Chapter 4

Relationships and social engagement

Introduction

We may see ourselves as separate individuals who spend some of our time relating with others. This is the view from the left hemisphere, whilst the view from the right is of the interconnectedness of inner and outer worlds, which include other people. We begin life by attaching to others, and only later do we develop an autonomous self. As we progress through life, our relationships are fundamental to our well-being, and our right hemisphere does much to look after them in the background, without our left noticing.

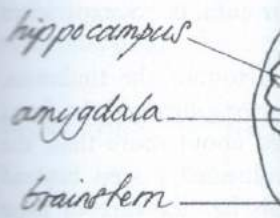
Images of brains usually show a single brain, which is misleading because brains imply other brains – the context of relationship, family and community which supports them. Keeping brains isolated is a technique used either for spiritual advancement, as in silent retreats, or for punishment, as in solitary confinement, and both are a challenge for the nervous system. So let's look at real brains that relate to other brains: the contributions of each hemisphere to relating, the state of the autonomic nervous system in the pleasurable and painful aspects of relating, the role of the body – and the dynamics of therapeutic relationships.

The 'social brain'

Brains are inherently social, so the idea of the 'social brain' is a construct that points to brain areas and biochemicals involved in relating. Much social brain activity happens implicitly, outside our awareness. Psychotherapy is full of mysterious manifestations of the social brain, including projection, transference, countertransference and projective identification, and we'll see how the nervous system provides a platform for them. But first, we need to get some more neuroscience detail onboard.

Social brain areas

Certain areas are key players in the social brain and feature in discussions of this subject. We need to work bottom-up here, and return to the three levels



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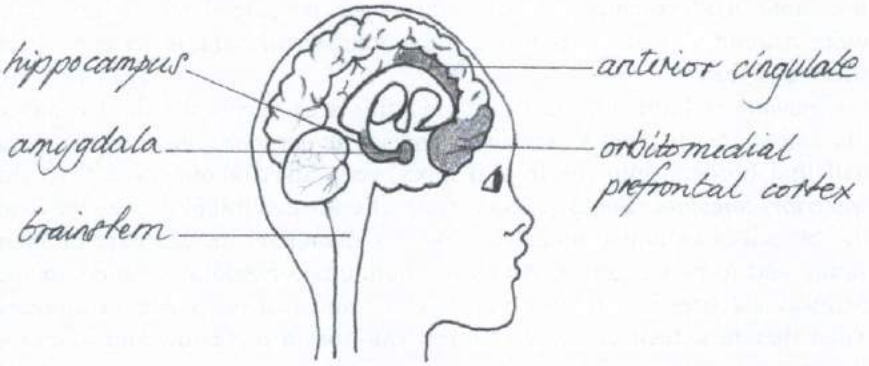

Figure 4.1 Social brain areas: brainstem, amygdala, hippocampus, anterior cingulate, and orbitomedial prefrontal cortex. The insula, not shown, sits next door to the anterior cingulate, hidden behind cortical areas

of the triune brain – reptilian, mammalian and human – adding a fourth level between the limbic system (mammalian) and the neocortex (human), that of the paleocortex ('paleo' meaning old). The paleocortical areas, the insula, cingulate and orbitomedial prefrontal cortex, were the first cortical areas to evolve, and neural development in infancy re-traces the path of evolution. These areas sit above the limbic areas below and contribute to the bodily and emotional aspects of our social life (see Figure 4.1).

The *brainstem* is working at birth. As well as handling aspects of bodily life such as breathing, it's the home of reflexes that kick-start attachment, such as orienting to the sound of mother's voice.

The *amygdala* is a limbic area working at birth, which means it's well-connected within itself and with areas it links to. One such is the hypothalamus which raises heart rate and blood pressure, another is a motor nerve in the face that triggers fearful expressions. The amygdala generates stress, anxiety, fear and fight-flight reactions to certain stimuli. Babies arrive in the world ready to become stressed and anxious if circumstances warrant it. Circumstances for babies mainly concern relationships, and the amygdala fires if mother's behaviour seems threatening. It pairs particular feelings with a fear reaction, and a baby can learn to fear attachment itself. Worse, the amygdala has a tendency to 'generalise': the more it fires in reaction to genuine threats, the more it appraises other stimuli as threatening even when they aren't.

The *hippocampus*, also in the limbic system, is associated with memory. It can dampen the amygdala's reactions because it organises memory by context, a more sophisticated method than the amygdala's simple pairings. If it appraises a stimulus the amygdala considers a threat to be a false

alarm, it can trigger a parasympathetic response to slow heart rate and breathing. Unfortunately, it isn't sufficiently developed to do this until we're around 2 years old, hence the potential for infants to experience stress and fear.

Cingulate is Latin for surround, and this area surrounds the thalamus, the limbic area that relays sensory signals. The *anterior cingulate*, the front half that borders onto the frontal lobes, gets talked about more than the *posterior cingulate*. Being paleocortical, it's an evolutionary step beyond the capacities of limbic areas that enables mammals to take care of their young and to play together. An association area for emotional and somatic pathways, it fires in infants when they cry out in distress and in mothers when they hear their cry, when we feel emotion in our body, and when we experience pain or witness others experiencing pain.

Insula is Latin for island, and this is a well-hidden island, usually absent from brain diagrams. Also paleocortical, it handles body signals conveying physiological and emotional sensations on their way to the *somatosensory cortex* in the parietal lobes above. It contributes to our awareness of what's happening in our body, and fires when we see changes in another's facial expression or eye gaze that affect us. Attachment trauma can lead it to associate body awareness with feelings of shame and disgust, leaving us reluctant to sense within.

Prefrontal cortex is the main part of the frontal lobes, and the more social life a mammal has, the larger it is. It's an evolutionary improvement on the cingulate, permitting greater neuroplasticity and therefore more scope for learning and conscious control. The prefrontal cortex is an 'association area' for sensory signals from the posterior lobes, knitting them together into one big picture, which enables it to inhibit brain areas lower down the hierarchy, including the amygdala. We need it to imagine another person's inner world.

Orbitomedial prefrontal cortex is the key area of the prefrontal cortex for the social brain. 'Orbito' means above the eye sockets, 'medial' means in the middle, and it features a lot in neuroscience discussions. Sitting at the apex of social brain networks organising attachment, it's the first frontal lobe area to develop in infancy. The highest level of integration of signals from external senses and internal ones from the body happens here, especially in the right hemisphere (Cozolino 2017). It's needed for considered social responses based on the awareness of both self and other.

Mirror neurons are a type of neuron rather than a brain area because the research that discovered them involved attaching electrodes to particular neurons in monkeys' brains – to avoid having to persuade them into brain scanners (Ramachandran 2011). When a monkey watched another monkey eating a banana, the same neurons fired as when the monkey ate a banana itself.[1] Mirror neurons are found in the frontal and parietal lobes and fire both when we observe another person make a movement, such as a facial

expression, and when we make such a movement ourselves. The implication is that when we observe another's movement, our brain prepares us to make the same movement. They enable us to imitate others and anticipate their intentions.

Social brain chemistry

Certain neurochemicals appear frequently in discussions of social experience. This subject gets very complex very quickly, so I'll keep it simple.

Dopamine is associated with feeling motivated and excited. It fuels our social lives and energises us to engage with the world and other people (Panksepp 2012). Infants need dopamine to forge their attachments, and we all need it to seek the rewards of social interaction.

