

Snakes, Conditional Stimuli, and Equanimity

Approaches to treating mind-body disturbances

Preamble

In this paper we will review some recent developments in our understanding of neuro-physiology, fear, and previous traumas. Such conditions do not generally respond too well to cognitive type treatment approaches. We will look at a model of what is happening in the body when we are distressed, and then look at ways in which the body-mind distress can be reduced. Please note that the model presented here draws extensively on the work of Alastair Dobbin – and his recent paper (Dobbin & Ross 2011). B11, a related webpage, discusses some of these matters further.

1. We run away after seeing a snake: why?

This seems a daft question; the obvious answer seems to be because we are afraid of the snake. However, this is not entirely true.

William James (1842-1910) suggested that we are afraid because we realise we are running away: not because of the conscious awareness of the snake. LeDoux has confirmed this (e.g. LeDoux 1999). Let us imagine that we are on holiday in some exotic place and we see a snake. Light rays from the snake enter the eyes, and are relayed to the Visual Thalamus. From there, direct pathways go to the Amygdala, which is alerted and sends Sympathetic Nervous System messages to the body – including the heart, lungs, muscles and guts. This puts the body in the fight / flight mode. We start to run away. At this stage, we have not yet consciously seen the snake (see Figure and comments for explanation).

Feedback from the body, with the relevant organs all Sympathetically (SNS) primed, makes us feel afraid: for example, the realisation that our heart is pounding.

The essence of LeDoux's findings are illustrated in Figure 1.

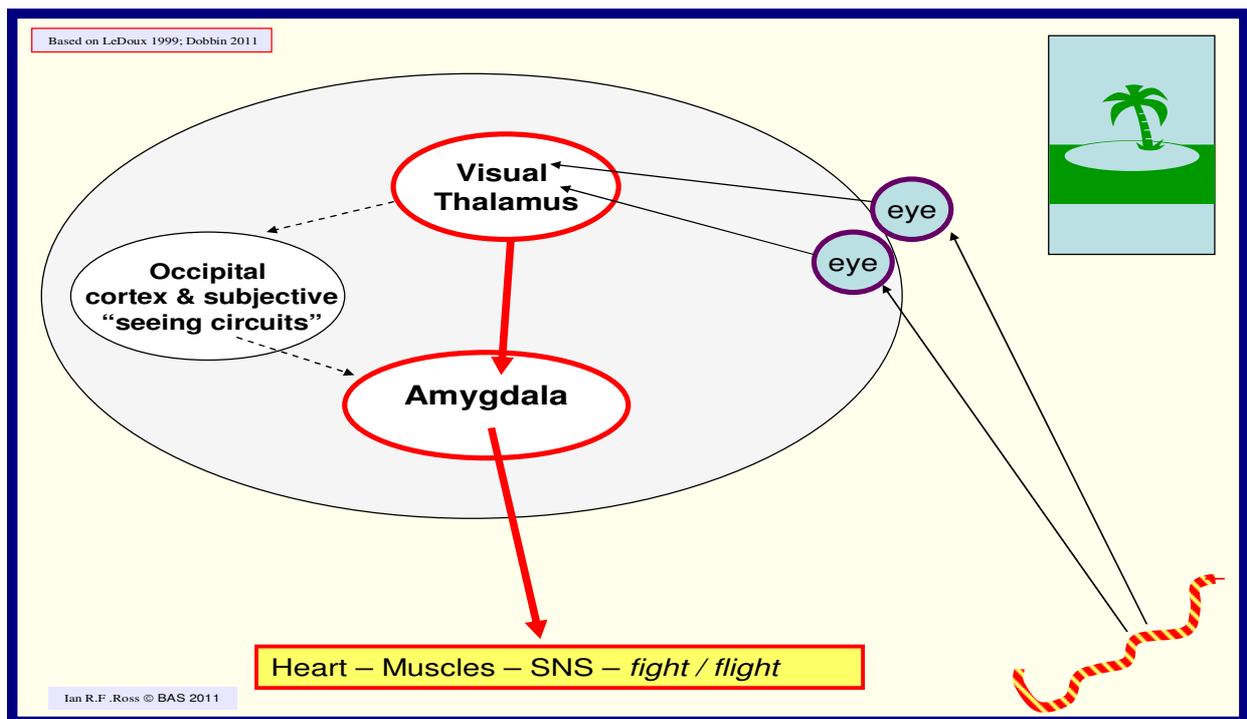


Figure 1

The flight / fight response is initially pre-conscious

Comments on Figure 1 (also see text above)

