# Business Change Process, Creativity and the Brain

## A Practitioner's Reflective Account with Suggestions for Future Research

ROWENA M. YEATS[a,b] AND MARTYN F. YEATS[c]

[a]*Cognitive Evolution Laboratory, Harvard University, Cambridge, MA 02138, USA*

[b]*Psychology Department, Aston University, Aston Triangle, Birmingham B4 7ET, UK*

[c]*Frazier Yeats Associates, Brighton and Hove BN3 7NB, UK*

**ABSTRACT: Resolution of a critical organizational problem requires the use of carefully selected techniques. This is the work of a management consultant: facilitating a business change process in an organizational setting. Here, an account is provided of a practitioner's reflections on one such case study that demonstrates a structure for a business change process. The reflective account highlights certain affective states and social behaviors that were extracted from participants during the business change process. These affective states and social behaviors are mediated by specific neural networks in the brain that are activated during organizational intervention. By breaking down the process into the affective states and social behaviors highlighted, cognitive neuroscience can be a useful tool for investigating the neural substrates of such intervention. By applying a cognitive neuroscience approach to examine organizational change, it is possible to converge on a greater understanding of the neural substrates of everyday social behavior.**

**KEYWORDS: functional magnetic resonance imaging; business change process; creativity; social behavior; affective states; social cognitive neuroscience; organizations**

## INTRODUCTION

Management consultants are often approached by senior organizational management teams to channel such groups through a difficult or "wicked"

Address for correspondence: Rowena M. Yeats, Psychology Department, School of Life & Health Sciences, Aston University, Aston Triangle, Birmingham B4 7ET UK. Voice: +44(0) 121 204 3000; fax: +44 (0) 121 204 3696.
yeatsrm@aston.ac.uk

**Ann. N.Y. Acad. Sci. 1118: 109–121 (2007).** 
**doi: 10.1196/annals.1412.004**

problem.[1,2] Such problems are characterized by their "interconnectedness, complexity, uncertainty, ambiguity, conflict" and by their "societal constraints."[1] One example of a wicked problem concerned a senior management team in place to provide domiciliary care services to older people within a largely rural area of England. The team faced severe budget problems due to cost overruns occurring only part-way into the fiscal year. The primary implication of the continuation of this problem was a possible reduction in preventative services to vulnerable, publicly funded older people living at home. For these older people, a reduction in preventative services typically resulted in early admission to hospital with a consequent increased demand for already scarce resources.

The goal of the management consultant (M.F.Y.) was to facilitate a problem-solving process and, through this process, develop mechanisms to address the cost overrun. This was achieved by encouraging a natural thinking process in the senior management team through utilizing various techniques that extracted, as well as built, a platform for certain social behaviors and affective states to occur. Essentially, this method was intended to allow members of the senior management team to become sensitive to their own thoughts. This would then facilitate goal-oriented behavior using the available information produced by group reflections and decisions about the problem.

This case study is presented to demonstrate a business change process and to highlight the manner in which certain affective states and social behaviors emerge as a result of the techniques used for the business change process. Existing cognitive neuroscientific research into these affective states and social behaviors is then discussed in light of the case study.

## THE PROBLEM

A local social care senior management team was allocated a budget of approximately £1.5 m (approx US$3 m). Partway through the fiscal year this budget was approaching a significant overspend.

### *The Problem Definition*

A problem trigger occurs when a combination of events and indicators reaches a response threshold.[3] The trigger is not a problem in itself, but suggests that a problem exists; this, in turn, can lead to a fuller diagnosis. By applying a problem trigger analysis, it is possible to break down and identify the individual components that constitute a negative organizational situation.

The use of a problem trigger analysis assisted the management consultant in the present case study in two ways. First, it enabled clarification that the budget overspend was not the problem—it was merely the symptom. Second, given the extent of this symptom, it highlighted the urgency of further work on problem definition.

