

Love in a scientific climate

By Roz Carroll

In the third of this series on neuroscience and psychotherapy, Roz Carroll considers how neuroscience can expand our understanding of the impact of the human face and differentiate aspects of love.

Many therapists are wary of the influence that science might have on psychotherapy. They are concerned with both the theoretical implications and the practical applications and the way psychotherapy is perceived in the light of new research. I believe that to make science useful to psychotherapy, we need to be selective about what we read. Only where there has been a considerable amount of assimilation and contextualisation done already by the authors can we begin to consider its relevance to the subtle processes of psychotherapy. Secondly, we need to deconstruct both the external and internalised hierarchies which get set up between science and psychotherapy. We need to dialogue as equals, not masochistically submit, or narcissistically appropriate or denigrate.

Scientific 'knowledge' is always provisional, political, and approximate. I think of the new models emerging from neuroscience as suggestive hypotheses to free associate to rather than fully established facts. What we have in common with scientists is our commitment to observation. Therapists, like scientists, are always engaged in constructing and deconstructing hypotheses – our own and our clients. Therapy involves weaving and re-weaving threads, undoing knots, and reviewing the pictures that emerge. Science is not as open-ended, but despite the need to declare results, substantiate hypotheses and so on, scientific discourse has no actual end point, no ultimately objective account.

Science is, however, inevitably concerned with accuracy and precision. In contrast, I am willing to be a bit 'fast and loose' with the models generated from research. There are risks of course in popularising science – not least exasperating scientists – still, words like adrenalin, progesterone, oestrogen, testosterone, opiate, DNA are part of our culture now. And more recent terms, like oxytocin and cortisol are increasingly familiar.

Neuroscience *is* offering new metaphors, and new metaphors can re-orient and re-frame our thinking about process, without excluding ideas from other sources. Any neuroscientific proposal depends on an implicit metaphor: for example we've moved from 'brain as computer' to 'brain and body as psychobiological state', a shift I find encouraging. In fact, for me, the touchstone of the relevance of a proposed scientific explanation for any psychological phenomenon is: is it congruent with my experience and does it expand my understanding?

Its on this basis that I want to summarize Allan Schore's hierarchical model of self-regulation, because it provides a neurobiological context for how people have an impact on one another. (Schore 2000) Schore's strength is in his ability to take a very wide range of research and integrate this with psychoanalytic theory into an overarching theory of development. He makes detailed proposals linking cognitive/ emotional/bodily developmental stages in an integrated way with precise accounts of sensitive and critical periods for brain changes. What follows is a very simplified version of his very complex and substantial model of development, which I use to consider the varieties of love/aspects of attachment.

The human face of science

Evolutionary arguments are often used in crude ways which deny the incredibly complex and life-shaping interaction which take place between individuals and the environment.

Schore really turns this bias on its head by insisting that the powerful innate genetically driven process of development is inextricably bound up with the attachment relationship, because, he argues, 'brain-mind-body' development is 'experience-dependant'. What is more, his model bridges the gap between theories which focus on reflexive responses, which are relatively primitive and unmediated expressions of instincts, and theories about the internalisation of an elaborate and complex social environment.

Schore's work emphasizes the powerful trajectory of development which is marked by radical shifts in brain organisation and the ways in which information is processed and stored. The key neurological sites for these levels of regulation include the amygdala (active at birth), the cingulate (on-line around 3 months), the orbito-frontal cortex (rapidly re-organising in two phases, 10-14, and 14-16 months), and the dorsolateral cortex (on line at 18 months). Interactions between self and other generate body states which become encoded and act as a representational system which influences future behaviour. These hierarchically organised areas of the brain all interconnect with each other and with the autonomic nervous system.

The sequence of these stages of brain re-organisations influence and are affected by the baby's experience of relationship. Through intricate and subtle aspects of interaction – or non-interaction - the infant internalises the mother, and/or the major caregiver(s), and through her the culture which has shaped the mother's way of being . One of the primary vehicles for this is the mother's face. Significant studies are confirming the depth and extent of the impact of facial expressions preceding the capacity for, and often overriding the experience of, verbal communication. (Bateson's double bind theory was the first to articulate the effects of incongruence between different aspects of perceived communications).

The infant is born with an interest in and sensitivity to expressions on faces. Meltzoff has shown that infants barely an hour old can imitate the facial expression of an adult. Initially appraisal is fairly crude – there is an inborn response to faces with fear or anger registered immediately via the amygdala. Within months, a baby can discriminate among surprise, fear, sadness and make corresponding faces of his or her own. At 10 months, the infant seeks out affective information from the partner's face to help them interpret the environment. (Beebe)

The mother's face has particular importance as a 'hidden biological regulator' of the infant. The mere perception of emotion on the mother's face creates a resonant emotional state in the baby. Dilation in pupil size, for example, which is associated with interest, engagement and pleasure, makes babies smile more. The expression on the mother's face triggers changes in the baby's own autonomic state, the felt body feeling. Studies suggest that expressions can be detected and a positive or negative valence put on them in under a 100 milliseconds (a percept must be held on line for 500 milliseconds to be conscious). The baby is responsive to every dimension of change – in the face, tone, body posture. Intense face to face transactions – traumatic or loving - becoming imprinted in long-term memory and act throughout the lifetime of the individual as an internal regulating object, whether consciously remembered or not.

