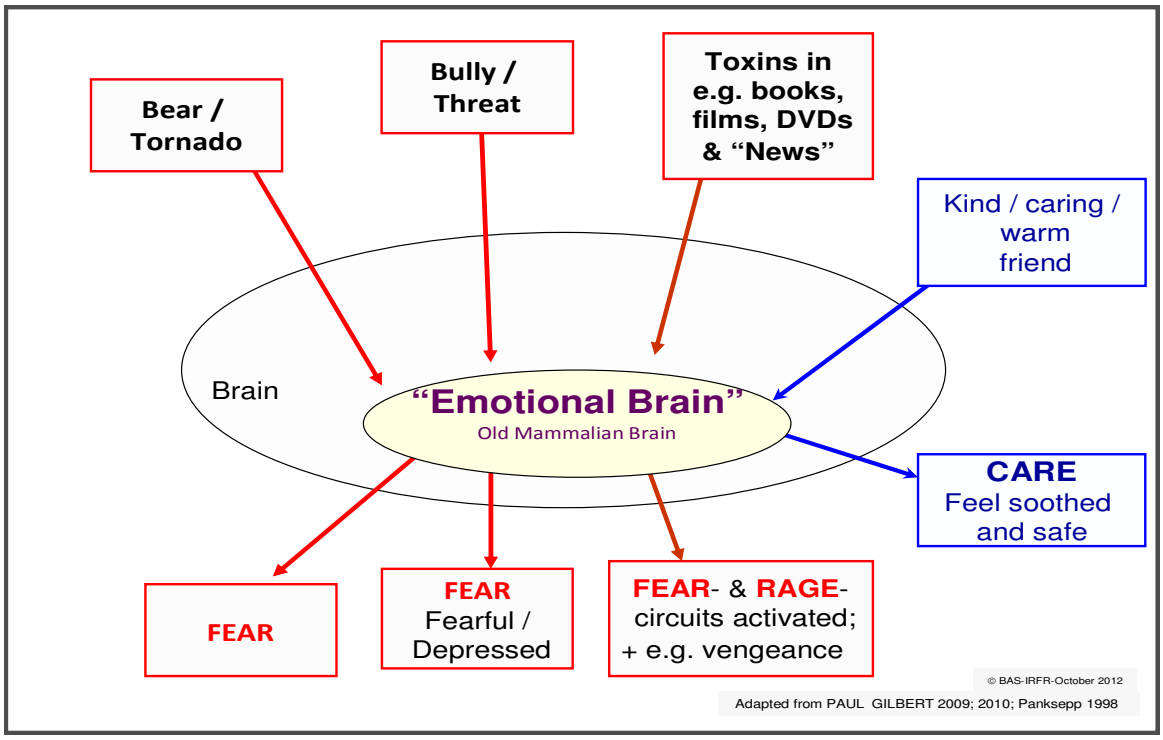

Figure 1
External Threats and their consequences
[Adapted from Gilbert 2009; 2010; Panksepp 1998; Soms & Panksepp 2012]

Comments on Figure 1

- External threats can take the form of, for example, bears, severe storms, or humanly created toxins, including distressing "news" and gratuitous violence in films (see e.g. Fredrickson 2009 pp 172-173).
- Such threats tend to produce spontaneous responses. The FEAR and RAGE illustrated in Figure 1 is a short hand for the FEAR and RAGE Emotional Operating Neuro Circuits (or Systems – EONS) of Panksepp (Panksepp 1998; Panksepp & Biven 2012). Such FEAR and RAGE circuits have their behavioural manifestations – such as running away from danger (e.g. from the bear), or raising our arms in anger, respectively.
- Note that if we meet a kind and caring friend, this will have a very different effect on us, and activate our own CARE circuits with the release of oxytocin. This will then facilitate our own social engagement with others (Porges 2009; A7 & A8 in this web series).

Now if we recall or imagine negative memories, this too can activate our Emotional systems in a similar way, as illustrated in Figure 2 on page 3. If we imagine we are biting into an apple, this can cause our mouth to water (i.e. a physiological effect). Recalling a memory of being bullied at school can also have a physiological effect, such as FEAR.

[1] This will actually include the Limbic System / Amygdala (the Old Mammalian Brain) and the even more ancient Reptilian Brain (basing this model of MacLean's Triune Brain – MacLean 1990).