## THE IMPORTANCE OF TECHNIQUE

To solve organizational problems, clearly defined procedures or problem-solving techniques must be designed to facilitate specific goals or outcomes. Such problem-solving techniques smooth the process of gathering information, mapping situations, generating ideas, and choosing among ideas. One technique, on its own, is generally not enough to solve an organizational problem, given the inherent complex nature of such problems. It is therefore essential for the contribution of any one technique to be viewed as playing its own distinct role, as well as a role within an overall problem-solving process. For example, the problem trigger analysis, as a problem definition technique, indicates that a problem has arisen. However, this is only the starting point—a range of other techniques must be utilized to reach a resolution.

### *Technique Selection*

Within a business change process, it is important to structure the choice of techniques to ensure that problem solving remains the central focus. Structuring this choice can hinge on both established methods and personal intuition.

A four-component model drawn from Backoff and Nutt (1988), Checkland (1981) and Martin (2000) on behalf of The Open University Business School was used to select the techniques for the present organizational problem.[3–5] The first component of the model is *functionality*; this has to do with the identification of the functional requirements for a solution, such performance and fitness for purpose. Second, *innovation* is the need for a solution to be new in some respect; it must be perceived as a change by members of the organization. Third, *feasibility* is the solution's ability to satisfy objective constraints in terms of being technically and organizationally deliverable. Finally, *acceptability* is the solution's ability to meet stakeholder criteria, such as belief systems, cultural acceptability, and consistency of company image.

Individual differences in problem-solving style have been attributed to personal preference for particular stages of the solution.[6] A kind of favoritism among solution stages. For the present business change process to occur intuitively, the value of experimentation and innovation was clear. Techniques intended to channel and develop a full problem description were first chosen by the management consultant.

## MANAGING THE BUSINESS CHANGE PROCESS

The management consultant must address logistics, communication, progress control, emotional support, containment, inspiration, and role modeling. In the present case study, a problem-solving group was selected by the

management consultant with the help of the overall manager for the service. The problem-solving group comprised the 15 or so senior managers concerned with the assessment for and delivery of domiciliary services for older people within the geographical area. The group session was held offsite in a room with an atmosphere and appearance different from that of the normal working environment. The location of such sessions is of crucial importance and should be selected to promote the idea that this is the place for doing things differently.

In planning and execution, the management consultant allowed room for flexibility to maximize and use the creativity within the management team. An effective creative team generally comprises a blend of characteristics.[7] The blend of styles is important for creative teams. A variety of approaches can be employed to address a given problem, and any tensions generated within the team often result from a mix of inharmonious approaches.

The present business change process was shaped around a set of four principles that can encourage creativity: curiosity, forgiveness, love, and a sense of direction.[3,8] Curiosity allows us to stimulate a need to examine, enquire, challenge, and understand. Forgiveness ensures that curiosity will be uninhibited as the dead ends that are part of all exploration must be accepted. Love allows us to genuinely value the people involved in the problem to provide the scope for confident exploration and learning. Finally, a sense of direction ensures that, overall, work appears to be moving in a meaningful direction.

## TECHNIQUE APPLICATION

### *Story Writing*

Story writing is a creative problem solving technique that encourages access to intuitive responses, such as underlying motives, personal agendas, and understandings that might not easily be put into words.[9] Story writing involves creating a story or parable that is clearly fictional but that also has some relationship to the actual circumstances behind the problem.

In the present case study, the management consultant suggested that the participants prepare, in advance, a description of the problem under discussion as a story or a fairytale. Each participant was then asked, as part of the same exercise, to identify his or her own character in the story and then to identify the remaining characters. The purpose of this exercise was to encourage participants to go beyond the traditional framing of the problem, and to think outside the box. This exercise also enabled participants to experience role-taking, as it allowed them to arrive at an understanding of the problem from various points of view. An extensive body of literature exists on the cognitive neuroscience of role-taking, and this is discussed below.