Noradrenaline is associated with feeling energised and in a good mood. It's released when we experience something new, especially in the right hemisphere (McGilchrist 2009). Too little and we may feel bored and lethargic, too much and we may feel anxious and irritable.

Serotonin does different things in different places in the brain.[2] It lowers emotional arousal (Panksepp 2012), thereby helping us control our impulses, remain even-tempered and have social confidence. Too little and we may feel awful, become aggressive and sleep badly.

Endorphins generate feelings of well-being when we enjoy others' company.[3] Also referred to as 'endogenous opioids', Panksepp calls them 'comfort and joy' chemicals (2012). Low levels of endorphins correlate with feeling lonely, distressed and miserable.

Oxytocin facilitates the good feelings that come with emotional bonding with others.[4] It promotes attachment and intimacy. Oxytocin has a big effect on a mother's body, helping her to give birth and to breastfeed and, combined with endorphins, to experience motherhood as rewarding.

Vasopressin facilitates aspects of bonding and attachment, including sexual and paternal behaviour in men.[5]

Social hemispheres

Our patterns of relating, along with the affect and somatic regulation that accompany them, are biased towards the right hemisphere, "the mediator of social behaviour", according to McGilchrist (2009: 58). This is due to its richer connectivity with subcortical areas and the body. It keeps our autonomic state in sync with the needs of relating and communicating, such as more arousal for speaking and less for listening, and provides the implicit foundation for our finding relationships rewarding or frustrating.

So my 'real' emotional self (that I experience inside) lies in my right hemisphere background, while my persona or social self (the person I want to be and want others to see) is a construct in my left hemisphere

foreground. When the two are congruent, relationships are rewarding, but when they're not, I may present a 'false self' and feel uncomfortable. Others are affected by my real self, whether they realise it or not, and whether I like it or not.

The relationship patterns of the real self in the right hemisphere form in early childhood in attachment relationships. They guide our habitual behaviours and felt experience for the rest of our lives, or until we reflect on them with our frontal lobes in a close relationship or in therapy.

The right hemisphere maps our inner sense of self that's rooted in the body. Developing more rapidly than the left in the first 18 months, it absorbs our early experience of attachment and family (Schore 2012). It learns how others are and how to respond to them, shaping our appraisal of social safety or threat, and our ability to regulate our emotions with others.[6] These patterns manifest in relationships later in life, especially when we're under stress.

The right hemisphere's bias for regulating body and emotion in the background frees the left to focus attention on others and our interactions with them. But left's ability to inhibit right can lead to its focus on others disconnecting from right's self-awareness and empathy. What we say (left) and how we say it (right) may not be congruent. Our social self can become grandiose and unaware of its failings, whereas our real self is more realistic about its place in the social milieu (McGilchrist 2009).

Social engagement

Social engagement is about what happens when nervous systems come into contact with each other. Do they fight, withdraw, or do they engage in rewarding ways? The *social engagement system* is the contribution of Stephen Porges, an American neuroscientist with a mammalian perspective. His work is important to therapy because it describes the different states of the nervous system in relationships, including the therapeutic one.

This 'system' is a branch of the autonomic nervous system that enables "positive social interactions in safe contexts", states Porges (2011: 270).[7] It links facial expression and voice prosody with heart rate and breathing to allow mammals to engage with each other without lapsing into fight-flight behaviours. Central to it is the *vagus* nerve, one of the bundles of cranial nerves descending from the brainstem into the body and the main nerve bundle of the parasympathetic nervous system (Porges 2017). Vagus refers to wandering in Latin (think vagrant), and the vagus nerve wanders to many places in the body, including heart, lungs, gut, face and throat. It includes sensory nerves that allow the body to signal its state to the brain, and motor nerves that allow the brain to signal the body to change something.

The following is based on Porges's *The Polyvagal Theory* (2011).

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optimal balance of sympathetic and parasympathetic
optimal arousal
social engagement
eye contact
facial expression
vocalisation

Polyvagal theory

The basic model of the autonomic nervous system is of a 'paired antagonism' between sympathetic and parasympathetic branches. But three is more interesting than two, and polyvagal theory describes a more elaborate model with three levels in the neuroanatomy underlying our social reactions (see Table 4.1). Porges first developed the theory while researching heart rate changes, and heart rate is the key here. He thinks "affect and interpersonal social behaviour are more accurately described as biobehavioural than psychological processes" because of the effect of bodily processes on psychological ones (2011: 257).

The prelude to the three levels is that there are two branches of the vagus (hence 'polyvagal') which enact different behaviours, one related to safety and the other to threat:

1 The *dorsal vagus* evolved first in primitive vertebrates, and it can immobilise us so we 'play dead', shut down and dissociate.
2 The *ventral vagus* evolved later in mammals, linking the heart to the face, dampening the sympathetic nervous system and the stress response, and enabling social engagement.[8]

The ventral vagus, unlike the dorsal, is myelinated, so it works more efficiently. It's the foundation of attachment in the nervous system.

Our physiological reactions to social stimuli, which underlie our psychological reactions, are ordered in a three-level hierarchy, which means they kick off in order:

Table 4.1 Polyvagal theory, following Porges (2011). In response to triggers from the environment and from within the brain and body, the autonomic nervous system goes into one of three states: safety, danger or life threat. Social engagement is only possible in a state of safety

safety	*danger*	*life threat*
ventral "smart" vagus		dorsal vagus
optimal balance of sympathetic and parasympathetic	*sympathetic arousal*	*parasympathetic shutdown*
optimal arousal	hyper-arousal	very low arousal
social engagement	*fight, flight, freeze*	*immobilisation*
eye contact	dissociated rage	dissociated collapse
facial expression	panic	
vocalisation	going mute	

- *Safety*: the ventral vagus, cortically controlled, modulates sympathetic arousal. It adjusts heart rate, breathing rate, facial expression, eye contact and gaze, posture, and voice prosody so that social engagement can be rewarding.
- *Danger*: the sympathetic nervous system, subcortically controlled, triggers high arousal and defensive behaviours including fight, flight, freeze and active avoidance. Dissociated rage and panic, and going mute, also belong here.
- *Life threat*: the dorsal vagus, controlled from the brainstem, triggers very low arousal states of immobilisation, parasympathetic shutdown, passive avoidance and dissociated collapse.

In social situations, nature primes us for safety, but if we feel unsafe (whether we're aware of it or not) our sympathetic nervous system propels us into danger. If this doesn't lead us back into safety, we fall back on our evolutionary past and into life threat.

Two more physiological states are needed for a complete picture of human behaviour:

- *Play*: a hybrid state requiring both the sympathetic mobilisation of danger and the social engagement of safety.
- *Immobilisation without fear*: the safe sort of immobilising associated with intimacy and childcare, quite unlike the immobilisation of life threat.

Together, these five states colour our perception of others. If the other person is in the safety zone, social engagement is reciprocal, but if they're aroused in the danger zone, they may respond aggressively or withdraw. Each person's right brain and subcortex dictates what happens since, whatever their respective conscious stances, their autonomic state determines the nature of their interaction.

We take social engagement for granted. It allows us to co-operate in groups and look after children, both of which require subtle regulation of the autonomic nervous system. The social engagement system works implicitly in the background, interacting with the stress response and immune system, and releasing neuropeptides and hormones, including oxytocin. Some people, however, have difficulties sustaining social engagement. Their ability to read social cues and their affect regulation may be compromised, and in children this affects language development. They may have difficulty establishing and maintaining relationships.