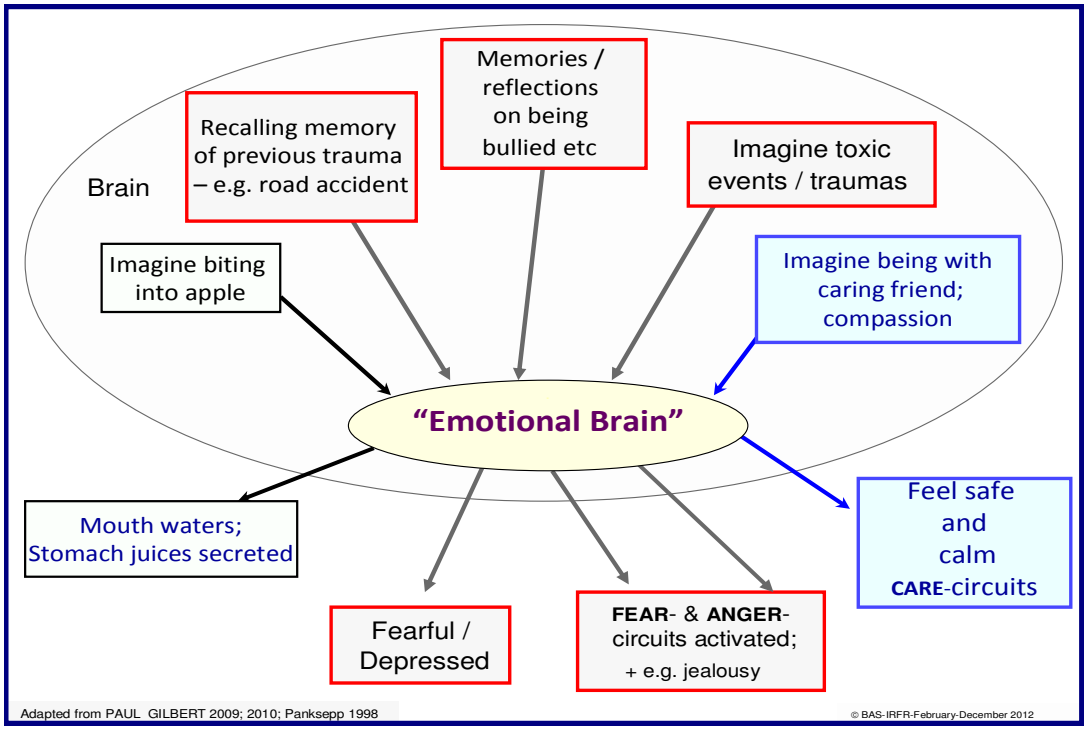

Figure 2
As we imagine, so we become
[Based on, and adapted from, Gilbert 2009; 2010]

Comments on Figure 2

i. External threats / events can trigger our emotions (e.g. FEAR) and the associated emotional response (e.g. running away, or feeling like running away; or jealousy[2]).
ii. So too can our imagination – as we recall a previous memory.
iii. The recollection of the memory can arise in an unconscious way, such as described by Proust[3] in the famous passage where a madeline cake is dipped in tea and brings a memory flooding back.
iv. Unconscious fears can also be precipitated in a similar way. For example, if in childhood we were repeatedly upset and made fearful by say a tall man, then such fears can be precipitated in adult life by men that resemble in some way that tall man. [For further details of what is in effect a type of Pavlovian Conditional Response, see Ross 2010 p 275, in the Glossary under "Extinction".]
v. The above four examples may manifest in a physiological disturbance within us (e.g. from the activation of FEAR circuits) that will of course be distressing.
vi. On the other hand, recalling and visualising[4] in our mind a pleasant memory – such as being with a loved one and / or a memory of a tranquil holiday on one of the Scottish Islands – will reactivate not only the memory but the feelings and physiological state associated with that memory (see, for example, Benson & Stark 1996 pp 75-77).
vii. It can be particularly helpful to visualise such positive memories during or towards the end of a Meditation / Autogenic sequence.

[2] FEAR and RAGE are examples of Primary Process Emotions (Panksepp & Biven 2012); emotions such as jealousy, hatred, and ill will towards others can be regarded as neo-cortical elaborations of the Primary Process Emotions.
[3] This is related to the concept of State Dependent Memory; that is, the memory is recalled when our present physiological state matches that of the original incident. This (State Dependent Memory) has been recognised in literature for over a century, for example:

"Marcel Proust was aware of it [i.e. the concept of State Dependent Memory] – and indeed it is mentioned more than once in his classic *À La Recherché du Temps Perdu* (*In Search of Lost Time)*; the best-known passage being in relation to the narrator tasting a madeleine cake dipped in tea, which releases a flow of memories. (Proust translation1996 p. 51)" [Extract of e-mail on 11.11.2009 from Michael Ross – with thanks.]
Also referred to in Ross 2010 p 199

[4] Note it is the imagining / visualising that produces a positive physiological state, not thinking per se (Benson & Stark 1966; Holmes et al 2009; and B7 in this web series).