### *Rich Pictures*

The rich pictures technique[5] provides a way to consider the relationships among objects, and thus helps a management consultant gain an understanding of the problem. In this way, rich pictures supplies a useful means of capturing the elements of unstructured situations. The technique was adapted to the present problem-solving session. Thus, the group spent 30 minutes using finger paints and play dough to express, in alternative media, the various aspects of the problem.

During group facilitation sessions, it is of great importance for the management consultant to engage as much as possible in the exercises. The rationale is that colleagues will be more inclined to do something unconventional and unusual in an occupational setting if the facilitator is also seen engaging in the process.

### *Multiple Redefinition*

Multiple redefinition[10] is designed to help users develop imaginative and original redefinitions of the problem and its context via a set of questions that systematically take the participants through different mental modes, such as empathic and analytic. The purpose of using this exercise in the present case study was to build upon the rich pictures exercise[5] and to challenge assumptions and predispositions surrounding the problem. This further encouraged an examination of alternative views of the problem.

Participants were asked to work on their own to complete predefined statements such as, "if I could break all laws of reality (physical, social etc) I would try to solve it by. . .. "

### *Developing a Balanced View*

In the Fishbone Diagram technique,[11] participants draw a horizontal line representing the issue to be discussed. Spurs are then drawn at 45 degree angles, one for every likely cause of the problem. Subspurs are added to represent subsidiary causes. This approach, which is intended to structure the process of identifying possible causes of the problem, has been developed to facilitate a complete and balanced view of the problem, involve the whole group, keep everyone focused on the problem, and show the relative importance of, and interdependencies between, the different parts of the problem.

The significance of this exercise for the present case study was in the definition of the problem. The result of preceding work moved the group forward, from seeing the problem in terms of a budget overspend to perceiving it as a lack of a system for managing resources. As the work

progressed through the four techniques, the participants began to break down the problem to its constituent parts—these were discovered to be information technology, the budget, managing expectations, workforce planning, vision and clarity, and the commissioning of preventative services for older people. Once the components had been clarified, they could be thoroughly investigated to bring about resolution of this organizational problem.

Because the business change process is facilitated by highlighting certain social behaviors and affective states, it is reasonable to consider such phenomena in light of relevant cognitive neuroscience research. By identifying the cortical substrates that are implicated in the business change process, it would then be possible to see whether there is overlap with or distinction from networks highlighted in contemporary cognitive neuroscience investigations. Subsequent investigations could then examine whether, and to what extent, activity in these networks is modulated by the specific interventions prescribed by a management consultant. This is important to know because it could facilitate the design of more efficient interventions. Although numerous examples exist of the contributions of cognitive neuroscientific investigations of social and affective processes, the contribution of cognitive neuroscience to the organizational world is less evident.

## COGNITIVE NEUROSCIENCE AND THE BUSINESS CHANGE PROCESS

Using a management consultant's reflective account allows the business change process to be broken down into its constituent parts, in this case the principles upon which it was based: curiosity, love, forgiveness, and a sense of direction. Among other components of the business change process were role-taking extracted by the story-writing technique and empathy extracted by the multiple redefinition technique. By taking these elements from this case study, the cognitive neuroscientific approach can then be applied as a powerful tool in this research area[36] and in light of this is discussed below.

### *Role-Taking, Morality, and the Frontal Lobes*

The importance of role-taking within the present business change process case study was demonstrated by its use within a problem-solving technique. Story writing[9] used role-taking to help participants arrive at an understanding of the problem from various points of view. Investigation of the neural correlates involved in role-taking could enhance understanding of the overall neural network involved in the business change process.