- The red/yellow squiggly line represents a snake.
- Light rays from the snake enter the eyes, and go direct to the Visual Thalamus. This processes the signals unconsciously and relays messages direct to the Amygdala.
- The now primed amygdala activates the heart and muscles etc of the body for fight and flight: and we start to run away.
- Signals are also relayed from the Visual Thalamus to the Occipital Cortex, and mini-seconds later we become consciously aware of seeing the snake; but by this stage we will already be taking avoiding actions via the pre-conscious circuits illustrated with red arrows.
- Note the Palm Tree in the background.

2. Environmental images / sounds at the time may be paired, neuro-physiologically, with the SNAKE

In future, if we see a snake, we will of course be primed to take avoiding action. However, possibly of more importance is that the next time we see a palm tree, we may experience a sudden pounding of our heart and an associated feeling of great fear – but we cannot fathom why. We may or may not have any recollection of there having been a palm tree (in the background) in the experience depicted in Figure 1.

In neuro-physiological terms, the palm tree has become paired with the snake, and thus, even if we come across a palm tree without any snake, we may have this response – activating the FEAR circuits described by Panksepp (Panksepp 1998).

- This is similar to Pavlovian conditioning. In Pavlov's classic experiment, a dog is presented with food, and naturally salivates. Then a bell is sounded every time the food is presented; the dog salivates. After a week or two of this, if the bell is rung without any food, the dog salivates. So now the bell, technically here called the Conditional Stimulus¹, produces the salivation, the Conditional Response.

In a similar way, in our example of the snake, the Palm Tree becomes the Conditional Stimulus, and the subsequent increased heart rate and fear becomes the Conditional Response.

Should we in the future come across a twisted stick that looks like a snake, this will initially have the same effect as the snake depicted in Figure 1. However, cognitive and conscious evaluation of the stick via the occipital cortex circuits may result in us realising it is only a stick – and this realisation can then switch off our fight / flight response: but by then our heartbeat may well be racing.

3. Practical relevance of such pairing

Now of course, these days most of us (in urban environments) do not see snakes. However, similar pairing can occur for us in, for example, childhood experiences; this can then lead to major problems for us later on – such as in a future close relationship. For example, it can happen that a young girl has a father who is often verbally and physically aggressive in the home. His outbursts naturally cause the girl's alarm (FEAR) system to become active, much in the same way as in the snake example in Figure 1². In the home situation running away is not an option, so the girl's fear tends to be bottled up, leading to a hyper-vigilant type state. Let us suppose that her father is also very tall. This tall male figure may then, over time, become paired within the girl's brain with the angry outbursts, so that the tall male figure becomes unconsciously a conditional stimulus.

Later in life, when the girl becomes a young woman, she may experience, should she develop a close relationship with a tall man, an uncomfortable beating of her heart associated with fear. She will not know why this is: she will not understand that the tall and friendly man has set off a conditional response within her – which she experiences as fear.

Treating such conditions can be very difficult. It is unlikely that the young woman in this instance will benefit from psycho-analysis or other specifically cognitive approaches such as CBT. The neuro-circuits in her brain have become wired to respond to tall men with the flight / fight response. A purely cognitive understanding that, for example, tall men have become a Conditional Stimulus for us will not in itself change the underlying neuro-circuits of this conditioning – for this we (also) need other approaches. We will return to these other approaches in due course.

4. Ruminating negatively

If we dwell negatively on past events, or ruminate negatively about the future, this will also distress our body and being through similar pathways. Recalling previous traumas / negative memories can activate the amygdala and set in motion, for example, the FEAR circuits discussed above (see also B1 – e.g. Figure 5). This will result in arousal (in a Sympathetic Nervous System sense) of the organs of the body – resulting in background feelings (Damasio 1999) that are associated with the state of hyper-vigilance; and can give rise to many unpleasant or disagreeable bodily symptoms which, if investigated, may remain unexplained [Medically Unexplained Symptoms – MUS (Dobbin 2011)].