The three levels are not mutually exclusive so, for example, we can experience a mix of safety and danger simultaneously. The precise balance may determine the outcome of many interpersonal encounters. Too little safety between colleagues and partners, or amongst group members, and a

human version of the fight response may be enacted, whatever each person claims ("I'm not the problem, you are").

On the left-right axis, we may tell ourselves all is well and we feel safe ("I'm fine"), but in reality our right brain-body ensemble may be experiencing danger. We may become highly aroused with anxiety or anger, or find ourselves going strangely mute, in a way that causes problems in our relationships. Genuinely rewarding interactions only happen when there's biological safety amongst the nervous systems present.

Underlying such phenomena is what Porges calls 'neuroception': "the neural evaluation of risk does not require conscious awareness ... the term *neuroception* was introduced to emphasise a neural process, distinct from perception, that is capable of distinguishing environmental (and visceral) features that are safe, dangerous, or life-threatening" (2011: 273). So our inner world can go into danger or life threat without our realising, and we may be so accustomed to this that we don't pause to consider the effects.

A further possibility is that, even with our nervous system in relative safety, we habitually enact danger behaviours learnt during past experiences when we *were* in the danger zone. Left hemisphere defences may rule the roost even without emotional threat in the right, having developed to *avoid* triggering danger. This would be a reversal of the above scenario of thinking we're safe when our body says otherwise.

Vagal brake, vagal tone

A secure attachment or a loving relationship helps develop our *vagal brake*, the capacity of our frontal lobes to use the ventral vagus – the brake is on the sympathetic nervous system. This releases oxytocin and vasopressin so we feel safe and can trust others, and inhibits defensive aggression in response to cues that might distress us. The result is the ability to engage and disengage quickly with others, and to remain calm when there's disagreement or conflict (or when you're in a group waiting your turn to speak).

An effective vagal brake means having good *vagal tone*, the nervous system's capacity to regulate the heart and other organs in support of social engagement. Good vagal tone means we can express upset or anger without withdrawing or becoming aggressive. We're safe to express our feelings.

With good enough parenting, children can grow up with good vagal tone. This supports their ego strength and ability to sustain relationships, and contributes to a healthy heart and lungs. The foundation lies in early attachment relationships, but vagal tone can improve later on in supportive relationships.

Good vagal tone correlates with:

- the ability to self-soothe, instead of becoming irritable
- emotional range and control, instead of emotional dysregulation
- social engagement, instead of social withdrawal
- secure instead of insecure attachment
- suppression of *heart rate variability*, the autonomic smoothing out of heart rate ups and downs, instead of a racing heart in social situations.

Social engagement is therefore about the capacity of the vagus to link the nonverbal aspects of communication with the rapid adjustment of heart rate and breathing. It's part of the weaving together of inner and outer that happens in the right brain-body ensemble.

Social reward

'Reward' is a term associated with pleasure and motivation, succinctly summarised as "whatever makes us feel good and want more" – food, sex or the stimulation of social engagement – by Lewis (2012: 135). It refers to the pleasure of anticipation which involves seeking rewards, rather than of their consummation. Reward helps with understanding addiction and compulsion, our motivation to consume things that aren't good for us.

Our expectations of social reward are learnt in attachment relationships. A brainstem area fires with such expectation, leading to the impulse to approach someone with whom we seek social engagement (Cozolino 2010).[9] Social engagement *feels* rewarding. These expectations needn't be conscious; they trigger patterns of thinking and behaving in interpersonal situations, and become self-fulfilling prophecies. If we expect social reward, we're likely to seek it, but if we don't, we may not bother.

Reward system

The notion of a reward system pops up frequently in neuroscience. It's potentially misleading as it concerns the *pursuit* of rewards rather than their enjoyment (Panksepp 2009). It fires when we expect social reward, such as getting approval. The system is active from birth to stimulate attachment and bonding, and our attachment relationships regulate the biochemistry.

Dopamine gets all the attention here. The brainstem triggers its release along 'dopaminergic' pathways to many brain areas leading up to the frontal lobes (Sapolsky 2004). Reciprocal links back down from the frontal lobes modulate further release. Dopamine fuels the effort of seeking rewards, and is thought to facilitate the synaptic change that accompanies our learning how to get them (Goldberg 2009).

Dopamine combines with endorphins to drive social reward (Watt 2003). Endorphins increase the flow of dopamine in the brainstem where it's produced. "In the neural mechanics of feeling good, the excitement orchestrated by dopamine joins the soothing balm of opioids", says Lewis (2012: 135) – opioids meaning endorphins. And with the pleasures of life, it's "dopamine's flame of desire, unleashed by the *ahhhh* of opioids, that causes animals to repeat behaviours that lead to satisfaction" (2012 135). First you feel good thanks to endorphins, then you want more and dopamine helps you get it. Endorphin release triggers further dopamine release, leading to a virtuous cycle of behaving in ways that lead to satisfaction.

A little transient stress helps this process. When cortisol levels rise in moderation, dopamine is released (Sapolsky 2004). The sympathetic activation means more glucose and oxygen going to the brain, leaving you feeling motivated and focused. In a word: stimulation.

A child who grows up experiencing rewarding contact with parents and others has plenty of dopamine flowing in his brain, which encourages a positive approach to life (Gerhardt 2015). The dopamine in his orbitomedial prefrontal cortex helps him to delay gratification and pause to consider his options.

Implicit social memory

Long before we start collecting explicit memories, implicit memory of our embodied experience is being laid down.[10] It includes motor skills such as learning how to walk, and "guides us through well-established routines that are not consciously controlled", states Kandel (2007: 279). For therapists, the interesting part is what we learn about the social and emotional aspects of life. Explicit memories we recall are merely the tip of the iceberg of our memory, most of which is implicit and beneath awareness (Cozolino 2010).

On the top-bottom axis, implicit memory is more subcortical than explicit memory which is more cortical. On the left-right axis, Schore is clear that "the right hemisphere is the locus of implicit memory" (2012: 88), and we could say that the right brain-body ensemble is guided by it. It includes attachment patterns, transference dynamics and family systems. It influences how we relate and how we end up feeling in relationships and groups.

Implicit memory starts in the womb and then encompasses our birth and early experiences with mother, other attachment figures and the world. We learn how we feel when we see our parents' faces, and what happens when we cry or reach out for help. "We learn how to walk and talk, whether the world is safe or dangerous, and how to attach to others.... we do not remember how we learned them", says Cozolino (2010: 78).

Implicit memory responds to cues, such as the tone of a parent's voice or family tension around the dinner table. As it functions independently of

the hippocampus that adds context (place, time, narrative) to explicit memories, our reactions are not modulated by the reality of the present situation. Feelings are generated in the background that may conflict with family or social norms in the foreground. A child who suffers early abuse may be aggressive at school; his behaviour may be seen as his intrinsic personality, and he may see himself as essentially 'bad'. But he's aggressive for a reason.

Implicit memory leads to 'acting out'. The emotional and behavioural patterns it embodies can be observed by others, and by ourselves if we're open to others' feedback or become self-aware. 'Enactments' happen in therapy when implicit memory is triggered (Cozolino 2010). The client may experience criticism and abandonment where to the therapist there's none. Implicit memory can be explored in therapy using imagination – the look on a parent's face and how it made us feel, for example; it can be brought into awareness for frontal lobe reflection.

