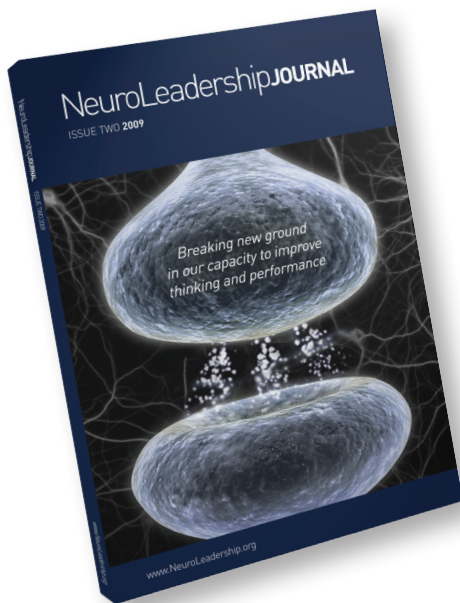


Neuroscience of engagement

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Neuroscience of engagement

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Introduction

Over recent years, employee engagement has become an area of focus for practitioners in the HR field. Until now much of the research on engagement has been at the macro level, e.g. defining the meaning of employee engagement (Macey & Schneider, 2008) examining the degree to which engagement impacts organizational performance (Conference Board, 2006; Saks, 2006), investigating the way engagement varies across different organizations and different countries (Gallup, N.D.) or the importance of employee engagement (DDI, 2005). However, little research has been done, at the individual level, to leverage recent neuroscience breakthroughs to assist in identifying the underpinning neurological drivers of engagement, it's effects on various brain networks, and how we might measure engagement more objectively through neural or biological markers.

We believe that understanding the neuroscience of engagement is more than just an interesting discussion; rather, it will open up insights for leaders to more accurately and effectively predict, measure and improve employee engagement across all types of organizations. The need for this understanding cannot be taken lightly; according to DDI (2005) quoting Gallup a) the lack of engagement alone costs companies in the UK \$65 billion, b) in Japan they estimate that only 9% of the workforce is engaged and c) business units with employee engagement above the median, had a 70% greater chance of success.

Recent neuroscience research has begun to provide insights into the neurological drivers of behavior in the social environment (Lieberman & Eisenberger, 2008), (Ochsner &

Lieberman, 2001), (Rock, 2008), (Ringleb & Rock, 2008), (Tang & Posner, 2008). While we recognize there is much research still to do, both from the neuroscience and leadership arenas, the purpose of this paper is to take a step towards providing a theoretical foundation that can help shape future research.

In this paper we will draw on neuroscience research to explore these five questions:

1. What is the neural basis of engagement?
2. What are the neural drivers that enhance and decrease engagement?
3. What are the levels of engagement from a neural perspective?
4. What effect does increasing or decreasing engagement have on the brain and our wider biology?
5. What neural markers might be used to more accurately measure engagement and the effects of engagement interventions?

Engagement is something the employee has to offer: it cannot be 'required' as part of the employment contract.

The neural basis of engagement

The use of the term, 'engagement' in this paper refers to the idea of employee workplace engagement. Even a brief review of the literature will reveal multiple views of, and little agreement about, the definition of engagement. For the purpose of this paper, a couple of samples will be sufficient to illustrate the underlying meaning:

A heightened emotional connection that an employee feels for his or her organization, that influences him or her to exert greater discretionary effort to his or her work (Conference Board 2006).

and

A combination of commitment to the organization and its values, plus a willingness to help out colleagues (organisational citizenship). It goes beyond job satisfaction and is not simply motivation. Engagement is something the employee has to offer: it cannot be 'required' as part of the employment contract (CIPD, 2008).

Neuroscientist Evian Gordon, in one of the largest meta-analyses of brain research in the world, proposes that the organizing principle of the brain is to minimize danger and maximize reward (Gordon, 2008). In this paper we propose that the neural basis of engagement is closely linked to this threat / reward function. The basis for this belief is the extensive literature emerging about the reward / threat response (e.g. Elliot, 2008), and the common themes emerging when comparing engagement research to neuroscience research. For example, in the reward state, versus the threat state, people:

- Experience increased cognitive resources (Arnsten, 1998)
- Are generally more creative (Friedman & Förster, 2001)
- Solve more problems with the insight phenomenon, which is required for complex problem solving (Subramaniam *et al.*, 2009)
- Come up with more ideas for actions (Frederickson, 2001)
- Have a wider field of perceptual view (Schmitz, De Rosa & Anderson, 2009)

These findings are consistent with definitions of engagement, where people are more capable overall at making decisions and solving problems (Conference Board, 2006).

We propose that the neural basis of *engagement* of an individual can be defined by considering the average levels of activation of the brain's reward and self-regulation circuitry when that individual thinks about or participates in their work. For example, an employee who has a high level of engagement would experience high levels of activation of their reward and self-regulation circuitry when at work; when they are working, they would have good levels of dopamine in their executive attention or self-regulation networks and reward circuitry including the prefrontal region

(PFC), anterior cingulate cortex (ACC), and striatum, and only moderate levels of activation of the threat circuitry. The striatum releases dopamine directly into the PFC, ACC, and other associated regions, positively affecting a wide range of cognitive and emotional functions through increasing brain resources and functional connectivity (Arnsten, 1998; Tang & Posner, 2009; Tang *et al.*, 2009).