Just today a client comes with a set of incidents which I suggest to him are related to the theme of gifts. Deprived of the gift of a mother's loving face, he is doubtful of his capacity to receive another's love, although he yearns for it. He has always found it difficult to make eye contact with me and for the first 15 minutes of the session, he doesn't look directly at me. He is frustrated with his friends' insensitivity to his feelings and his needs. When I point out that I have something to give him, he looks at me for the first time. Later in the session he remembers a dream – an encounter with a seven year old boy in a state of panic. They make contact – a long intense look which feels very loving. After the session, I

am so moved still by the emergence of this new intense experience in my client and between us, that I put my hand on my own belly and feel the wordlessness of it.

What kind of love is this? We could say it is welcome, recognition, a moment of meeting defined by what Sander refers to as matched specificities, that is, mutual adjustment and re-organisation. So far, so not very new, as far as psychotherapy is concerned. How can neuroscience help unpack this further?

Three tiers, three facets of love

The autonomic nervous system (ANS) maintains homeostasis and manages basic body/affect state changes. It used to be thought that the ANS had fixed functions and operated autonomously (hence its name), ie independently from the Central Nervous System. Interest in the ANS is increasing as its role in regulating the tides of energy, mood and feeling are mapped. Schore has focused particularly on the developmental process by which the ANS becomes more integrated within a hierarchy of brain functions. With good enough parenting the infant internalizes, through a neurobiological process of structuralisation, a range of self-regulating strategies. Environmental failures derail this critical process and leave individuals with life-long difficulties in managing feelings and relationships.

There are many internal and external cues which influence the ANS, but Schore focuses on three key areas of the brain which have a direct effect on its function: the amygdala, the cingulate and the orbito-frontal cortex. Each of these areas is a convergence zone for information related to learning from experience and each acts as a representational system. The amygdala governs basic survival responses – it attributes an immediate good (safe) or bad (unsafe) valence to sensory information. The cingulate is involved with shared pleasure, motivation, vocalisation and the beginnings of self-other awareness. It stimulates and is stimulated by social interaction. The orbito-frontal cortex is much more complex in its operations, and its development parallels the critical early phase of separation-individuation (6-18 months). As the infant matures with good enough parenting, the orbito-frontal cortex mediates and stores more elaborate, finely-tuned representations of qualities in its interactions with others. Whilst the baby responds spontaneously to the human face, the older child and adult will often be embroiled in a more complex relationship to faces, negotiating self and other, inner and outer, past and present.

The role of the amygdala is to make a rapid first assessment of an event – it triggers reflex actions such as the startle response. Its appraisal is crude, and related to survival priorities. Mapping the role of the amygdala has significantly advanced understanding of trauma. (Rothschild, Schore, 1997) Traumatized individuals are susceptible to over-activation of amygdala. In infancy safety is equated with autonomic equilibrium. When that is disturbed through hunger, waking, an urge for contact, the immediacy of the appropriate touch, taste, smell can forestall alarm. We could say that the amygdala monitors the adequacy of – in Winnicott's term - the environmental mother. In terms of therapy, a detail or fleeting expression on the therapist's face can trigger terror in some clients. Often the fear of looking at the therapist's face amplifies the projection. At such moments I will often invite the client to really scrutinize my face – the longer the gaze, the more likely they are to perceive the actual detail of my face and its expression. The cingulate mediates a very different level of interaction, which involves contact and play behaviours, laughing and crying, and making faces. Its activation around 3 months correlates with an expanding intersubjective sense. An fMRI study even implicates the cingulate in the anticipation of being tickled! The cingulate seems to be active during mother-baby 'proto conversations' and its critical period of onset coincides with the infant forming a discriminate attachment to the mother's face. The cingulate is also involved with pain and temperature regulation and may be responsible for the acute physical experience of pain related to loss of the attachment figure – the longing for the body of the other. In addition, feeling cold in

association with conscious or unconscious feelings of abandonment, may reflect a subtle breakdown of temperature regulation involving this social part of the brain and its connection to the ANS

The cingulate is involved in a more complex representation of body image – a mapping of motor and sensory elements of the body-engaged-with-another. It supports co-regulation of states, a sense of mutuality. Neuroscientists are suggesting that the cingulate has a key role to play in the infant becoming more aware of the other's state of consciousness. Apparently, the cingulate is relatively large in dolphin brains - perhaps this has some bearing on their social and sonar skills. (Panksepp, 334) Physical damage to the cingulate – as a result of a stroke, for example – results in a condition called akinetic mutism – the complete absence of motivation (not capacity for) moving or vocalizing. Damasio reports of such a brain-injured patient that when she recovered, she commented of her akinetic mute phase, “I really had nothing to say”. (Damasio, 73)

The amygdala influences the autonomic state which pertains to immediate safety or danger, and the cingulate modulates this via social responsiveness. The orbito-frontal cortex develops connections to the ANS in two phases: the first is about the infant's capacity to tolerate high levels of excitement and arousal (the wiring occurs in a critical period of 10-14 months); the second phase involves refining the capacity to modulate, slow down or inhibit impulses (this involves the emergence of a second circuit in the brain at 14-18 months) At the end of this major re-organisation of the brain, the orbito-frontal cortex will have – given optimal experience – added a new dual circuit of higher control and flexibility.