Implicit memory is less bordered than explicit memory. It connects us to genetically inherited memory, to our parents' unconscious, and to the collective unconscious of the world we grow up in.

Nonverbal communication

Nonverbal communication tends to be spontaneous, meaningful and outside awareness. We may underestimate the degree to which ours is apparent to others. It's implicit, expressed bodily, and biased to the right hemisphere (McGilchrist 2009). While we focus attention on what we say with our left hemisphere, our right conveys our emotional state via muscles controlling eyes, face, voice and body. And while we focus attention on what others are saying, we absorb their emotional communication, especially their responses to us (Trevarthen 2009). We're affected by it, even if we're unaware. Our right hemisphere registers the felt meaning behind the words so we can understand how others are really feeling.

Nonverbal communication, including bodily mirroring reactions, allows mother and baby to engage and understand each other (Trevarthen 2009). The infant has a means of expression and of sharing his interest in what's around him.

Eye contact and gaze

How and where the eyes look, the dilation of the pupils, and the rhythm of making eye contact, are all significant. Another person's eye movements and the direction of their gaze fire up the insula, so we have emotional reactions (Cozolino 2006). We depend on the eyes to judge others' trustworthiness, the right hemisphere detecting deceit better than the left partly because it pays more attention to them (McGilchrist 2009).

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Facial expression

The face is the main way we communicate our feelings and read others' feelings. Muscles controlling face, eyes, mouth, head and neck are involved (Trevarthen 2009). Changes in facial expression also fire up the insula and trigger emotional reactions, and mirror neurons if our face reflects the same expression. The right orbitomedial prefrontal cortex is the key area for responding to facial expression; small facial changes can be mirrored by the observer's right hemisphere in less than half a second, outside awareness (McGilchrist 2009).

Gestures, postures, movements

'The body doesn't lie'; our body language is usually a good reflection of our real feelings and attitudes. We take in others' body language, gestures, the speed and variations of their movements, including of their hands (Trevarthen 2009). When we get our words wrong, our body may nevertheless give away what we really want to say. The right hemisphere expresses feeling authentically, while the left's speech may or may not be congruent with it.

Prosody

This means the rhythms, pitch, intensity and quality of the voice – intonation (Trevarthen 2009). Prosody conveys the feeling and real meaning behind our words, while our left hemisphere may try to say something completely different. Schore says "the right hemisphere is important in the processing of the 'music' behind our words" (2012: 38). When words and prosody are congruent, we communicate effectively.

Conversational habits

There are many aspects to how we conduct a conversation; they're biased to the right hemisphere and may contrast with what the left wants to say. They manifest in therapy, which is a good place to point them out. They include:

- *Intensity*: speaking more intensely than seems warranted, or with a lack of intensity that suggests emotional deadness.
- *Pace*: speaking so quickly it's hard to follow what the client's saying, or so slowly that he seems half-dead.
- *Taking turns*: who speaks first, who has the last word? When the client speaks, at what point does he pause and allow you to respond? Some people don't pause, as if they don't expect us to respond helpfully.

Others say something and then stop prematurely before we have a sense of how to respond. If someone replies before we've finished speaking, they may be hearing us with just their left hemisphere rather than *really* listening with their right.

- *Coherence*: clients may leave us with the sense of a coherent story, or not. A lack of coherence may reflect fragmentation and dissociation in their right hemisphere.

These habits may lie outside awareness until the therapist brings them to the client's attention, expressing curiosity without judging or interpreting. The therapist can speak from her felt sense of the dialogue, and be mindful of her own conversational habits.

Attachment

Relating starts with attaching to mother, and babies are born primed to attach. They seek interaction with others but turn away if they feel overwhelmed, or freeze if they feel endangered (Gerhardt 2015). They influence mother as much as she influences them, by seeking to engage and by smiling. Mother gets a lot of attention when we discuss attachment, but babies also form attachments to others, including their father – so 'mother' here means the actual mother and others in a mothering role.

Newborns start out with their brainstem reflexes ready to kick-start attachment. They smile, imitate mother's facial expressions, and try to make her feel good. Their embryonic social engagement system means they can experience polyvagal safety, danger or life threat. Subcortical areas get them started, and then the cortex gradually takes over as the brain develops. Brainstem reflexes are replaced by the frontal lobes, especially the right, and voluntary control of social engagement behaviours becomes possible.

Attachment experiences organise the growing pathways between cortical and subcortical areas (Schore 2012). Babies form working models of attachment in implicit memory networks biased to the right brain. Attachment supports healthy neuroplasticity (the number of synapses peaks in infancy) and brain development; poor attachment can hinder them. Enjoyable interaction aids the healthy development of their biochemistry and sympathetic nervous systems, stimulating oxygen consumption, energy metabolism and gene expression.

The right hemisphere develops faster than the left in the first 18 months, weaving attachment together with affect and somatic regulation (Schore 2012). Facial expression facilitates this: "emotionally expressive facial expressions between mother and baby in the child's early maturing right hemisphere means that, long before the infant either comprehends or speaks a single word, it possesses an extensive repertoire of signals to

communicate its internal state", McGilchrist says (2009: 108). Disapproving or angry looks trigger unhealthy parasympathetic activation, with lower blood pressure, shallow breathing and shame (Gerhardt 2015).

Enjoyable interactions release endorphins in the brain, and a good attachment relationship is an "endogenous opioid addiction" (Panksepp 2012b). They relieve pain and stress, bringing feelings of well-being and pleasure. "Babies love opioids, and presumably their mothers, because of the feelings of warmth and safety produced by these molecules", says Lewis (2012: 133). Breast milk contains endorphins, and they're released with soothing touch and holding.

Rewarding attachment experiences also boost oxytocin and dopamine, both of which contribute to warm feelings (Cozolino 2010). When babies are stimulated, they produce more dopamine and noradrenaline, which enhances their enjoyment and neural development. Plenty of dopamine primes them for approaching attachment, and everything else, with enthusiasm.

The quality of the attachment relationship affects the orbitomedial prefrontal cortex in particular, and the development of the vagal brake associated with it. One aspect of this is the regulation of heart rate: the more secure the attachment, the more regular it is (Porges 2011). Then the social engagement system can restore safety after moments of danger, and the frontal lobes can replace subcortical areas, especially the amygdala, as arbiters of neural life.

Attachment centres on communication between mother and baby that's essentially right brain to right brain (Schore 2012). Their left hemispheres are activated by enjoyable exchanges (the baby's isn't entirely idle at this point) and do focused attention, but the intuitive responding to each other arises in their right. Mother's right hemisphere appraises her baby's nonverbal communication faster than her left. Mothers tend to cradle their babies on their left side, which makes it easier to take in their emotional communication, since the visual signals go to her right occipital lobe and onwards to her right frontal lobe.

The right brain enables attachment to grow in "episodes of mutual gaze" in which "mother and infant engage in intuitive and nonconscious facial, vocal, and gestural preverbal communications", says Schore (2012: 228). Attunement creates 'affect synchrony' in which their emotional arousal is matched. Periods of social engagement need to be followed by periods of disengagement for rest – there can be too much attachment (Fonagy 2010).