5. Negative Interpretation of experiences / events /

¹ A note on Pavlovian terminology. "Conditional is what Pavlov actually wrote, but the early mistranslation of 'conditioned' is now widespread in the psychological literature" (Martin Roth 2004 p 704). In this essay we will use Pavlov's original term.

² Note that if the negative / traumatic experience occurs before the age of 3 or 4, the hippocampus may not be mature enough for a memory (autobiographical / episodic) of the event to be formed; in this case the girl will have no conscious memory of the original trauma: the CS will of course still activate the FEAR circuits, so in this sense the body remembers even before the age of 3 or 4 years.

5. Negative Interpretation of experiences / events

If we become stressed for any reason, with activation of the stress response (A1), the two way communications between the amygdala and the neo-cortex tend to be closed down (B4). Furthermore, because of the activation of the Stress Response neural circuits (including FEAR – Panksepp 1998; B3), our brains tend to interpret everything in a negative way and in terms of a “worst case scenario”³: thus the actual stick metaphorically always becomes a snake. This is sometimes called a “negative interpretation bias”, and results from our body being primed for fight and / or flight; so it will happen when our system is alerted with the activation of the Sympathetic Nervous System. If all is not quiet in the periphery of our body, our minds cannot be quiet and composed. This is physiologically associated with over-generalisations and catastrophising: “My boss frowned this morning so that means she / he will never like any work I do however hard I try.” (The boss may have had a difficult day yesterday and the frown may be nothing to do with us.)

A neuro-physiological note

Over-generalising and catastrophising are associated with us no longer having access neuro-physiologically to specific positive memories (see page 8). This then leads to a negative interpretation bias. For example, we see the face on the left in Figure 2 not as a neutral face but as a frowning / aggressive / unhappy face.

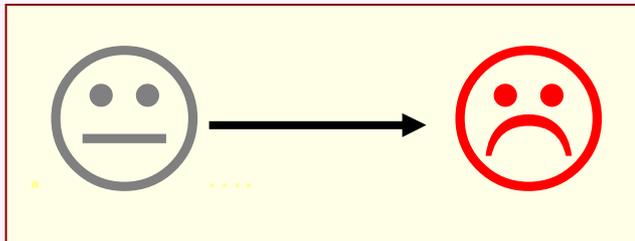


Figure 2
An example of Negative Interpretation Bias (NIB)

The neuro-physiological conditions of catastrophising / over generalising lead us to interpret a neutral face as a frowning or aggressive face.

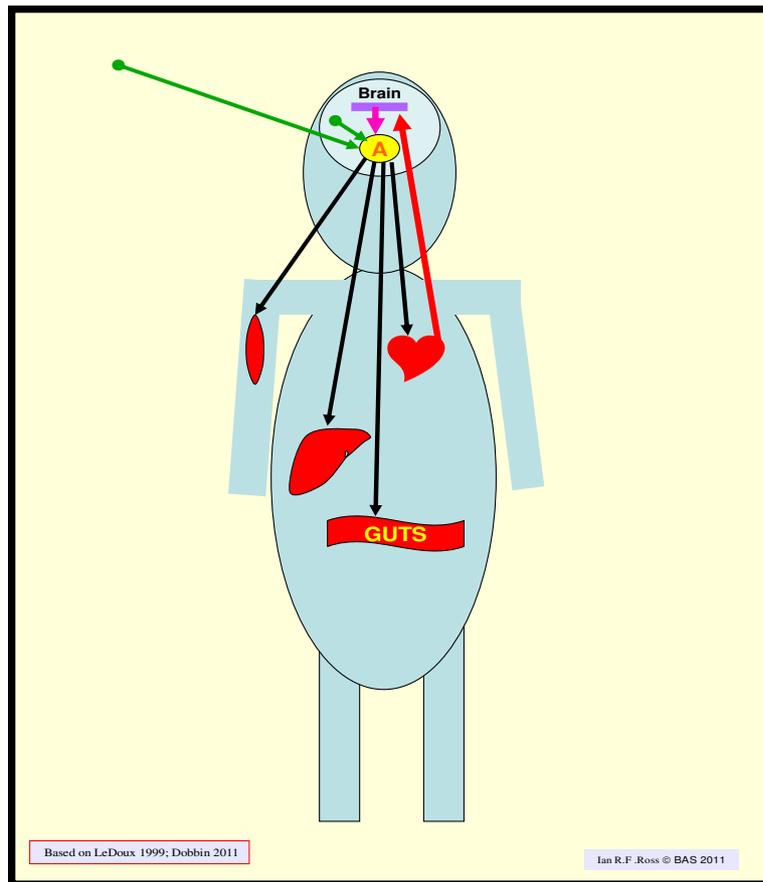
See also appendix II on page 8 which looks at some of the underlying dynamics of CBT in the context of over-generalising and the resultant NIB. Note that appendix II also gives a case example of a woman accessing specific positive memories.