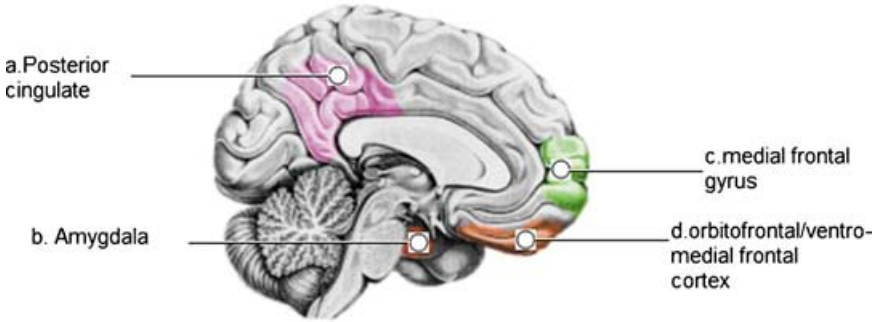


**FIGURE 1.** Sagittal image of the human brain indicating the proposed regions implicated in the business change process. Adapted from Ref. 15.

Role-taking can be used to make social judgments. Damasio has examined social judgments and their neural basis using patients with neurological injuries.[12,13] The focal damage of these patients was found in the ventral and medial areas of the frontal lobes (see FIG. 1). Damasio has demonstrated that this damage led to the patients' inability to use emotions to guide their intuitive responses. Patients with this type of frontal lobe damage have shown poor performance in tasks thought to replicate ecologically valid decision-making.[14] Tasks related to role-taking and integrating emotion into decision-making, such as intention assigning, have been related to the medial frontal gyrus (FIG. 1) and, in particular, the paracingulate sulcus.[15] These frontal lobe areas appear to be important in integrating emotion and intention assigning; therefore, they may also play a part in role-taking abilities.

Moral judgments also highlight the importance of role-taking. Lawrence Kohlberg's cognitive–developmental approach considers developed moral judgment to be a result of moral reasoning that stems from an understanding of and familiarity with role-taking.[16]

In light of this research, neuroimaging techniques should be used to measure activity in the ventral and medial areas of participants' frontal lobes while they carry out tasks with an occupationally based role-taking focus, along with baseline measurements. Identification of the overlap between role-taking as a social and organizational behavior can then occur.

### *Empathy and the Anterior Insula*

Building on the importance of role-taking within a business change process, empathy has also been described as a key window into organizational behavior. Tudor Rickards's multiple redefinition technique[10] used empathy as one of a set of mental modes extracted from participants to help them arrive at original definitions and alternative views of the problem.

One can appreciate the mental states of others without necessarily engaging personally in this mental state; this ability is reflected in role-taking, However, true empathy is present when one's affective state is identical to that of another individual and is elicited by the observation or imagination of another person's affective state.[17] Empathy seems to take role-taking to the next level.

Neuroimaging techniques, such as functional magnetic resonance imaging (fMRI),[18] reveal functional overlap in brain areas that are activated when participants are exposed to the emotional state of others and when they experience that same emotional state themselves.[17] This suggests that a shared affective neural network is central to our capacity to empathize.

Additional studies of affective neuroscience have focused on the importance of modulation of the empathic state. Confederates acting fairly, when seen as being in pain, elicited empathy-related brain activation in participants in the anterior cingulate cortex and anterior insula.[19] Only male participants displayed a lack of this activation while observing the unfair confederates in pain; instead, seemingly due to the desire for revenge, they showed activation in the nucleus accumbens, an area which has been linked with reward.[19] Investigators found a positive correlation between this activation and the expression of a need for revenge by the male participants. This research not only implicates distinct substrates in the mediation of personal empathy, but also highlights a possible interaction with the experience of social morality.

It can be argued that we evolved empathy as a way to achieve social cohesion and communication.[17] Clearly such a process would have great utility in an organizational setting. Findings here suggest that the anterior cingulate cortex and anterior insula are involved in the empathic state and should be the focus of investigations of this process in a business change intervention. Empathy can help one understand the motivations of others;[20] this suggests that empathy is crucial to the business change process. By understanding the motivations of others, one can help change the organizational behavior of individuals where necessary to make it more advantageous in the work group.

