Cognitive neuroscience, metaphor and pictures: part 2

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Abstract
This paper provides a sense of the value of a 'cognitive' perspective to therapists when thinking about minds and situations that they encounter. As well as helping to establish knowledge, the science also offers a framework for critical assessment. The paper also aims to prepare the ground for future progress in our understanding of the value of metaphor or picture-based communications. This is part 2 of 2.

Key words
Cognitive neuroscience, metaphors, pictures, images, brain

The first part of this paper appeared in the previous edition of Mental Health Nursing (October/November 2019 issue).

Structures in the brain

The brain is divided into two asymmetrical halves or hemispheres. Each hemisphere develops in a rather specialised way, carrying out specific functions.

McGilchrist (2010) notes that the brain, like the universe, has no profound symmetry and is in fact profoundly asymmetrical. Generally both sides of the brain share similarities, with the exception of the hippocampus being in the left hemisphere and the amygdla being in the right hemisphere.

The brain has been described as having three layers that communicate in a left-right and back-to-front manner (and visa versa).

The oldest layer is the brain stem, which connects to the spinal cord, with the medulla oblongata regulating body functions (such as total peripheral resistance/blood pressure) and automatic and reflex actions (Voke, 1986).

This has been described as our 'reptilitan brain' (Carter, 2003), and is connected closely with the cerebelllum, our little or ancient brain, which has been superceded in modern humans by the cerebral cortex.

The second layer, the mid-brain, holds the parts that deal with emotion, such as the thalmus, hypothalmus, amygdla, and hippocampus – sometimes called the 'limbic system' or our paleomammalian brain (Carter, 2003). The mid-brain is densly connected to the orbitofrontal cortex (Wilkinson, 2006).

Emotions are the underlying mechanisms that create body states and actions. There is no action without a chemical synapse, and in order to prepare a body for specific action it is argued that there needs to be an emotion (Carter, 2003).

LeDoux (2002) notes the components necessary here are an emotion system, a memory system and a feeedback system from the body. Feelings are both stimulated by the mind and messages sent to the body and stimlated by the body and messages sent to the mind, with a sense of these being constantly monitored for internal and external stimuli (Carter, 2003).

Consciousness is suggested to be located in the the third layer, the cerebrum, cerebral cortex, neocortex or neomammalian brain (Carter, 2003).

The third layer enfolds the other parts of the brain with its densly folded thin outer layer and holds an estimated 12-15 billion neurones in its folds (Voke, 1986).

The cerebrum is divided into four lobes: the occipital lobe deals with visual processing; the temporal lobe deals with some aspects of memory, sound and speech comprehension (usually left hemisphere); the pareital lobe movement and sensation but mainly as the termination of nerves that have coded information for heat, pain, cold, touch and pressure and limb position; and the frontal lobes have responsibility for executive decision making (Voke, 1986; Wilkinson, 2006).

This sophisticated part of the brain is considered the humans' 'separateness' from other mammals. Associated areas include memory, intelligence, imagination and creative thought (Voke, 1986) and are not localised but involved in back-to-front and side-to-side inter-connectedness (McGilchrist, 2010).

The right hemisphere

The right hemisphere is more mature at birth, and grows quickest. It contains the amygdala, so processes the earliest experiences of the primary caregiver (especially in relation to the face and emotions).

The amygdala is on line at birth, involves the nature of good and bad, safety/danger and the startle reflex, and is sensitised to trauma (Carroll, 2005).

The amygdala is pivotal in processing threat and paralinguistic (e.g. facial) emotional stimuli (Beutal et al, 2003).

At three months the anterior cingulate is preparing the infant for socialisation, social contact and motivation to communicate. A suggested main need is responsive contact and acceptance (Wilkinson, 2005; Carroll, 2005). At this stage psychological proximity binds the infant's interpersonal relationships (Bowlby, 1969).

The corticolimbic and orbitofrointal regions of the brain are also associated with the regulation of emotion (Cappas et al, 2005).

If there are problems with the responses of others at this crucial stage, and as the brain is developing these 'circuits', the infant is necessarily vulnerable to environmental experiences, both positive and negative.

At 10 months of age the prefrontal cortex matures, enabling the baby to experience a more mature kind of relating, leading to self-regulation, to deal with experiences and shame.

Procedural or implicit memory is held here and encompasses automatic performance, disosition and non-verbal habits (Fuchs, 2004).

Furthermore, the right hemisphere stores emotions, appraises thoughts and ideas and is reflective, is dominant for awareness of the physical and emotional self, and has a key role in recognising and distinguishing the self from others (Wilkinson, 2006).

The left hemisphere

The left hemisphere matures later. By the age of 2-3, a child has increased linguistic and analytic ability, functions that are left hemisphere. It enables experience of agency, relating and of separateness. The left hemisphere also holds the hippocampus, which enables explicit or declarative memory.

Fuchs (2004) notes that the hippocampus is involved in a lifelong remapping of cortical networks according to the individual experiences.