Such negative and recurrent evaluations are common in some forms of depression: they may also lead us into feeling we have some physical illness when actually the underlying problem is disturbed inner physiology – as a consequence of the hyper-vigilant state that our bodies can get into as a result of various stressors and / or conditional stimuli that are working on us at an unconscious level (the tall men in the example given above about the woman whose father was aggressive).

6. Disturbed physiology of the organs of the body feed back to the brain – *which increases the fight / flight response*

So the organs of the body can become disturbed as a result of a primary threat (e.g. a snake or a bear); by a conditional stimulus setting off a conditional fear / anger response; and / or as a result of negative ruminations about the past or the future. These dynamics are illustrated schematically in Figure 3 on the next page.

³ This makes evolutionary sense: for if we interpret a snake as a stick, we may not live to tell the tale.



Legend

- A: Amygdala
- Green arrows – inputs to the amygdala from the external environment (e.g. a bear) and the internal environment (imagining a bear or a previous traumatic event; input may be unconscious).
- Black arrows: chemo-neural pathways from brain to organs of the body.
- Four organs only shown – muscles of limbs; heart; liver; and guts.
- Red arrow (here only shown from the heart) depicts messages from organs back to brain⁴.
- Purple bar, the “Feedback Centre” (see comments below).

Figure 3
Neuro-physiology of
hyper-vigilant (agitated)
body-mind state

Comments on Figure 3

- A Conditional Stimulus (CS), or recollection of a negative memory, activates the Amygdala (A). [These inputs are notated by the green arrows – which may come from the external environment in the case of a CS – e.g. the palm tree, the tall man; or from the internal environment in the case of a recollected and disturbing memory.]
- As a result, messages (indicated by the black arrows) pass down to the organs of the body, here simply represented by muscles, heart, liver and guts.
- The organs are thus “primed for action” (fight / flight): depicted by the colour red.
- Messages return from the organs to the “Feed Back Centre” of the brain, depicted in Figure 3 by the purple bar.
- The “Feed Back Centre” is alerted by the excited state of the organs, and so alerts the Amygdala to further stimulate the organs. This second order activation of the amygdala is depicted by the short tubby pink arrow.

As a result of the above dynamics (i.e. i. to v.), a state of chronic hypervigilance (Dobbin 2011) can develop in the organs – leading to inner tenseness and often unexplained symptoms (MUS). Such a state is incompatible with inner harmony and equanimity. Luthé described a theory of personality involving the Authentic Self, the Natural Self, and the Artificial Self (Luthé 1983; Ross 2010 pp 36-41). It is suggested that if we become stuck within the dynamics of the Artificial Self, this will be associated with the state of hyper-vigilance illustrated in Figure 3 above. We tend to adopt our Artificial Self when we are afraid of what others may think about us; FEAR circuits may be mobilised and hence we enter into the fight / flight domain – with the associated hyper-vigilance. (Thanks to LT August 2011 for enabling me to see this formulation).

Direct cognitive approaches may not be that helpful at reducing such hyper-vigilant states because, as mentioned above, they do not specifically affect the sympathetic (SNS) arousal in the organs – the heart of the matter.