### *Forgiveness and the Cingulate Gyri*

The relationship between empathy and forgiveness remains contentious.[22] Forgiveness, defined in a broad sense as "ceasing to feel angry or resentful toward another",[22] is one of the key principles that encompass the capacity to encourage or discourage creativity in an organizational setting.[3,21] Without forgiveness, the possible outcomes that may arise from curiosity, as one of the four principles that can encourage creativity, may be inhibited and hence may inhibit the business change process.

Along with empathy, forgiveness has been portrayed as playing a central role in social cohesion.[22] Areas of brain activation involved in forgiveness and

empathy include the left superior frontal and posterior cingulate gyri (FIG. 1).[22] In one study, patients suffering from post-traumatic stress disorder showed a significant increase in activation engendered within the posterior cingulate gyrus once eradication of their symptoms occurred.[23] Interestingly, a study found activation elicited by both empathy and forgiveness in the left superior frontal gyrus, as well as the orbital frontal gyrus and precuneus. This overlap in the superfrontal regions supports the idea that empathy and forgiveness, as cognitive processes, may share a common component.[22]

An integrated model proposes a three-stage forgiveness process. First, in the motivational stage, a decision of whether forgiveness is suitable is made. Second, if forgiveness is deemed suitable, a level of forgiveness is decided upon, from false to complete forgiveness. Third, intrapsychic and interpersonal challenges are completed; these include awareness in the forgiver that the process of forgiveness has happened.[24]

A model has been mapped to network of cortical regions. The amygdala is at the core of the model because a fear response in the amygdala is activated in response to thoughts regarding the act to be forgiven. A fitting event will then cause the frontal cortex to stifle the amygdala's fear response, which then causes muscular relaxation; this, in turn, indicates to the cortex that forgiveness has occurred. Subsequent memory pathways to the amygdala are inhibited.[25]

Understanding the nature of forgiveness in an organizational setting can act as both prevention and cure; thus, knowledge of forgiveness at a neurological level is extremely beneficial. Ensuring that others know they are in a safe, forgiving environment prevents stifled behavior in a creative setting. A greater understanding of forgiveness, which can be achieved through a social cognitive neuroscience approach, can be translated into the organizational setting to alert individuals to their own behaviors, thus acting as a cure.

### *Love and the Anterior Cingulate Cortex*

From an evolutionary perspective, love is part of a group of affiliative responses, which cohere a social bond.[26] In an organization, love is another mechanism that has the capacity to provide an encouraging environment in which creativity can occur.

The interlocking components of love—the emotional, cognitive, and behavioral aspects—make it one of the most, if not the most, complex affective states.[27] However, it is important to note that love as referred to in the context of creativity is not the romantic love associated with red roses and fireworks, but an affective state of genuine value held for those people around you and the context in which you work. Work on the neural basis for love has focused on romantic and maternal love and again provides the organizational world with a tool from which to base hypotheses and future research.[28]

fMRI studies have shown bilateral activation in the anterior cingulate cortex and (primarily) on the left side of the middle insula, when participants describing themselves as "truly deeply and madly in love" viewed pictures of their loved partners.[27] Data were further analyzed in this study to produce a timeline showing that the anterior cingulate and the insula were differentially activated, suggesting that these areas may play separate roles in the experience of love.[27] Subcortically, the stimuli engendered activation in the caudate nucleus and the putamen, both of which have previously been associated with positive affective states.[27]

The other central form of love that has been investigated at a neurological level is that of maternal love. It is reasonable to assume that love as a means of encouraging creativity may be more similar to maternal love as its components of building an environment in which people feel genuinely valued certainly relate more closely to a warm and caring affect rather than the eroticism more associated with romantic love.[28]