This all means that we can become stressed not simply because of severe (external) stressors in our lives (for example, having to work long hours / overnight for a company where we are not involved in the decision making process), but also as a result of what is going on in our heads – that is, what we are imagining or thinking – and / or what may be unconsciously going on within us. If this is negative and persistent (especially in the form of negative / brooding ruminations), it can set in motion a chronic Stress Response – with the related informational substances such as cortisol; this in turn can lead to depressive feelings and mood (see for example Sunderland 2007 pp 54-59; Panksepp & Biven 2012 pp 333-338) and a Negative Interpretation Bias[5] (Dobbin & Ross 2012; B10 & B11).

On the other hand, the reverse is also true: by recalling positive memories our body physiology changes and mirrors the positive physiological state we had during that original positive experience.

2. Paul Gilbert's Model of Emotions

Paul Gilbert classifies emotions into three basic groups:

i. The Threat and Self Protect System
- This includes the classic Flight and Fight Response.

ii. The Incentive and Resources Seeking System
- This is crucial to maintaining fundamental well-being, such as SEEKING food, shelter, and companionship. In humans, this also includes seeking meaning (Panksepp 1998 p 145; and B3 Part ll pp 4-7).

iii. The Soothing & Contentment System
- Human babies and small children do not have a sufficiently developed Pre Frontal Cortex to modulate their own distressing feelings and emotions. For this they rely upon the physical closeness (e.g. through touch and suckling) and a positive emotional bonding with their mother / parent figure. This has the effect of soothing the child and will be linked with contentment (cf. Harlow's Monkeys and Romanian Orphans – see A8 pp 7 – 10).

Figure 3 summarises this perspective on emotions.

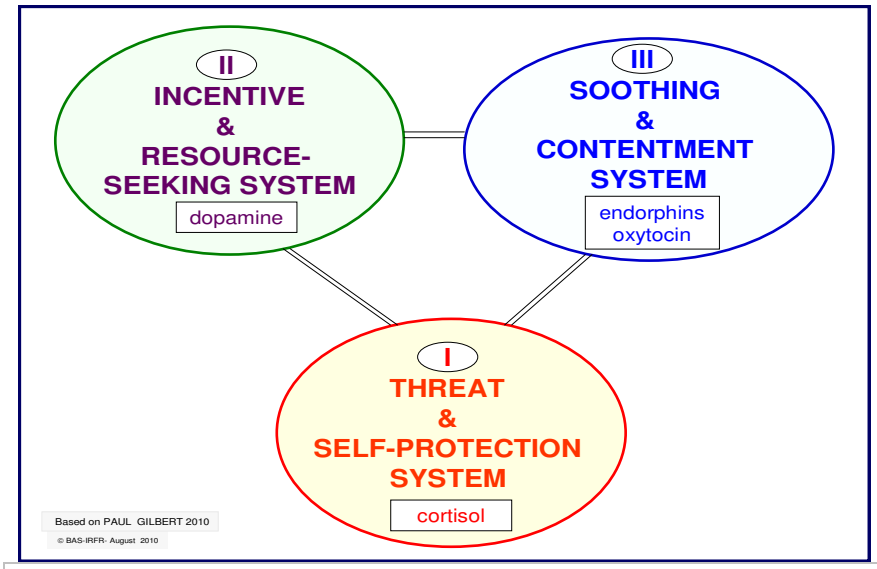

Figure 3
A Model of Emotional Systems
(based on Gilbert 2009; Panksepp 1998)

Note:

i. Human (emotional) distress is generally associated with the activation of the Threat and Self Protect System (e.g. FEAR, RAGE, and PANIC circuits – Panksepp 1998). This may be the result of external stressors – or, as discussed above, internal stressors; both of these can lead to elevated and damaging cortisol levels.

[5] For example, we may interpret a neutral face as an angry face.

ii. Healing and resolution of such disturbances can come about by the activation of the Soothing and Contentment System (CARE and Nurturing circuits) and….

iii. ….. the Incentive and Resource Seeking System (SEEKING and PLAY circuits – Panksepp 1998 / 2009).