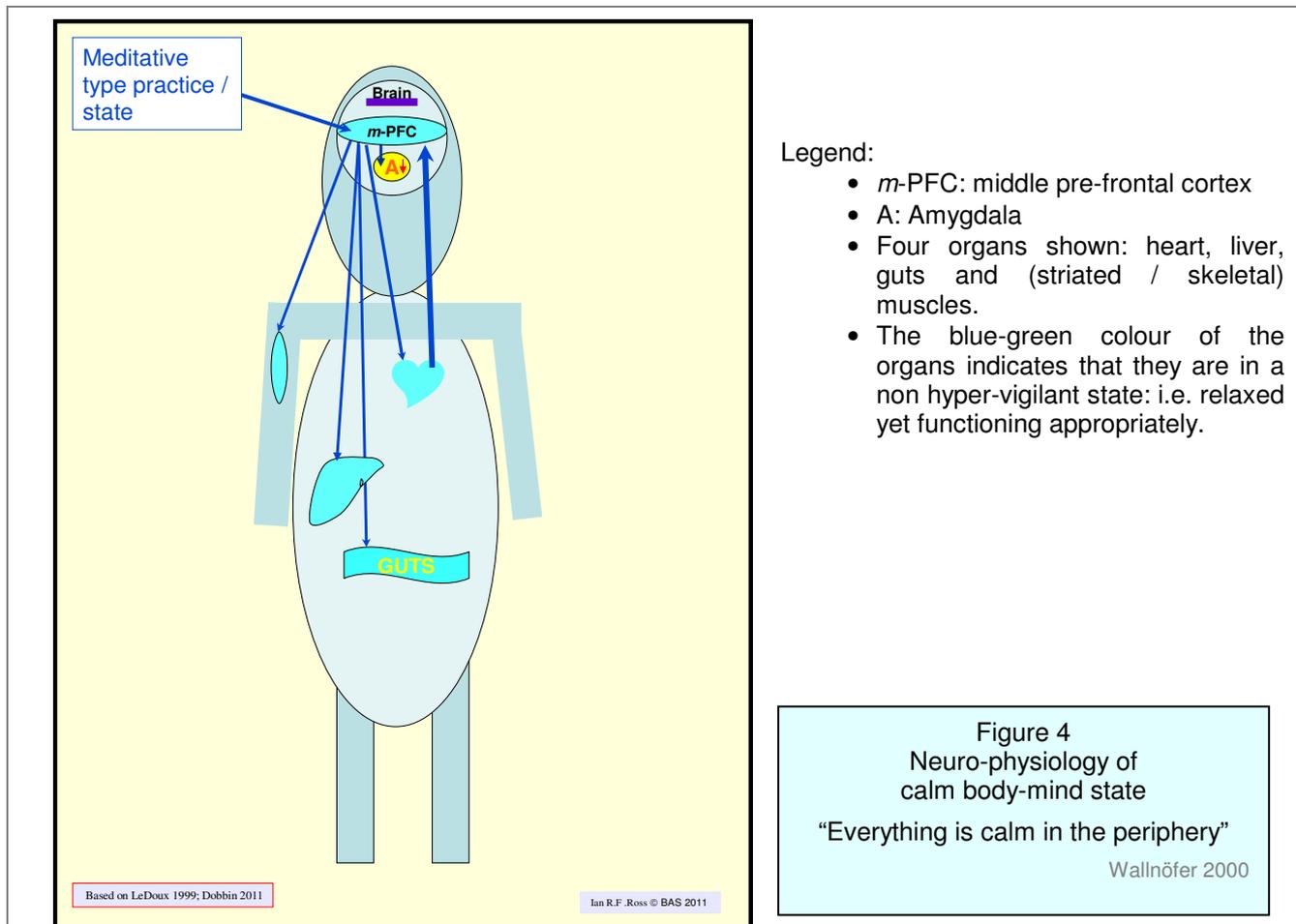
7. Mind-Body Distress, Disturbed Background Feelings,

and neuro-physiologically informed approaches to treatment

⁴ Note that 80% of the vagal innervation of the heart is afferent fibres back to the brain: i.e. only 20% are from the brain to the heart (noted in Dobbin 2011).

In order to reduce and settle the hyper-aroused state depicted in Figure 3, we need to have a deeper understanding of the neuro-physiology of the brain. Now research has shown that meditative type states – including those developed in Meditation, certain forms of Tai Chi, Positive Mental Training, and Autogenic Training – can alter the dynamics and activity of the middle pre-frontal cortex (m-PFC) of the brain: such activation is associated with several positive outcomes – including down-regulating the amygdala: that is, specifically reducing the fear response in the amygdala (Siegel 2007; 2010; and C2 in this series).