The inevitable misattunements and ruptures need to be followed by repair. Learning that positive feelings can be restored helps the child tolerate negative feelings and develop emotional security (Gerhardt 2015). Patterns of rupture and repair, comforting or its absence, become implicit memory. Self-esteem comes from learning that mother will comfort him when he's distressed.

Attachment patterns reflect neural networks from infancy in which implicit memories of interactions with mother are paired with feelings of safety and warmth, or of danger and fear. But they're not set in stone, since these networks remain plastic into adulthood (Cozolino 2010). A happy consequence is that parents who grew up with insecure attachments can nevertheless provide secure attachments for *their* children – the power of love to heal.

Secure and insecure attachments

Secure attachments form when mother is available and responsive to her baby and can use her right hemisphere to sense what he needs. His brain develops with good vagal tone and good integration across the three axes. His right hemisphere is imprinted with the implicit expectation that interpersonal ruptures will be repaired (Schore 2012). But if mother is engaged sometimes and withdrawn at other times, the attachment may be insecure. Her child may grow up with poor vagal tone, and his brain may develop with poor integration, leaving him with a tendency to either emotional reactivity or deadness (Gerhardt 2015).

In *avoidant* attachments, mother tends to be distant and rejecting, while her baby doesn't seek closeness or appear to be upset. He tends towards parasympathetic dominance, which manifests in avoidance of eye contact and little emotional expression, as he learns to suppress his feelings lest he upset or anger her. He may also appear calm when his heart rate is high (Gerhardt 2015).

With *anxious-ambivalent* attachment, mother may oscillate between overstimulating her baby and neglecting him. He may be hyperactive, tending towards strong sympathetic arousal which manifests as irritability, dependency and acting out. He may cling to her and seek attention (Gerhardt 2015). He becomes over-sensitive to his mother's feelings, and insensitive to his own. As an adult in therapy, he may keep returning to his parents, still looking for safety as an adult despite the accumulated evidence that he won't find it with them (Cozolino 2010).

In *disorganised* attachments, mother may feel devoted to her baby but struggle to be emotionally available and responsive, often because of her own unresolved traumatic childhood (Gerhardt 2015). She may be unpredictable, sometimes dissociating and other times getting too close to him. Often frightened by her, his social engagement system may not develop, leaving him in a helpless but dependent state, prone to fight-flight or freeze reactions in relationships. Such chaotic behaviour is better understood as a sign of hyper-arousal rather than as a coping strategy.

These attachment styles aren't mutually exclusive, of course. They become biological structures that affect how we respond and react in our relationships. The therapeutic relationship is a fresh attachment experience,

and the client's original attachment to mother is often central to the work, whether it's addressed explicitly or implicitly through what transpires between therapist and client. There's time and space to repair ruptures and misattunements. Incursions into polyvagal danger and life threat states can be explored if there's enough safety and trust in the relationship.

My own experience of therapy was ultimately of being gazed at, and responded to, calmly, kindly and approvingly, in stark contrast to my mother's tendency to lurch from idealising me to becoming fearful, angry and disapproving. It was only then that I was able to settle happily in a long-term relationship.

What social brains do

There are some common phenomena in the social life of brains (and bodies) that may appear in any relationship, whether the original attachment relationship, the therapeutic relationship or any others. Some of the terms come from the neuroscience and psychology worlds rather than the therapy world.

Resonance

Underneath our focused attention to others is the emotional effect we have on each other. 'Resonance' describes this implicit communication between right brain-body ensembles. It results in people finding themselves in similar emotional places: enjoying a good conversation, getting into arguments, or picking up each other's anxiety. Resonance leads to 'atmospheres', and to the contagious nature of emotion whereby someone inspires us or a group descends into mass hysteria. It happens outside awareness, and can leave us wondering which feeling belongs to whom ("is this my sadness or your sadness?"). It determines whether we experience polyvagal safety or danger. Young children absorb their parent's feelings, whether positive or negative, and adults sometimes need self-awareness to protect themselves from being unduly affected by others' emotions.

Neuroscience ascribes resonance to our capacity for automatic imitation of others via mirror neuron systems. Cozolino describes 'resonance behaviours' such as mutual smiling or yawning as reflexive, implicit and obligatory (2006). Resonance is also called 'contagion'. Watt, for example, refers to "primitive emotional contagion" that's faster than the cognitive aspects of relating (2005). But is there more than imitation going on?

Resonance is fundamental to neural development. The infant brain uses it to link with adult brains: "the intrinsic regulators of human brain growth in a child are specifically adapted to be coupled, by emotional communication, to the regulators of adult brains", says child psychologist Colwyn Trevarthen (1990: 357). The adult's feeling towards the child

colours his emotional experience. "Resonance phenomena are now thought to play one of the most important roles in brain organisation", states Schore (2003a: 32). It underlies attunement in attachment relationships; enjoyable resonance states are part of secure attachment. Conversely, anxious parents are liable to have anxious children.

Resonance is a right brain to right brain phenomenon (Schore 2003). Mirror neurons play a role, as does the insula which links sensory perception with emotion and body. At the top of the neural hierarchy, resonance networks in the orbitomedial prefrontal cortex enable empathy and compassion (Siegel 2007). It's based on nonverbal communication, including movements that imply intentions.

Resonance happens whether we're aware of it or not. Therapists are trained to notice resonance effects, which evoke countertransference feelings and 'the feeling in the room'. Our frontal lobes can reflect on what we feel as we listen to a client, whose feeling it is, and whether and when to draw attention to such feelings. As Panksepp says,

> if therapists cannot assume an interpersonal stance in which they resonate with the psychic pain of the client, there can never be that sense of trust that is critically important for the healing touch ... to take hold in the client's mind.
>
> (2009: 14).

Attunement

Attunement enables a mother to intuit what her baby needs, and a couple to dance together. It allows us to 'feel felt' by each other (Siegel 2007). When this happens, we feel understood and the relationship feels alive, and neither partner dominates. Attunement builds on resonance, and if resonance evokes positive feelings, it flows easily. I have good memories of simple attunement exercises in workshops designed to break down the sense of separation from others – they evoked profound experiences of interpersonal unity.

Attunement is more conscious and less reflexive than resonance. It involves the prefrontal cortex with its inhibitory pathways to the amygdala that dampen anxiety. It also includes motor areas and mirror neurons, as it involves movements. It contributes to good neural integration and healthy development in the child (Siegel 2007). The right hemisphere is dominant for the implicit process of attunement; if we deliberately try to attune via our left, our right may undermine us.

Social engagement is facilitated by attunement, and neural integration flows from attuned relationships (Siegel 2007). Without it, we have to manage the effects of misattunement, compromising ourselves in vain attempts to attune, or acting out our frustration. Our left hemisphere then

defends against negative feelings in our right, rather than co-operating to pursue the rewards of social engagement.

Attunement happens through nonverbal communication. Facial expression, for example, allows us to attune faster than talking, and is important in infancy before we have language. It's part of a child's early right hemisphere development that enables him to express his emotional state (McGilchrist 2009). It also happens through touch, as mother attunes to her baby's visceral communication. Their attunement builds neural pathways in the child's right brain-body ensemble that last a lifetime. The success of mother-infant attunement in the first year predicts a toddler's degree of self-control when he's 2 years old (Cozolino 2010).

When misattunement happens, the rupture needs repairing for positive feelings to be restored. Some children experience a lot of misattunement and negative feelings, which sets up trouble for the future – or until other relationships and their own efforts enable them to learn the art of attunement (I think I've spent much of my adult life doing this).