Many of us have traumas / distressing memories from the past, and these can activate the Threat and Self Protect system, which means that we can end up in a hyper-vigilant and distressing state (Dobbin & S. Ross 2012); without necessarily knowing or understanding why (B11 & B12 in this series). This can result in recurring distress / depression / medically unexplained symptoms (Dobbin & S. Ross 2012), in which we can feel as though we are being tossed about on the sea (tsunami) of life without any means to settle matters (Bromberg 2011) – just as the vulnerable distressed child without a caring / nurturing parent.

Our dilemma / task is to find approaches that are appropriate for our own unique situation and which will act as anti-dotes to such hyper-vigilant / distressed states. When distressed, we may not feel in a hyper-vigilant state at all – more one of profound depression / despair. Yet this can still be a manifestation of the Threat and Self Protect system, in which the distress is so profound that it is activating the primitive reptilian Freeze Response, a manifestation of the unmyelinated vagal system (Porges 2009; 2011; see also A7 [e.g. Figure 1] & A8 [e.g. Figure 2] in this series) – in which we feel like crawling into a cave / cupboard.

3. Antidotes to negative mind states

3.1 Preamble

In the context of our nurturing and positive Primary Process Emotions, antidotes will axiomatically facilitate our Incentive and Resources Seeking system, and our Soothing and Contentment system. This will include activation of one or more of our basic Emotional Operating Neuro Circuits – Systems (EONS, Panksepp 1998; Panksepp & Biven 2012; Ross 2010; and B3 Part I & Part II in this series) including:

- CARE circuits
- PLAY circuits (including a feeling of vitality)
- SEEKING circuits

Our Pre Frontal Cortex (PFC) is crucial for our well being, and it is just this area that is not developed when we are born – and which remains underdeveloped in childhood (Sunderland 2006 / 2007). Many activities can facilitate in the development of our PFC – not just in childhood but also adults (see C2 in this web series). In what follows we select some of these.

3.2 Social contact

Some form of social contact is crucial for our well being, yet when we feel distressed this may be the last thing we want. This may include one to one counselling – and / or having a close confidante – both of which can facilitate in the activation of our own CARE circuits, with the release of oxytocin and endorphins (antidotes to FEAR – Panksepp 1998). In time this may enable us to become more playful, and so activate our PLAY circuits. Play is associated with the release of endorphins and dopamine, both of which act as antidotes to negative mind states (B3 Part ll, pp 26-27).

Mental states that facilitate the Relaxation Response (Benson & Klipper 1975) activate the myelinated vagal system, and this in turn facilitates Social Engagement (Porges 2009; 2011; and A7 Figure 1 page 4 in this series). Increased positive social contact has been shown to reduce the negative consequences of stressors – including death (e.g. Falk et al 1992; McGilchrist 2009 pp 434-438; note also that the Japanese have a special work, "Karoshi", for "death from overwork" – see also handout C4: Time & Time Management).

3.3 Expressive Writing

Expressive writing has long been seen as an effective means of reducing distress and negative affect (Pennebaker 1990 / 1997; Pennebaker & Chung 2011; Sloan et al 2012; and B13 in this series). A moving example of expressive writing is given in Anesa Miller's poem: "When the world came down upon me" (Miller 1995; and Panksepp 1998 – on page before Preface).

3.4 Music, Musicality, and Healing

Certain music has an uncanny way of affecting us profoundly. This is illustrated in the following account by Mendelssohn of a woman's meeting with Beethoven:

> She (Baroness von Ertmann) told me that when she lost her last child, Beethoven was at first unable to come to her house any more. Finally he invited her to come to him, and when she came he sat at the piano and merely said: "We will converse in music," and played for over an hour and, as she expressed it, "He said everything to me, and also finally gave me consolation."
>
> Felix Mendelssohn-Batholdy
> Milan, 14th July, 1831
>
> Quoted IN: **Beethoven: his life, work and world. H.C. Robbins Landon; Thames & Hudson 1992, p. 126. ISBN 0-500-01540-6**

The earliest human interactions, in terms of the mother–infant dyad, are pre-verbal, and can be seen in terms of dance and musicality (Trevarthen 2009; Trevarthen 2011). For some, as Baroness von Ertman found, music can have deep healing qualities[6].

> The power of particular configurations of music, especially favourite and loved pieces, to inspire, heal or teach proves that musical expressions, and their communication, can engage the core mechanisms of the brain that regulate well-being in body and mind, and that guide the formation of self-confidant associations and memories in affectionate relationships.
>
> Panksepp & Trevarthen 2009 p 107

Note that Panksepp and Trevarthen are indicating that the music that moves each one of us is very specific for each individual – in both time and place[7].