The left hemisphere holds explicit or declarative memory, recording single experiences (ibid). Long-term memory processes are involved in the medial temporal lobe and prefrontal cortex.

Cappas et al (2005: 376) describe memory's action as 'an event takes place or information is learned, the hippocampus begins processing that information then becomes dependent on this structure until it becomes old knowledge, at which point it is organised in the neo cortex'.

For example the:

- Dorsolateral prefrontal cortex – considers thought and feelings, 'working memory', and assembles current and past experiences for working in the immmediate moment.
- Anterior cingulate and hippocampus – tag time and place to memory and assist in storage and retreival, thus having a role in the developing the social self.

The control centre

The prefrontal cortex is sometimes described as 'the thinking cap'. It acts as the emotional executive of the right brain as it has strong neural connections into the emotional systems located there.

The cortex is organising from 10-18 months of age in two phases: first, acting as an interface between cortex and sub cortex between the other (especially eye contact) and internal bodily senses, and second, enabling the individual to recover from disruptions of state to integrate a sense of self across states, allowing for continuity of experience (Carroll, 2005).

Communication systems and information systems

Communication within the brain is not one-dimensional, rather it is a martix of left-right and front-back inter-relationships.

Pathways include the 'dense network' of the thalamocortical system multi-meshed connections; 'long loop systems' that link the cortex to and from a set of appendages, the cerebellum, the basal ganglia (including the amygdla) and the hipocampus; fan-like systems that form pathways for the hormonal system; and major interhemisphere link routes like the corpus callosum enabling continuous exchange of information (Wilkinson, 2010).

> "Therapy must not only help develop insight but also restructure neural networks"

McGilchrist (2009) comments on this and the developments in neuroscience in general, that fMRI scans, while seeking to understand behaviour, thinking and emotion, set a 'bar' whereby activity is studied above it and therefore 'activity' is found to be localised to certain regions of the mind.

However, if one set the bar lower, one would find activity generally spread across the mind with 'hot spots' in certain regions.

Metaphors and the mind

It is important to note that the brain is acting always as a scaffold with respect to its components. Carroll (2005) notes that mental functions are necessarily correlated with interruptions, displacements and distortions in the organising processes of the body.

In order for change to happen and produce lasting effects, therapy must therefore not only help develop insight but also 'should arrive at restructuring neural networks, particularly in the sub cortical limbic system in order to alter motivation' (Fuchs, 2004: 480).

Furthermore, as memories can be modified when stored and retrieved, it is 'possible to shape the manner which painful experiences are remembered and integrated' (Cappas et al, 2005: 377).

Cappas (2005) goes on to discuss narrative therapy, whereby a dialogue is a thread that weaves events together, with the intention to revise these narratives through the process of therapy so the story is reconstructed to a more adaptive account.

Metaphors form part of our dialogue and it has been suggested that the way they work in the mind is on the divergence between the left (rational) and the right (creative) brain

(McGilchrist, 2009).

It is proposed they have a long-lasting effect, a mnemonic property, lasting longer than literal phrases (Ryena, 1996) and can be a conduit to material that has been buried (Bayne and Thompson, 2000).

Goncalves and Craine (1990) suggest that at the unconscious levels, knowledge is represented in analogical and metaphorical ways. The use of metaphors is suggested as a therapeutic tool to access and change tacit/unconscious levels of cognitive representation.

Some clients, and indeed some therapists, lean towards one or the other. What appears important is to recognise is that a person has the ability to comprehend both the metaphorical and the literal, incorporate imagination, and synthesise all of this, leading to growth and positive mental health (Welch, 1984).

Furthermore, if the metaphoric mind is acknowledged and worked with, there is less distinction between rational and metaphoric minds; there is only mind (Samples, 1976; Welch, 1984).

Pally (2000) observes that metaphors contain 'sensory, imaginistic, emotional; and verbal elements' and as such can activate multiple brain centres.

Metaphors can emerge to capture and convey our earliest experiences (Wilkinson, 2006; 2010). Only the right hemisphere mediates the capacity to understand metaphor (Mitchell and Crow, 2005; McGilchrist, 2009).

As our right brain is the earliest developing hemisphere, it follows that metaphors are stored and worked with in that hemisphere when processing metaphor, particularly when novelty, creativity and imagery are involved (McGilchrist, 2009; Wilkinson, 2010).

This logic is supported by the notion that a right hemisphere processing of metaphor activates particularly when novelty, creativity and imagery are involved and can involve specialisation of emotionally charged words (Ortigue et al, 2004).

Research into hemispheric action indicates the left hemisphere superiority for most semantic processing tasks, whereby figurative meaning is activated in the right hemisphere (Marshal and Faust, 2008).

Focus has been placed upon the processing of metaphors where retrieval may involve the 'retrieval of alternate, distantly related and even unrelated interpretations in order to process unusual or unfamiliar word associations' (Marshal and Faust, 2008: 103). The implication is that the differences between the left hemisphere and the right hemisphere enable complexity in comprehension.

Pictures and images and the mind

'A mental image is a pictorial representation, akin to a private photograph, from which one can derive information as to what it is an image of by observation' (Bennett and Hacker, 2008: 43).