Schore calls the orbital cortex the ‘executive centre’ of the right brain, because of its role in more complex assessment of and response to incoming sensory information. As the orbital cortex is rapidly myelinating at 9 months, the infant becomes capable of ‘joint attention’, the ability to shift between an object and a person. The gradual maturation of this area – which is highly dependant on experiences within the attachment relationship - allows the infant to self-regulate on the basis of experience, with an embodied memory and able to manage more complex simultaneous processing.

So far, up to 18 months, all these levels of self-and-other representation involve a bodily sense combined with visual images, sounds etc encoding the interaction in a pre-verbal form. This hierarchy of key sites in the brain can modify the level of arousal, the orchestration of responses to stress, or pleasure, loss, frustration etc. Subsequently, the left cortex – involved with language and logic – comes on line at 18 months, adding the structural potential for a further level of representation and regulation. This evolution of the nervous system – which continues into adulthood, with further concentrated periods of change - supports the emergence of increasingly complex emotional (psychobiological) states.

With an increasingly detailed map of developmental sequences Schore and others have been able to formulate hypotheses as to how failures in the early environment have such detrimental long-term consequences. (1994, 1997) Experience is what activates the necessary re-organising of the brain and body: if the critical window is missed, such shifts are harder to initiate at a later date. The good news is that it is possible through psychotherapy – and other relationships – to generate sufficient appropriate experience to make change possible. Despite limitations in the technology for mapping the dynamic activation of the brain and body during psychotherapy, preliminary studies do suggest that amygdala, cingulate and orbito-frontal cortex are all engaged and structurally modified in the course of psychotherapy. (Schore, 1994, 468; Cozolino)

I haven't answered the question I posed myself in relation to my client: what kind of love is this? First I want to say that when I am sitting with a client I am not analysing which parts of the brain are being activated, but rather trying to be present in the relationship and in the

psychotherapeutic process. My client's history is one of severe early trauma, of violence and hatred on the mother's face, rather than loving acceptance. I think that 3 aspects of love – the experience of basic safety (amygdala), of social contact ('someone is out there and interested in me', cingulate) and relationship (anticipation, negotiation, boundaries between self and other, orbito-frontal cortex) – were highly compromised in this client's early life. In very heightened moments, I am sure that the brain as a whole is dynamically activated – just as we see the total animation in the body – and that quite possibly in the moments I described all 3 layers of the hierarchy are in operation.

Bibliography

Beebe, B & Lachman, F (2002) *Infant Research and Adult Treatment: Co-constructing Interactions* (Analytic Press, Hillsdale)

Carroll (2000) 'The Autonomic Nervous System: barometer of intensity and internal conflict' www.thinkbody.co.uk

Carroll, R (2002) "Intrinsic Potentials: Panic, Seeking and Play in Psychotherapy" (The Psychotherapist, 19, Autumn 2002)

Carroll, R (2002) Interdisciplinary Thinking; an introduction to some neuroscientists (The Psychotherapist, 18, Spring 2002)

Cozolino, L (2002) *The Neuroscience of Psychotherapy* (Norton, New York)

Damasio, A. (1994) *Descartes Error: Emotion, Reason, and the Human Brain* (Putnam, London)

Meltzoff, A (1990) 'Foundations for developing a sense of self' in ed.Cicchetti *The Self in Transition* (pp.139-164) (Chicago)

Pally, R. (2000) *The Mind-Brain Relationship* (Karnac,London)

Panksepp, J (1998) *Affective Neuroscience: The foundations of human and animal emotions* (Oxford University Press)

Rothschild, B (2000) *The Body Remembers: The Psychophysiology of Trauma and Trauma Treatment* (Norton, London)

Schore, A. (2000) 'Attachment and the Regulation of the Right Brain' *Attachment and Human development* vol 2, no 2

Schore, A. (1997) Early organisation of the non-linear right brain and development of a predisposition to psychiatric disorders' *Development and Psychopathology* 9 (1997) 595-631.

Schore, A (1994) *Affect Regulation and the Origin of the Self* (Lawrence Erlbaum, Hove)

Interview with Allan Schore, July 2001 'The American Bowlby' – www.psychotherapy.org

Trevarthen, C & Aitken, K.J. (2001) 'Infant Intersubjectivity: research, theory and clinical application' *Journal of Child Psychology and Psychiatry* vol 42, no 1 pp3-48