Music has the potential for being inter-personal, cultural, and universal. In November 2012 I attended a concert in the Queen's Hall, Edinburgh by the Pacifica Quartet. Their playing of Shostakovich's Second String Quartet (1944) was a reminder of the devastation and horror of the Stalin years and World War ll; yet in the quiet passages, played exquisitely by the Pacifica, there emerged the sublime beauty underlying the human spirit. This was a manifestation of the personal, inter-personal, and cultural. The interval was followed by one of Beethoven's Late Quartets, opus 132: at the time of composing this quartet (1825), Beethoven had just recovered from a debilitating illness, and above the opening of the third movement he wrote: "Heiliger Danksgesang eines Genesenen an die Gottheit, in der lydischen Tonart" [A convalescent's hymn of Thanksgiving to God, in the Lydian mode" (Rowland 1984) or "A song of thanksgiving, in the Lydian mode, offered to the Divinity by a convalescent" (Golding1987)]. Here the music goes beyond the personal to the universal domain (Kornfield 2008 p 80; also see D4 in this series – page 17). The miraculous healing abilities of the body seem to have given Beethoven the creative energy and humility to compose "music of the spheres".

[6] Beethoven was renowned for his ability to improvise in a remarkable way when playing the piano.

[7] This is clearly the case if we listen, for example, to Desert Island Discs (BBC Radio 4). For example, some people may find that Schubert's late Piano Sonatas and his String Quintet (D 956) go "where not other composer has ever gone" – tapping into the depths of our Being [JW].

3.5 The Pre Frontal Cortex (PFC) and Modulating the Emotional Brain

3.5a: preamble: chronic hypervigilant body states

Internal and external threats activate our Threat and Self Protect system, often resulting in FEAR (or RAGE). The FEAR response occurs prior to our conscious realisation that we are threatened (LeDoux 1999 and B10 Figure 1 in this series), and this includes:

- Activation of the FEAR / flight response[8], resulting in the body being aroused [i.e. for Flight / Fight – or sometime Freeze] and
- Deactivation of our logic and rational mind [in an evolutionary terms we need to respond immediately to a threat from a snake / bear, not think about it].

If the external / internal threats become chronic / recurrent, this may result in the development of a hypervigilant (chronic) state of the body – which is then relayed back to the brain with the clear message that "everything in the periphery is not well" (cf. Wallnöfer 2000) – and this then further reactivates the FEAR system. These dynamics are shown schematically in Figure 4.

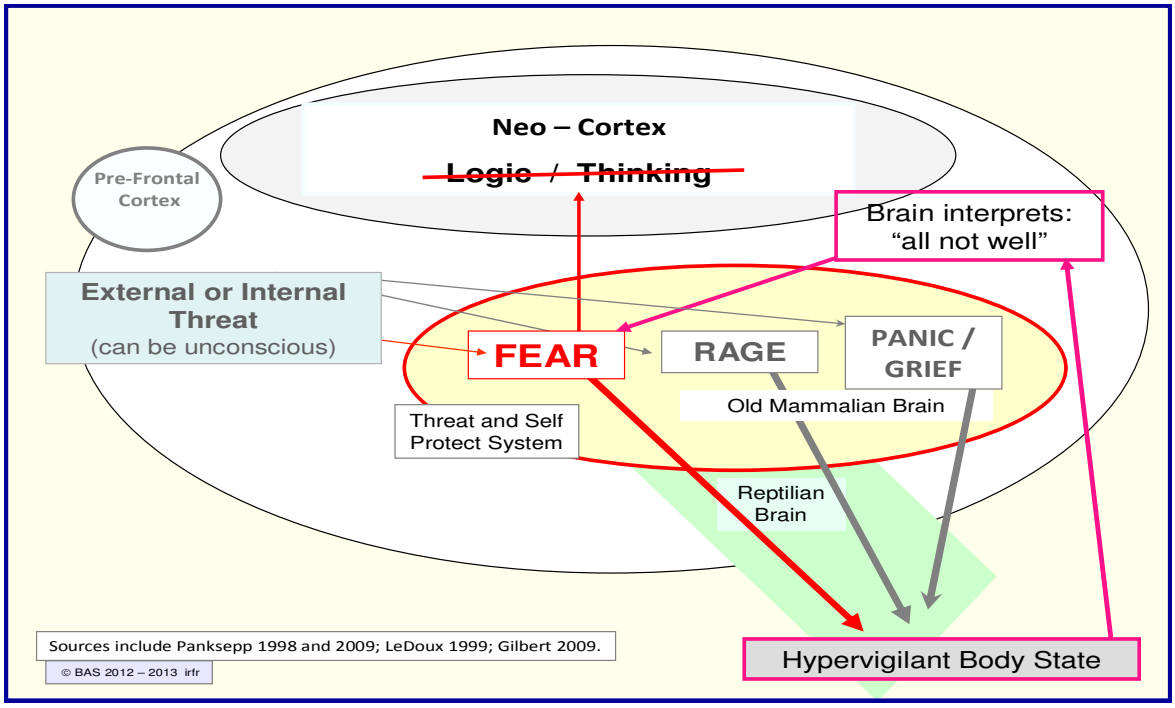

Figure 4
Recurrent External and Internal Threats produce a Hypervigilant Body State