Maternal love, as an attachment-specific affective state, has been investigated using the same methods as for investigations of romantic love; both overlapping and distinctive activation have been found for the two forms of love.[28] Those brain areas found showing coincident activity in response to both states of love are the striatum and, more specifically, the putamen, globus pallidus, and caudate nucleus, as well as the dorsal anterior cingulate cortex and the middle insula. Those areas distinctly activated in response to maternal love were the lateral orbitofrontal cortex (FIG. 1) and the periaqueductal grey area; the areas activated only for romantic love were the dentate gyrus and hippocampus and the hypothalamus. Specific brain areas that have previously been linked to negative affect appeared to be inhibited; for example, the amygdaloid region was deactivated.[27]

Drawing on the distinct and overlapping brain areas activated for maternal and romantic love and investigating the neural correlates of love in a creative sense would confirm whether the latter kind of love produces its own neural signature or one similar to either romantic or maternal love. Grounding the research of the elements involved in the business change process in established cognitive neuroscience will allow for better understanding of the origins of these elements and, as a result, support them in an organizational setting.

### *Curiosity and a Sense of Direction*

Curiosity is fundamental to human behavior, it fuels our need to investigate, to question, and to comprehend. The key to human curiosity is our ability to satisfy it behaviorally through exploration. At both a social and organizational level, exploration is a mechanism that, among other things, provides us with information to make decisions and achieve goals.

Exploratory behavior is linked with exploitation in that we explore a given environment or problem and then choose an option to further exploit it.[29]

Research using an exploratory phase have found increased activation in both the frontopolar cortex and the intraparietal sulcus.[31] These cortical regions have been linked to high-level control and decisionmaking, respectively.[30]

As previously stated, curiosity and its subsequent exploratory behavior is essential to encourage creativity in the work place. However, it is equally important that the energy devoted to this exploratory behavior is channeled appropriately to ensure that it is a constructive pathway to an objective. In creative terms, this is one's sense of direction.

Our ability to stay focused to achieve a goal or objective can be investigated using the motivation and reward processes of the brain as a starting point. Rewards can come in any number of forms, from the more tangible forms (e.g., fruit juice) to more abstract forms (e.g., laughter). Essentially, a reward is anything that produces positive affect, and hence reinforces the behavior that led to its realization.[31]

Specific brain areas are reliably activated in response to reward, including the ventral striatum and nucleus accumbens, the amygdala, and the orbitofrontal cortex. The orbitofrontal cortex appears to connect the reward system with the input of the outside world, as it is here that connections between sensory stimuli and the value produced by the reward seem to occur.[31] Theories have differed with respect to the role of the amygdala. However, a consensus now suggests that the amygdala conveys information on the salience of the stimulus.[31] Activation in the ventral striatum may indicate when mistakes in reward prediction have been made.[31]

Exploration stemming from curiosity and motivation and reward derived from a sense of direction can be seen as key adaptive behaviors. In a business change process, our ability to adapt is what makes the outcome of the process workable. By taking the behaviors from the organizational setting and reducing them, their closest matches in the established world of cognitive neuroscience can be found. This then allows for more effective cognitive neuroscientific investigation, the findings of which can lead to an improved understanding of the behaviors occurring within an organizational setting.

Cognitive neuroscientists work to understand the relationship between the brain and the mind. It would be neglectful of the organizational practitioner not to use this research. However, this is a symbiotic relationship. By using a practitioner's reflective account as an inside window to social behavior occurring in the real world, it will be possible for the cognitive neuroscientist to understand the components that make up this behavior.