Therapy offers the opportunity to experience better attunement. The therapist has to be flexible in attuning to clients who bring patterns of misattuning into the relationship. Some clients expect misattunement and are therefore defensive. They enter polyvagal danger states easily, or avoid going to places where they might. The therapist must adapt; for example, by listening patiently for long periods before giving feedback to the client about his nonverbal communication. Here lies the art of therapy: attunement can't be explicitly taught, but we absorb it in our own therapy and fine-tune it sitting in the therapist's chair.

Theory of mind

Theory of mind isn't about a grand theory of the mind, but the more humdrum matter of reading other people's intentions and motivations. If resonance allows us to be in a similar emotional state as another person, and attunement to enjoy social engagement with them, next up is mapping their mind. This is the realm of projection, and what we assume others are thinking. We get a sense of 'where someone is coming from', and anticipate what they'll say and do, what they know and don't know. Ramachandran thinks we "automatically project intentions, perceptions, and beliefs into the minds of others", and are able to "infer their feelings and intentions and to predict and influence their behaviour" (2011: 138). This starts outside awareness with our brain mapping others' minds based on nonverbal cues.

The term was coined from observing how primates read each other's intentions. Theory of mind can be seen in animals and birds that hide food from each other. Camels, goats, squirrels and pigeons have been spotted displaying it (McGilchrist 2013). It starts early in life: six-week-old babies

already have a theory of mind about the implications of people's gestures (Gazzaniga 2016).[11] A baby is figuring mother out from the outset, learning to guess from her facial expression and tone of voice whether or not she'll feed him or comfort him. Secure attachment enables theory of mind to develop and support social engagement, whereas insecure attachment can lead to the child imagining that others will reject him as his parent does, damaging his ability to form relationships.

Theory of mind, with its automatic nature, independence from language and roots in early attachment, is biased to the right hemisphere. Neuroimaging studies show it centred in the right frontal lobe and cingulate (McGilchrist 2009). But it starts down in the brainstem since it manifests in the first weeks of life as a visceral sense of mother's intentions based on her eye gaze, facial expression and tone of voice (Cozolino 2006). Later in development, cortical areas enable a more elaborate capacity for theory of mind to emerge. The involvement of the brainstem and the cingulate implies the body's involvement: theory of mind starts with the right brain-body ensemble and how another person affects us emotionally and somatically. Reasoning in our left hemisphere about what they're thinking is merely the icing on the cake.

Clients sometimes say shocking things that reveal wild inaccuracies in their theory of mind; for example, "you think I was to blame for my father beating me when I was a child". Responding helpfully to such seemingly bizarre statements isn't easy. The therapist has to manage her shock and reflect on the sort of scenario that might give rise to such a self-destructive theory of mind.

Empathy

Resonance, attunement and theory of mind are the ingredients for empathy. Resonance happens naturally, while the capacity for attunement may have been damaged in early childhood, and theory of mind may be prone to inaccuracy – hence the differences in people's capacity for empathy. I once worried that I lacked it, though working as a therapist has convinced me otherwise. It's clearly not something you can make up in your left hemisphere. Empathy implies not only that I'll feel something when I listen to you, but also that I'll respond with sensitivity.

Empathy brings together psychological capacities that enable us to sense not only what another person *is* feeling, but also what they are *on the edge of* feeling – and *may* feel if we respond sensitively. Cozolino says it requires "conceptual understanding, emotional attunement, and the ability to regulate one's own affect" (2010: 118). The latter ability implies the need to experience our own feelings without being overwhelmed by them.

It's a more conscious ability than resonance, attunement and theory of mind, although it may rely on unconscious perceptions. Cozolino (2006)

points out that we need an awareness of our own inner world while we imagine that of someone else. He describes empathy as a hypothesis we make about another based on our own visceral, emotional and cognitive perceptions. This accords with Damasio (2010) who thinks that since our brains map our body states, they can simulate equivalent body states in others. This implies that the better integrated our body state is in the workings of our whole brain, the more natural empathy will be.

McGilchrist (2009) places empathy in the right frontal lobe as an association area for signals from other areas that contribute to it. He adds a front-back dimension: the right frontal lobe tempers the immediacy of emotion and body in the right posterior lobes, and allows others to be mapped as separate individuals, like me but not me. So a sense of self and a sense of other are necessary for empathy – which involves the body, as we'll see.

As empathy is centred in the right hemisphere, it functions implicitly and isn't normally the focus of our attention. But in the therapy room, we notice it and make it explicit. I may find myself listening to my client, responding to the content while simultaneously allowing my empathic sense to come into awareness. At some point, something in that empathic sense wants to become foreground, so I change tack and say something about it.

Self and other

The difference between us is obvious to our eyes and ears. But in our felt experience in the background, things may be less obvious. If we talk and I feel sad, is that my sadness or your's? Are you 'making me feel sad'? What are we projecting onto each other, and who decides? Things can get messy.

The left hemisphere distinguishes between self and other easily, as in "I'm right, you're wrong!" For the right hemisphere that weaves together inner and outer worlds, however, it's less straightforward. Our sense of self develops in the context of attachment so, as Cozolino says, "perhaps the separation of self and other is always a dicey distinction" (2010: 315). This is reflected in the fact that the right hemisphere is responsible for both our sense of self and our sense of other that are rooted in attachment patterns and the implicit aspects of relating.

A network linking right frontal and parietal lobes enables the brain to distinguish self from other (McGilchrist 2009). The parietal contribution includes the body, and bodily feedback to our thoughts and feelings allows the brain to distinguish self-mapping from other-mapping. We're talking here of a *sense* of self and a *sense* of other, the sort of wholistic picture favoured by the right hemisphere. The frontal contribution includes the distance needed to distinguish self from other in our awareness so that others

stand out as individuals, 'like me' but also different. The insula, where body signals arrive on their way to the somatosensory cortex, contributes to the distinction (Cozolino 2006), as do mirror neurons with intentional movements, mine and your's (Ramachandran 2011). So a lot of neural resources, and the body, go into distinguishing the two senses.

From birth, our senses of self and other are coloured by our experience of polyvagal safety or danger. Implicit memory develops along social engagement lines or along defensive ones. Later in development, the left hemisphere starts thinking about the differences between ourselves and others. Abstract ideas about personality types may be added (Cozolino 2006). But the right brain-body ensemble continues to provide the foundation for relating: either we enjoy fluid social engagement based on hemispheric integration and sensing self and other, or we repeat left hemisphere routines which suppress these senses to defend against the unpredictability of relating that feels alive.

Self and other awareness in therapy requires both hemispheres and the mind-body connection. A client's lack of such awareness implies a lack of awareness of his body. Bringing attention to his body may increase his capacity for self and other awareness, and directing it to what's happening in the therapeutic relationship may improve his mind-body connection.

Boundaries

A sense of self and a sense of other enable us to have boundaries. A person 'with no boundaries' lacks such senses and his right brain mixes himself and others up, perhaps because someone didn't respect *his* boundary in early childhood. When we imagine we're feeling exactly what another feels, the sense of a boundary isn't present: this isn't empathy, it's identification and fusion. To create a boundary, we need to sense where it feels right to have one – a job for the right brain-body ensemble.