Comments on Figure 4

- External and internal threats can activate FEAR, RAGE and PANIC / GRIEF circuits, resulting in appropriate behaviours [in an evolutionary context]. Here the specific focus is on the FEAR circuits (in red).
- If these threats become chronic, they can lead to a Hypervigilant Body State (Dobbin & S.Ross 2012) – and a feeling of dis-integration (see C6 in this series).
- FEAR, RAGE and PANIC[9] circuits are associated with reduced communication between the Old Mammalian brain and the Neo-cortex – and hence interfere with logic & thinking.
- In addition, the brain receives messages from the body that "all is not well in the periphery" – and this can then further activate FEAR / RAGE / PANIC circuits.

[8] In which blood is preferentially directed to our legs; in RAGE, on the other hand, it is preferentially directed to our hands (Ekman & Dalai Lama 2008 p 41; & B3 Part II page 8).
[9] Primordial Separation Distress produces PANIC; in adults, Separation Distress is more likely to manifest itself as GRIEF (Panksepp 2009; Panksepp & Biven 2012 pp 311-349).

3.5b: Pre Frontal Cortex modulation of threats / negative affect, and creating positive

Various forms of Mental Training can alter the dynamics of our Pre Frontal Cortex – and our emotions (Davidson et al 2003; Ekman et al 2005; Lutz et al 2008; Siegel 2007; 2010; and C2 & B5 in this series), and this in turn can have a profound effect on restoring appropriate affect regulation and Well-Being (A3), and a feeling of Integration (C6). These forms of Mental Training include:

- Meditation (e.g. Cahn & Polich 2006)
- Positive Mental Training (Dobbin et al 2009)
- Autogenic Training (Stetter et al 1998; and 2002; Krampen 1999).

Mental training has the effect of reducing disturbed physiology in the body [e.g. hyper-vigilant states] such that the brain – at an unconscious level – begins to pick up messages (from the body) that "everything in the periphery in quiet" (Wallnöfer 2000). This means that the Threat & Self Protect system (I in Figure 3) is no longer being activated, and this allows for free flowing of our Incentive & Resource SEEKING system (II) and our Soothing and Contentment System (III) [Gilbert 2009 – e.g. pp 23-30; Gilbert 2010].

Several inter-related processes are at work here, and these are summarised in Figure 5.