These meditative-type-states will then lead to the organs of the body settling, as they are no longer in an amygdala primed SNS milieu. Rather, they are now suffused with eu-molecules (Ross 2010) and more para-sympathetic (PSNS) autonomic balance. This changed state⁵ is depicted schematically in figure 4.



Comments on Figure 4

- Regular meditative type practice changes the dynamics of the middle pre-frontal cortex (*m*-PFC) of the brain; and this is associated with specific effects: these include inhibiting the fear circuits in the amygdala and improved bodily regulation (Siegel 2007; C2).
- As a result, the organs of the body are no longer in the activated mode of the fight / flight response shown in Figure 3.
- Rather, the organs now tend towards para-sympathetic (PSNS) dominance, notated in Figure 4 by the blue-green colour.
- In particular there will, over time, be a slowing of the heart rate, an increase in what is technically called Heart Rate Variability (HRV), and a slowing and deepening of the breath.
- This results in the organs of the body being in a positive, non-stressed, state.
- This positive state is then relayed back to the brain and *m*-PFC, and allows us to feel at ease and yet alert. In figure 4, this feedback is depicted just from the heart in the form of the thicker blue arrow to the *m*-PFC.
- As a result, our background feelings (Damasio 1999) are now in harmony, and so our whole being is better able to face the various ups and downs of life.

⁵ Note that this changed neuro-physiological state is associated with Decentred or Experiential thinking, which is the opposite of the Negative Analytical-Ruminative thinking associated with the neurophysiology of Figure 3. Decentred / Experiential thinking is discussed in greater depth in B11 – and is particularly important for our well-being in times of stress / distress.

Figure 4 has been configured in the context of a long term approach (e.g. Meditative-type disciplines) to overcoming disturbing background feelings including the hyper-vigilant state. In an acute situation, it has been shown that focusing on the breath for as little as two minutes can settle the disturbing feelings coming from the body. Such mindful breathing tends to slow down our breathing and extend the breathing out phase; in this way it reduces SNS activity and increases Para-Sympathetic Nervous system activity (Dobbin 2011). The Partial Exercises of AT (including the “three minute exercise” – Segal et al 2002 p 184 & 281) can have a similar autonomic effect.

In the context of Autogenic Training in general, the psycho-physiological shift described by Schultz (Schultz 1932; Schultz & Luthe 1969) is another way of describing the changed dynamics between Figure 3 and 4 above. In particular, I like the description by Heinrich Wallnöfer:

Everything in the periphery is quiet

Wallnöfer 2000

As implied above, this exactly captures the essence of Figure 4. As everything in the periphery becomes calm, the hyper-vigilant state settles: and with this, over time, may come a settling of the body-mind distress, and a move towards equanimity.

Appendix I (Background Feelings) and Appendix II (CBT and depression) appear on the pages 7 & 8.

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Linked themes in this Autogenic Dynamics section

A1	The Stress Response, the Relaxation Response, and the Tend and Befriend Response.
B1	Bears, Imagination, and Well-Being
B3	Emotional Operating Neuro Circuits – a brief introduction to Panksepp's model
B4	Emotional Triggers and the Refractory Period
B6	Perceptions, flowers, and reality
B11	Distressing Mind-Body-States – from Negative Ruminations towards Well-Being
B12	Affect Labelling, Autogenic Training, and reducing Emotional Distress
C2	Mindsight – our seventh sense – and associated middle pre-frontal cortex functions
D1	Reflections on foundations for mindful living