Intersubjectivity

Senses of self and other are accompanied by a sense of 'we', the quality of the relationship in the moment ("it feels like we're getting along well"). This is intersubjectivity, a shared field in which we can empathise and communicate while experiencing ourselves as individuals. We each have feelings and thoughts that may sometimes coincide and sometimes differ, and can sense the quality of our interaction underneath our words. Intersubjectivity allows for rewarding social engagement, and is coloured by implicit memory.

Relating starts with shared experience and develops into a sense of our own inner experience and that of others (McGilchrist 2009). The sense of a separate self emerges from relationship, sometimes promoted by

misattunements that get repaired. The shared intersubjective field of 'we' is centred in the right hemisphere, and bodily experiencing facilitates intersubjective processes because it enables the brain to distinguish self from other.

Intersubjectivity begins with what Trevarthen calls the "lyrical duet" between mother and baby, as their bodily mirroring helps them adjust to each other's sounds, gestures and behaviours (2009). The first task is the linking of his body and feeling with mother's responses so he can get his needs met and feel better. Intersubjectivity also enables him to learn playful games and, later on, learn about the culture he's been born into, as the intersubjective field becomes cognitive as well as affective. He learns what his parents know.

The intersubjective field is polyvagally coloured. "It is through this language of intersubjectivity that children learn from their mothers about the fundamental safety or dangerousness of the world", says Cozolino (2010: 184). Intersubjectivity flourishes in an atmosphere of safety; danger in the attachment relationship may lead to rigid defensive states lacking intersubjectivity. Our experience of intersubjectivity becomes etched into networks of the right brain-body ensemble. Schore says "the essential biological purpose of intersubjective communications ... is the regulation of right brain-mind-body states" (2012: 40). If we can't regulate each other, intersubjectivity evaporates, and we get locked into defending against polyvagal danger and interpersonal stress.

A relationship that feels alive is one where each person's left hemisphere welcomes the intersubjectivity of the right. It feels rewarding, rather than a dull ritual that protects against danger. You can be yourself, I can be myself, and we can enjoy social engagement – spiced with the risk of occasionally tasting polyvagal danger.

A good therapeutic relationship enables a person's capacity for intersubjectivity to grow, and deep and difficult issues to be addressed. Explicitly or implicitly, both bring their senses of self, other and 'we' into the interaction; perhaps the content doesn't matter so long as there's an intersubjective process. This may lead to 'edgy' moments of polyvagal danger, where the therapist asks the client to check whether, really, he feels uncomfortable or threatened. She must keep the relationship sufficiently grounded in safety for the danger places to be processed ("when you said that, I began to feel anxious"). If things become wholly dangerous, the intersubjective field is lost.

Projection

Projection, an aspect of anticipation, is automatic and reading others' minds is instantaneous and obligatory (Cozolino 2010). We can go with first impressions or patiently allow a deeper sense of other to form.

Inevitably our brain puts what we know about ourselves into this, below the radar, so we think we see in another what's really in ourselves. We understood this as schoolchildren when we retaliated to taunts with 'it takes one to know one'. To know ourselves, we should notice what we think of others.

Projections can become routine ways our left hemispheres relate. But if we listen to the senses of self and other in our right brain, we have a more nuanced picture of others and can withdraw faulty projections. Safety and social engagement are needed, as feeling threatened tends to cement the projection in place. We may *think* we're making good intuitive assessments of others; maybe we are, but it's better when they agree with us. Sometimes we get into strange interpersonal situations where we find it hard to distinguish a projection from an accurate perception of the other that they don't accept. Beware the certainty of the left hemisphere!

In therapy, the therapist thinks it's the client who projects. This isn't unreasonable if she allows her felt sense of him to unfold gradually, session by session. Therapists often think of projection as a defence mechanism, but since it's automatic, this is questionable. However, when it's repetitive and he avoids the intersubjective field where he might see both the therapist and himself differently, it's clearly defensive.

The therapeutic relationship

Therapists usually agree that the therapeutic relationship is the key to therapy. A trusting alliance enables therapy to work irrespective of the 'approach'. Empathy and compassion work their magic in the background, creating a relationship conducive to neuroplasticity and supportive of the client in tolerating the stress required for neural reorganisation (Cozolino 2010). At the same time, the emotional dynamics between client and therapist tend to mirror those in the client's attachment relationships. The therapeutic relationship is an opportunity for his emotional vulnerability to interact with the therapist's emotional availability (Schore 2009).

Explicit content and implicit engagement

Talking therapy focuses on the explicit content the client brings, but in a context of implicit engagement of two social brains. Therapy provides a regular time and space for the client's background relationship patterns to become foreground and be addressed. Attention can be drawn to the intersubjective field of bodily and emotional experiencing. Insecure attachment patterns can be healed in the secure attachment available in therapy, and the client's senses of self and other brought to awareness and reality-checked ("as you talk about this, I feel I'm not being very helpful").

Schore says the therapist's capacity to address implicit communication requires her to be in a state of right brain "receptivity" (2012). Such receptivity means responding reflectively: not arguing back or withdrawing, not rushing to judgements, and not taking remarks personally. Therapists hear things that are uncomfortable, challenging, and that they would rather not hear – *really* listening isn't easy.

Left and right hemispheres

If the aim of therapy is better left-right integration, then therapist and client must engage both hemispheres in the room. Right hemisphere contributions can be examined, and therapists are trained to use *their* right hemispheres to notice felt senses and images ("my sense is this was really painful for you"). Therapy is where what transpires between right brain-body ensembles can be safely explored; "the right hemisphere is dominant in treatment", says Schore (2009: 128). Exactly *what* the therapist says to the client may matter less than her *manner of being* with him, especially when he feels vulnerable.

While the left hemispheres talk to each other, the right hemispheres communicate nonverbally. Although the therapist's life isn't discussed, her feelings and attitude are conveyed to the client. "Implicit right brain to right brain intersubjective transactions lie at the core of the therapeutic relationship", says Schore (2012: 39). The therapist can notice her own nonverbal signals and their effect on the client. She can notice his nonverbal signals while she listens – his body language, facial expression, eye contact, voice prosody, conversational habits, narrative coherence – and their effect on her. She can make her impressions and feelings explicit when it feels right ("I notice you looked away while you told me that").

Polyvagal theory in therapy

The client needs to feel safe enough, and so does the therapist. Effective therapy must be rooted in social engagement, from which a 'blank screen' may detract. The therapist's efforts to attune to him can create a safe atmosphere where the threat of rejection is minimised (Cozolino 2010). It becomes possible to explore danger and sometimes even life threat states together. The more social engagement, the less need for concern over psychopathology and diagnosis.

How the client perceives the therapist depends on his autonomic state in her presence. If he feels threatened, he may go into danger and enact fight-flight or freeze behaviours; if very threatened, he may go into life threat and dissociate. The therapist must tread carefully since what works in safety may not work in danger or life threat. Many people seek therapy because close contact with others triggers danger or life threat. "If the

individual is in a state of mobilisation, the same engaging response might be responded to with the asocial features of withdrawal or aggression", states Porges (2011: 278).

The therapist can influence the client's neuroception but not control it. If her social engagement system is easy to access, then "reciprocal prosocial interactions are likely to occur", says (Porges 2011: 278). But tendencies to enter danger and life threat in close relationships will manifest sooner or later in the therapeutic one as unresolved emotional wounds and trauma are worked through. She has to tolerate moments of danger without withdrawing or becoming aggressive. The client's heart rate and breathing patterns may make him feel intensely uncomfortable, and her job is to make these moments bearable.