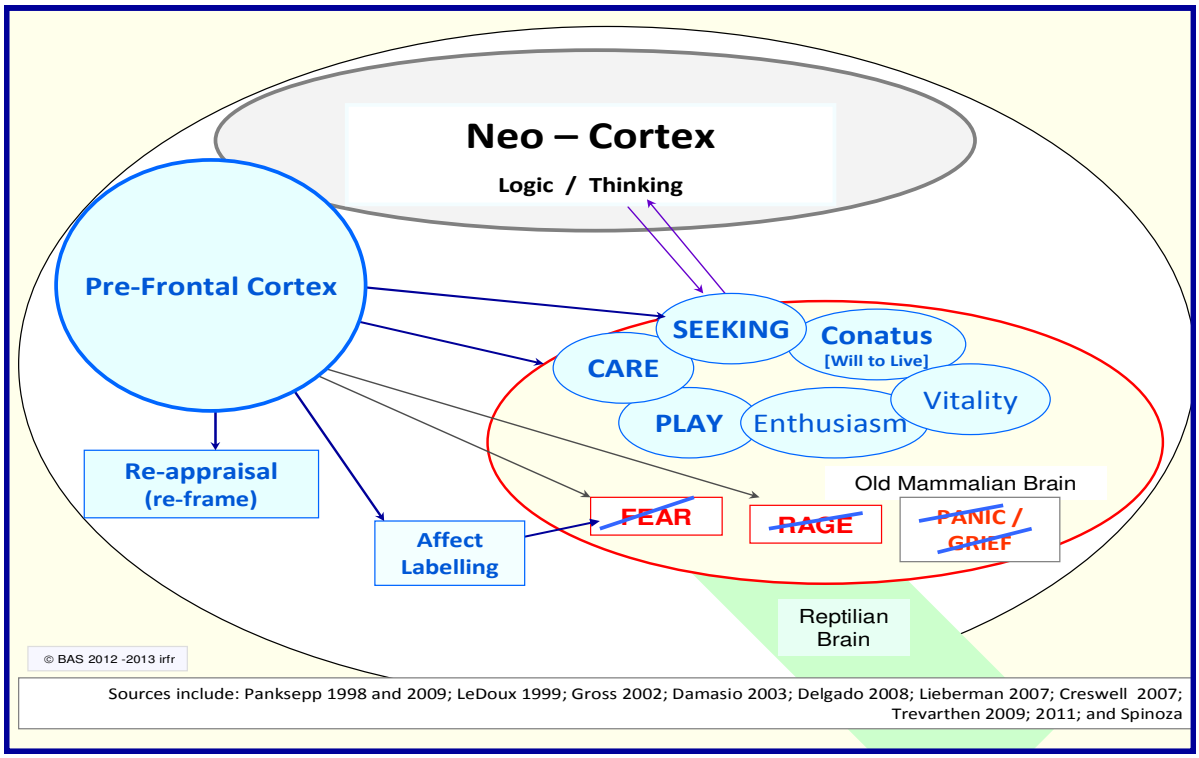

Figure 5

Highly Schematic Model for the modulating effect of Pre Frontal Cortex on Affect Regulation

Sources include Panksepp 1998 and 2009; LeDoux 1999; Gross 2002; Damasio 2003; Delgado 2008; Lieberman 2007; Creswell 2007; Cahn & Polich 2006; and Davidson 2003: Trevarthen 2009; 2011; Soms & Panksepp 2012; and Spinoza 1677

Comments on Figure 5

1. The Old Mammalian Brain includes the Limbic System and the Amygdala.
2. Words in full CAPITALS denote the Primary Process Emotions as notated by Panksepp (1998); these Emotional Operating Neuro Circuits are primarily in the brain stem / Reptilian Brain and the Old Mammalian Brain.

3. Activation of the PFC /

Comments on Figure 5 continued

3. Activation of the Pre Frontal Cortex (PFC) [specifically the Lateral PFC and the Ventro-Medial PFC] down regulates the FEAR and RAGE (and PANIC / GRIEF) circuits in the amygdala (Gross 2002; Delgado et al 2008; Ross 2010 p 210-211).

4. As a result, the FEAR / RAGE (and PANIC) circuits are switched off, so that they no longer produce the hypervigilant body state (that is shown in Figure 4); and so clear thinking can be re-established again.

5. Meditative type states are associated with increased Heart Rate Variability, an indirect measure of increased Para-Sympathetic Nervous System activity [myelinated ventral vagal PSNS which also acts as a brake on the heart rate (Porges 2009)].
    - The ventral vagal PSNS is also associated with a feeling of safety, CARE circuits, and the release of oxytocin (Porges 2009 & 2011; Schore 2009; Panksepp 1988).
    - This system [myelinated ventral vagal] is also associated with increased Social Engagement (Porges 2009 & 2011; and A7 & A8 in this web series).

6. Meditative / Mental Training type states activate the PFC [specifically the Lateral PFC which connects to the Ventro-Medial PFC], and this in turn is associated with re-appraisal / *reframing* (Cahn & Polich 2006; Davidson 2003A; and B2 in this web series) – *which* is a crucial element in facilitating positive mental change.

7. Activation of the PFC (the right ventro-lateral Pre-Frontal Cortex) is associated with Affect Labelling which in turn reduces amygdala activity in terms of the FEAR and RAGE circuits (Lieberman 2007; and see B12 figure 6 in this web series).

8. Meditative approaches have been shown to increase activity in the Left Frontal Cortex – and this is associated with positive emotions – for example, activation of our CARE circuits (B5). It is suggested that, in general terms, such meditative practices will also facilitate the activation of SEEKING, PLAY, and CARE circuits (extrapolating from Panksepp 2009). Figure 5 also includes Vitality and Enthusiasm – which are related to PLAY and SEEKING – and are crucial for our Well Being; they are also terms used specifically by Trevarthen in the context of the Mother-Infant Dyad (Trevarthen 2009; & [pc] 2011; 2012).
    - Vitality and Enthusiasm overlap with our innate will to live and the concept of conatus, a term used by Spinoza (Spinoza 1677). Conatus applies to all living organisms: "Each thing, is so far as it is in itself, endeavours to persevere in its own being"; "The effort by which each thing endeavours to persevere in its own being is nothing but the actual essence of the thing in itself" (Spinoza 1677A trans. White & Stirling p 105); or…. 'The striving by which each thing strives to persevere in its own being is nothing but the actual essence of the thing' (Spinoza 1677B trans. Curley p 75; Damasio 2003 p 36). This seems to be the essence of the will to be.