⁶ No relation to Ian Ross

Appendix I**A note on background feelings**

Background feelings	<p>Damasio uses the term Feeling to denote the subjective awareness of emotions (Damasio 1994; 2003). He also uses the term background feeling to denote the minute by minute subjective feeling state that we are in at any one moment that may or may not be a classical emotion such as fear or joy. We could say that the inner state of the body is constantly being monitored (in the brain and periphery) and this gives rise to background feelings.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>“It is probably true to say that background feelings are a faithful index of momentary parameters of inner organism state. The core ingredients of that index are (1) the temporal and spatial shape of the operations of the smooth musculature in blood vessels and varied organs, and of the striated muscle of heart and chest; (2) the chemical profile of the milieu close to all those muscle fibres; and (3) the presence or absence of a chemical profile signifying either a threat to the integrity of living tissues or conditions of optimum homeostasis.”</p> <p style="text-align: right;">Damasio 1999, pp 286-287 (Extract from Glossary, Ross 2010, p 271)</p> </div>
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Appendix II: Some reflections on how CBT (Cognitive Behaviour Therapy) may work in depression – see page 8

Appendix II includes some common misperceptions as to how CBT works; how we now think it does work; the concepts of over-generalising, negative interpretation bias and the ruminative modality; and developing access to specific positive memories and the experiential modality. This Appendix draws heavily on the work of Dobbin and Ross 2011 .

Appendix II**Some reflections on how CBT may work in depression**

CBT has been shown to be effective in many conditions, including depression. It was originally postulated that we become depressed because our thinking has become dysfunctional. When depressed, we may interpret this in a negative way by concluding, inappropriately, that our thinking is no good or bad. However, there is no real evidence that dysfunctional thinking (“thinking errors”) causes depression.

Rather, depression is associated with catastrophising (over-generalising in a negative way), and it seems that when this happens neuro-physiologically we are no longer able to access specific positive memories: rather, we develop a Negative Interpretation Bias discussed in the main text. Non-depressed individuals actually have just as many up and downs in life as those who suffer from depression; but the non-depressed individuals have access to specific (i.e. relevant for the situation) positive memories, and this enables them to bounce back out of the “downs” and return to equilibrium. So the positive memory here acts as an anti-dote, as it were, to the upset (see case example below).

So how does CBT work in this context? It seems that the CBT process can help us to become “decentred” from our thoughts, so that we do not identify with them so much: this is called having an “experiential” perspective. Compare the following two statements:

- “I am angry”.
- “Anger is arising within me”.

In the first of these, we are bound up with our anger / feeling. This is sometimes called the “analytical / ruminative mind-body state” (Dobbin 2011). Note it is a mind-body-state; both (i.e. mind and body) are hyper-vigilant and are increasing the hyper-vigilance in the other. This leads to negative over-generalising (fight / flight and FEAR-circuits being active) and is associated with ‘depression, vulnerability, and emotional distress’ (Dobbin 2011). Such states are associated with not being able to access the specific positive memories mentioned above. In fact, the state may more be associated with accessing previous negative / traumatic memories through negative ruminations – and each time we do this there is the potential that the re-called memory will re-traumatise us.

On the other hand, the second of the statements: “Anger is arising within me”, is quite different. First there is acceptance (D1) of the feeling I have at this moment; and second, there is an awareness that “I am separate from my anger”; that is, there is a recognition that “I am not my anger”. So in this way I have distanced myself from the feeling / thought / emotion. This is the experiential mode, better described as the “experiential mind-body-state”; this state is associated with our inner “resources, problem solving and resilience” (Dobbin 2011).

Note that in Mindfulness Based Cognitive Therapy (MBCT) for depression, specific meditative practices help us to shift from ruminative-type thinking styles to the experiential mode in non-cognitive ways (Segal et al 2002; Williams 2007). Positive Mental Training and Autogenic Training also specifically help us to develop the experiential modality – again in non-cognitive ways.

Being in the present moment is in itself a good antidote to negative thinking, negative ruminations, and our “Judging Mind” (see B6).

The linked webpage B11 looks at some of the above dynamics in more detail

Case example of having access to specific positive memories

A woman had been practising Autogenic Training for some years. Her husband became severely incapacitated, as a result of which he had to go into long term care. The woman was on holiday for a week, staying in a cottage on her own. On her last night there, as she was preparing for bed, she suddenly developed an overwhelming sadness that her husband was no longer there and present with her. She became distressed.

Then she reflected on many of the wonderful holidays and times she had had with her husband; and the many romantic memories of bedrooms they had slept in together. Her mind settled, she slept soundly.

Access to such specific and positive memories is facilitated by the “experiential mind-body state” (Dobbin 2011).