Transference and countertransference

Transference is what the client's right brain 'transfers' onto the therapist, namely his unconscious expectation of her response to him based on his early attachments. It's a projection, the nature of which depends on what happened in those attachments and the extent to which he's already become aware of it. Countertransference is what the therapist's right brain transfers onto the client, supposedly conscious thanks to her training. It's her sense of self in his presence rather than a projection, thanks to her receptive state. So they're not really two sides of one coin, as these terms imply. My perception of someone is of a different nature if I want something from her and tell her *my* life story than if she wants something from me and tells me *her* life story. If countertransference was merely the therapist's projection onto the client, therapy wouldn't work.

Both transference and countertransference are right hemisphere mappings. The client's early implicit memories and attachment patterns are activated when he engages with the therapist (Cozolino 2010). When a client tells me I haven't understood him and is angry about it, or when he tells me how much better I am than his previous therapist, I smell transference and administer a large pinch of salt. Countertransference, on the other hand, refers to feelings and thoughts evoked in me when I listen to a client. When he leaves me feeling alive and engaged, or half-dead and sleepy, I take note and don't administer salt. My sense of him might be tainted by my past relationships, but the practice of therapy tends to minimise this. Client and therapist use their right hemispheres differently, and for different purposes.

The client's transference mapping may include old attachment dynamics he's unaware of and which haven't been integrated across left-right and front-back axes. In the brain's quest for better integration, they're enacted and the therapist can bring them to the client's awareness. To the therapist, they're distortions of reality. It's possible, of course, for the client to have a

'healthy' transference that sees her as she is – implying a secure early attachment and good self and other awareness.

Transference is important because it demonstrates the client's earliest struggles for love that aren't part of his autobiographical memory (Cozolino 2006). Clients often come to therapy with negative expectations of how the therapist will respond to them, and the therapist's job is to counter these expectations with patience and kindness, drawing attention to them. By listening to her countertransference feelings, she can make good guesses about the nature of her client's attachment to, most often, his mother. Transference and countertransference are royal roads to resolving problems in the right brain-body ensemble.

Projective identification

This happens when the therapist identifies with the client's emotional projection and reacts without troubling her frontal lobes to reflect on its meaning. A moment later, she has a disturbing feeling that says "whoops! I shouldn't have said that". A similar phenomenon happens in close relationships when people fall in love, the happy version, and when couples argue with mutual recriminations ("I didn't start the argument, you did!"), the unhappy version. Intersubjectivity goes out of the window. But projective identification is a technical term best reserved for a therapist's theoretical understanding of challenging emotional interactions in therapy.

It's a resonance-fuelled right brain to right brain nonverbal communication that bypasses both parties' frontal lobes. Both act out in a subcortically-driven manner, their nonverbal communication conveying strong emotion that leaves both in a dysregulated state. Therapists catch themselves speaking in a different tone of voice, shifting posture or making a gesture they don't intend (Schore 2012). Such moments are re-enactments of the client's attachment trauma in which mother reacted to his strong emotion with disorganised hyper-arousal, as if two babies were screaming at each other. They embody both the force of his rage and terror, and the therapist's difficulty in containing the enactment.

The therapist's orbitomedial prefrontal cortex goes 'offline', so she reacts impulsively, becoming fearful without realising it. Schore considers the interaction as essentially subcortical in both parties, enacting a 'deep unconscious' communication rather than a 'preconscious' one closer to awareness (2012). The challenge is to get the cortex back online as soon as possible to recover the situation.

Projective identification is part of how therapy works, with intractable attachment trauma erupting in the room, bringing the possibility of resolution. The client might attack the therapist with "you're not hearing me! I'm not coming again", and the therapist react angrily like a scolding parent with "I *am* hearing you!". The therapist is landed in trouble; she

must re-establish safety, reflect on what happened and make something useful of it. If the therapeutic alliance is poor, such moments can be damaging, but with sufficient trust, they can be breakthrough moments.

Conclusion

Relationships are powerful transformers of psyches – since half the brain beavers away in the background with the implicit aspects of relating when we're in company, this is unsurprising. A better polyvagal experience means more rewarding relationships and a happier sense of self.

Enjoyable relationships require the integration of the hemispheres, subcortical areas and the body. The right brain-body ensemble provides the implicit foundation for the left hemisphere's conscious efforts to relate. A solid foundation enables rewarding social engagement, while one weakened by unresolved attachment conflicts may divide the psyche and undermine the left hemisphere's persona.

Therapy involves drawing attention to implicit aspects of relating that affect the client's relationships. Enactments of old attachment wounds and traumas can be responded to with compassion, perhaps by offering comfort in places of deep distress where the client's implicit memory is of being rejected, or by the therapist not taking it personally when he acts out rage his parents were unable to withstand. Unhealthy relationships can be questioned to encourage reality-testing, while healthy ones can be supported. Sometimes I'm grateful to a client's partner who's doing most of the work, while I support the relationship by helping my client remain in it.

We all have a lifelong need to attach to others for companionship, support, physical contact, emotional regulation and a sense of belonging. Relationships are emotional experiences, and we need other people to acknowledge our feelings if we're to accept them. So, in the next chapter, we look at emotions and feelings.

Notes

1 People get excited about mirror neurons. Ramachandran calls them "the closest thing to telepathy nature was able to endow us with", and thinks they facilitated the rapid growth of culture and language when we emerged from caves (2011: 22). Some claim they demonstrate that brains can do empathy (we knew that anyway!). The capacity of infants to imitate faces and tongues early in life may begin in brainstem areas because of the relative immaturity of the frontal lobes and their mirror neurons at that stage (Trevarthen 2009).
2 Serotonin does different things in different areas of the brain because of the large number of different types of serotonin receptors.
3 Pert says endorphins were discovered by researchers at Aberdeen University who called them enkephalins, but when the Americans found out they rediscovered them and called them endorphins in an act of transatlantic one-upmanship (1997).

4 Oxytocin is sometimes labelled a neuropeptide. Panksepp says the idea that it's the hormone of love "has a few ounces of truth as well as, all too often, pounds of exaggeration" (2012: 249). He thinks oxytocin's effect is more about confidence than love.
5 Vasopressin is another hormone/neuropeptide.
6 The child's right hemisphere is biased for receiving mother's communicative signals, while his left is biased for giving, or being proactive, in communicating with mother (Trevarthen 2009).
7 'System' is used to refer to large scale networks in the nervous system, with particular neural pathways and neurochemistry, that it helps to think of as such in understanding the brain.
8 The ventral vagus is also known as the 'smart' vagus – it enables the smarter aspects of mammalian relating.
9 The brainstem area where dopamine release starts is the *ventral tegmentum*, which projects to the *nucleus accumbens* and from there to many places in the brain fuelled by dopamine (Sapolsky 2004).
10 Implicit memory is also called *non-declarative* or *procedural* memory.
11 Gazzaniga observes that "the field of developmental psychology keeps driving back the age at which babies reveal their cards" (2016: 337–338). It's as if the earliest signs of everything we take to be human can be traced back to the first weeks of life. And further down the evolutionary ladder too: for example, deception was a purely human trait until someone noticed that a species of crow was messing around with its food to stop other crows from stealing it (never underestimate a bird).