9. In restoring mental harmony, re-establishing meaning is crucial for our Well Being (A3); this is facilitated by the SEEKING system [Panksepp 1998 p 145 suggests that in humans, the original SEEKING for food, shelter, companionship etc, has, in addition, been co-opted to embrace and include (seeking) meaning].

Note that these aspects of Well Being can be realised without explicit cognitive / thinking. That is to say, once the decision (cognitive) to do (be) an Autogenic Sequence / meditation has been made, and the being mode of the mental training is entered, then we are no longer actively trying or striving to achieve anything; rather, we are in the present moment. And it is this present moment state that is modulating the PFC with the subsequent transformation in brain dynamics leading towards Well Being and a feeling of Integration – as indicated in Figure 5.

In general terms, Meditative Type States change the dynamics of the two hemispheres. In so far as it is true to say that the hemispheres have different basic functions (McGilchrist 2009), Meditation, Positive Mental Training, and Autogenic Training (involving a meditative-type sequence) will all be associated with:

- *Reduced* analytical / ruminative thinking (Dobbin & *Ross* 2012); [analytical and ruminative type thinking are mainly mediated by the Left Hemisphere]; and
- *Increased* integration of emotions and a wide (non-reductionist) perspective related to a more global perspective and related overall Well-Being – mediated by the Right Hemisphere (McGilchrist 2009 pp 32-93; Siegel 2007; 2009; 2010; and also C6 & C7 in this series).

The Pre Frontal Cortex activation indicated in Figure 5 – as a result of specific Meditative type practices – activates our CARE circuits (Soothing and Contentment system). Activated CARE circuits release informational substances such as oxytocin, which themselves act as anti-dotes to FEAR, PANIC and anger / RAGE (Panksepp 1998; and see Davidson et al 2003; 2005; and B5 in this series).

4. Some concluding remarks

Human distress can arise from external events, internal bodily states, and what is going on in our minds. All of these can activate primary process emotions – that in evolutionary terms evolved to protect us. In the modern world, such emotions [e.g. FEAR; RAGE; PANIC / GRIEF] can often be dysfunctional – and can lead to a feeling of dis-integration.

We can develop various skills to help us with the ups and downs of life, and these can then act as antidotes to our distressing and negative states. In particular, Mental Training of some form, carried out on a daily basis, facilitates in this process and allows us to tune in to our Authentic Self. Such transformation is mediated to a large degree by the PFC, which activates, in particular, three key primary process emotions that are essential for our Well Being: CARE (self nurturing), PLAY (including both physical playing and being in a playful mood), and SEEKING – for example, seeking meaning (see Figure 5). Balancing and integrating our emotions is fundamental to our overall Well Being.

Linked themes in this Autogenic Dynamics section

A1	The Stress Response, the Relaxation Response, and the Tend and Befriend Response
A3	Toward a concept of happiness and well being
A7	Porges and the Polyvagal Theory – *reflections on clinical and therapeutic significance*
A8	The Polyvagal Theory *and a more sympathetic awareness of the ANS*
B1	Bears, Imagination, and Well Being
B2	Reframing, Reappraisal, and Well Being
B3	Part I: The Origins of Affect and Affective Neuroscience – *and the misplacing of Affect in the Neo-cortex*
B3	Part II: Emotional Operating Neuro Circuits – *a brief introduction to the work of Panksepp*
B5	Emotions, Frontal Lobe Dynamics, and Meditation
B6	Perceptions, Flowers, and Reality
B7	The Effects of Positive Imagination on Anxiety and Affect
B9	Mental Training, the Pre-frontal Cortex, Resilience, and Equanimity
B10	Snakes, Conditional Stimuli, and Equanimity – *Approaches to treating mind-body disturbances*
B11	Transforming Distressing Mind-Body-States – *from Negative Ruminations towards Well-Being*
B13	Expressive Writing and Well Being – *The efficacy of Intentional Off Loading through Writing*
C2	Mindsight – our seventh sense – *and associated middle pre-frontal cortex functions*
C6	Integration and Well Being
C7	Being in touch with our feelings – *Hemispheric Integration*
D4	Duhkha, Impermanence, and Inter-relatedness

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