## REFERENCES

1. MASON, R.O. & I.I. MITROFF. 1981. Challenging Strategic Planning Assumptions. Wiley. UK.

2. RITTEL, H. 1972. On the planning crisis: systems analysis of the "First and second generations". Bedriftsokonomen. Norway.
3. MARTIN, J.N.T. 2000. Managing Problems Creatively. The Open University. UK.
4. BACKOFF, R.W. & P.C. NUTT. 1988. A process for strategic management with special application for the non-profit organisation. Cited in Strategic Planning: Threats and Opportunities for Planners. J.M. Bryson & R.C. Einsweiller, Eds.: 120–144. Chicago.
5. CHECKLAND, P.B. 1981. Systems Thinking Systems and Practice. Wiley. UK.
6. BASADUR, M. 1990. Identifying individual differences in creative problem-solving style. J. Creat. Behav. **24:** 2.
7. BELBIN, R.M. 1981. Management Teams: Why They Succeed or Fail. Heinemann. Oxford.
8. ADAMS, J.L. 1987. Conceptual Blockbusting. Penguin Press. Harmondsworth, UK.
9. VAN GUNDY, A.B. 1988. Techniques of Structured Problem Solving. Van Nostrand Reinhold. New York.
10. RICKARDS, T. 1974. Problem Solving Through Creative Analysis. Gower Press. Aldershot, UK.
11. MAJARA, S. 1988. The Creative Gap. Longman. London.
12. DAMASIO, A.R. 1994. Descartes' Error: Emotion, reason and the human brain. Putman. New York.
13. DAMASIO, H. *et al.* 1994. The return of Phineas Gage: clues about the brain from the skull of a famous patient. Science **264:** 1102–1105.
14. BECHARA, A. *et al.* 1996. Failure to respond autonomically to anticipated future outcomes following damage to pre-frontal cortex. Cereb. Cortex. **6:** 215–225.
15. GREEN, J. & J. HAIDT. 2002. How (and where) does moral judgement work? Trends Cog. Sci. **6:** 12.
16. KOHLBERG, L. 1969. Stage and sequence the cognitive developmental approach to socialization. Cited In Handbook of socialization theory and research. D.A. Goslin, Ed.: 347–480. Rand McNally. USA.
17. DE VIGNEMONT, F. & T. SINGER. 2006. The empathic brain: how when and why? Trends. Cog. Sci. **10:** 10.
18. LEE, N. & L. CHAMBERLAIN. 2007. Neuroimaging and Psychophysiological measurement in organizational research: An agenda for research in organizational cognitive neuroscience. This volume.
19. SINGER, T. *et al.* 2006. Emphatic neural responses are modulated by the perceived fairness of others. Nature **439:** 466–469.
20. PERRY, J. 2001. Knowledge, Possibility and Consciousness. The MIT Press. USA.
21. ADAMS, J.L. 1987. Conceptual Blockbusting. Penguin. Harmondsworth, UK.
22. FARROW, T.F.D. *et al.* 2001. Investigating the functional neuroanatomy of empathy and forgiveness. Neuroreport **12:** 11.
23. FARROW, T.F.D. *et al.* 2005. Quantifiable change in functional brain response to emphatic and forgiveability judgements with resolution of post traumatic stress disorder. Psychiatry Res. **140:** 145–53.
24. KAMINER, D. *et al.* 2000. Forgiveness. Towards an integration of theoretical models. Psychiatry **63:** 344–57.
25. CLARK, A.J. 2005. Forgiveness: a neurological model. Med. Hypoth. **65:** 649–654.
26. CREWS, D. 1998. The evolutionary antecedents to love. Psychoneuroendocrinology **23:** 751–764.

27. BARTELS, A. & S. ZEKI. 2000. The neural basis of romantic love. Neuroreport **11:** 17.
28. BARTELS, A. & S. ZEKI. 2004. The neural correlates of maternal and romantic love. Neuroimage **21:** 1155–1166.
29. COHEN, J.D. *et al.* 2007. Should I stay or should I go? How the human brain manages the trade-off between exploitation and exploration. Philos. Trans. R. Soc. Lond. B. **362:** 933–942.
30. DAW, N.D. 2006. Cortical substrates for exploratory decisions in humans. Nature **441:** 876–879.
31. MCCLURE, S.M. *et al.* 2004. The neural substrates of reward processing in humans: The modern role of fMRI. The Neuroscientist **10:** 3.
32. DIETRICH, A. 2007. Who's afraid of a cognitive neuroscience of creativity? Methods **42:** 22–27.