People are in a daily dialogue with themselves in an attempt to create meaning through expression. One way of doing this, argue Loock et al (2003), is through the contents of their artwork.

As images and art can be an insight into a person's projections and personal perceptions, using creative expression could therefore be applied as a non-threatening problem identification experience (Loock et al, 2003).

Therapies can use imagery, referring to the capacity to imagine an object. It necessarily follows that a metaphor can generate an image, and a metaphor in a pictorial form is an image. The left hemisphere and right hemisphere mediate integration of imagery and emotion, in effect building a bridge between the 'Ikonic mode of the right and the linguistic mode of the left' (Cox and Theilgaard, 1987).

Various forms of imagery use distinct neurological pathways but in general use similar pathways to perception (Cappas et al, 2005). Again, it follows that the brain can affect emotions in processing non-verbal activity.

However, problems with imagery and location in the mind are less controlled and more difficult to interpret (Beutal et al, 2003). Wilkinson (2010: 193) notes 'the making of such pictures indicates a dawning, the ability to move from the concrete acting out of old trauma thought the transference to a more symbolic way of experiencing'.

In neural dialogue this reflects closely the views noted previously of reworking the mind's response to remembered trauma and relationships, and enabling a different response and action

McGilchrist (2009: 115) seems to tie this together in stating 'metaphoric thinking is fundamental to our understanding of the world, because it is the only way in which understanding can reach outside the system of signs to life itself. It is what links language to life', and later 'metaphor embodies thought and places it in a living context' (ibid: 118).

Although these are bold affirmations, the evidence seems to suggest significant importance in the role of right hemisphere activity in metaphor, with associated imagery being a vehicle to transport meaning across the hemispheres.

Summary

Gentner et al (2001) comment on metaphor being pervasive in language and thought, yet despite a considerable amount of research 'little is known about how metaphors are psychologically processed' (ibid: 199).

Current neuroscience and psychotherapy studies are identifying neural correlates, not only of mental disorder but also of therapeutic change (Fuchs, 2004). Hass-Cohen and Carr (2008: 50) remind us that 'sensory art therapy practices stimulate thalamic connections to and from cortical and sub cortical brain regions', and this seems to offer support for art-making in the therapeutic encounter to manage effect and stimulate neural connections.

The evidence from cognitive neuroscience seems to suggest that creative methods in psychotherapy can engage right brain activity within the therapeutic encounter.

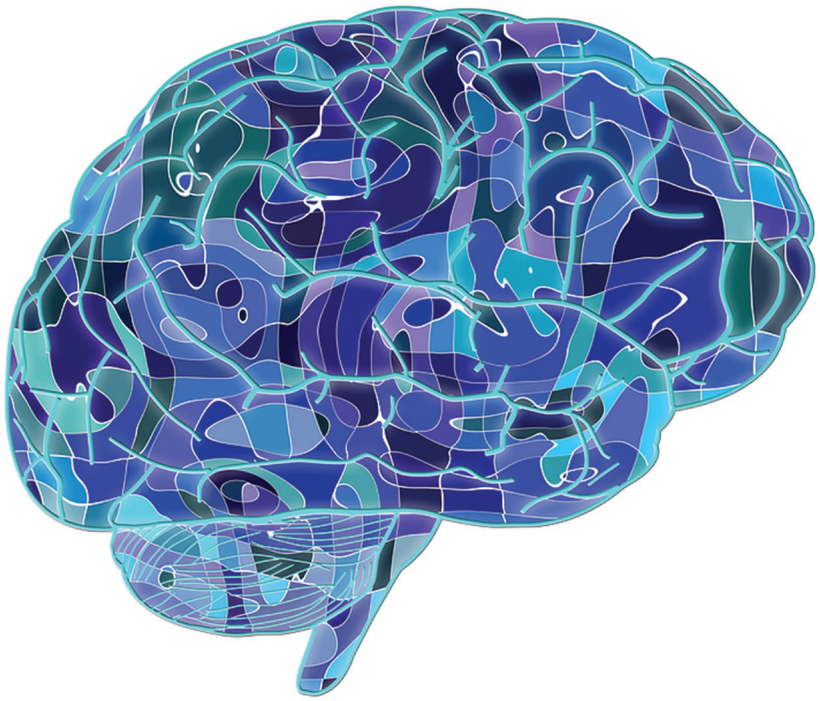
While the evidence is developing for right and left brain activity and up-down, front-to-back activity, there is still an assumption of the left brain

being rational and the right brain being creative. Client and therapists may lean towards one or the other.

What has been explored is the nature of metaphor and art as an enabler, using structures in the right and left brain to find a way forward for individuals in mental distress, as if enabling a new way of managing emotions.

Metaphor has many positive functions and can activate multiple brain centres. Equally art and visual metaphors use distinct neurological pathways.

We hope this review helps you in your thinking about practice and may encourage you towards creative endeavours and considering incorporating metaphor, pictorial metaphor and visual representations within your therapeutic encounters. ■



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