...an employee who has a high level of engagement would experience high levels of activation of their reward and self-regulation circuitry when at work...

The same principle applies not only when we think about the individual's overall job but also when he or she is participating in a particular task. It is possible that an employee might not be engaged overall, but have one specific task that they find engaging. Perhaps the employee doesn't like dealing with their boss or paperwork but is engaged when they deal with customers and are able to help them solve their problems. In this way, overall engagement can be thought of as the *average level* of reward experienced by an employee in their task. In developing this average level, an individual's tasks could all be measured, either on a one-time basis, or averaged over time. In addition to an average level of engagement in the work place, it should be noted that an individual's overall engagement in life could be assessed; this would include levels of engagement when at work, at home, or in social or leisure activities. It would be interesting in future research to see what levels of engagement people had within these domains, and the impact that increasing engagement in one area may have on others.

Conversely, we propose that the neural basis of *disengagement* can be defined by the average levels of activation of the brain's threat circuitry. Threat circuitry is not just fear. It includes anything that is an avoid response, including sadness, anxiety, lack of safety, and depression. Activation

of threat circuitry has a surprising effect at very low levels (Friedman & Förster, 2001) and the effect lasts significantly longer than an 'equivalent' activity in the reward circuitry (Baumeister et al, 2001). In many instances, the activation of this threat circuitry is both subtly primed and beneath conscious awareness. The impact of this is that employees in a threat state experience stress, anxiety and general angst, even though they may not be aware of any specifics as to why. They just feel disengaged. This disengagement state can occupy large amounts of brain resources and decrease the efficiency of the attention resources that are available. Disengagement, like engagement, can be measured across an entire job, or within a specific task.

It has been shown that threat can indeed be effective for increasing noradrenaline levels and thereby focusing attention (Arnsten, 1998). Under our premise, however, this type of engagement would not be considered as positive engagement; it would involve the activation of the stress response, with its attendant effects (see below). This type of engagement can be effective in the short term for executing tasks that are already well codified in long term habit circuits, but tends to be narrow in view, inhibiting creative thinking (Subramaniam et al, 2009), and inducing mental fatigue (Tang & Posner, 2009), and comes with long term consequences such as negatively impacting overall health due to increased cortisol (Boudarene, Legros & Timsit-Berthier, 2002). The results of all of these impacts will tend to lead to overall disengagement.

*Threat circuitry
is not just fear.
It includes
anything that
is an avoid
response...*

Neural drivers that enhance and decrease engagement

With the idea of the threat and reward response as the basis of engagement, the question becomes, what are the issues that generally create high levels of rewards or threats, especially in social environments? The answer to this question, we propose, is largely to be found in the social cognitive and affective neuroscience literature. The SCARF model (Rock, 2008) summarizes a wide range of social cognitive and affective neuroscience findings into five

domains of threat or reward. The five domains are Status, Certainty, Autonomy, Relatedness and Fairness. Status is about an individual's self-perceived importance in relation to others. Certainty concerns the degree to which an individual is able to predict the future. Autonomy encompasses an individual's perception regarding their sense of control over events. Relatedness is a sense of safety with others, of being associated with an in-group rather than an out-group. Lastly, fairness is a perception of fair exchanges between an individual and other people and/or the organization.

*Relatedness is a
sense of safety
with others...*

These five domains are environmental factors that people internally keep track of, in a similar way to tracking levels of food or water, and using similar circuits in the brain (Lieberman & Eisenberger, 2008). We propose that engaged employees experience high levels of positive rewards in these SCARF domains, and disengaged employees experience high levels of threats in these SCARF domains.

This model enables leaders to more easily remember, recognize, and modify their behavior so as to positively influence the core social domains that drive human behavior. Labeling and understanding these drivers draws conscious awareness to otherwise non-conscious processes, which helps leaders in two ways. Firstly, knowing the drivers that can cause a threat response to their employees enables leaders to explicitly design their interaction with their organization, team or other individuals in order to minimize the potential of threats. For example, knowing that a lack of autonomy activates a genuine threat response, a leader might consciously avoid micromanaging their employees or ask for more input when establishing goals and objectives. Secondly, knowing about the drivers that can activate a reward response enables leaders to motivate their staff more effectively by tapping into internal rewards, thereby reducing the reliance on external rewards such as money. For example, a line manager might grant more autonomy as a reward for good performance.

The research that supports this relationship between threat/reward and engagement, involved the identification of patterns in engagement models and meta-summaries of engagement models; we discovered that the elements of the engagement models typically fit into one of the categories of SCARF. For example, in one of the most common engagement models, The Gallup Organization's Q12, six out of twelve questions related to Status, one to certainty,

one to autonomy, three to relatedness and one to fairness (See Appendix 1). The Conference Board’s meta-summary determined eight themes, four which related to Status, one to certainty, zero to autonomy, two to relatedness and one to fairness (See Appendix 2).

The levels of engagement from a neural perspective

Gallup organization (Gallup, N.D.) has identified three levels of engagement:

- Actively Disengaged
- Not Engaged
- Engaged

We propose an expanded and more defined model with five levels, that link to the threat / reward response (see Table 1).

We have expanded Gallup’s three levels in order to provide a more robust model for future research on the topic of engagement. We have change the term from “Not Engaged” to “Disengaged” as we believe this more accurately describes an employee’s state of mind when in an average threat state. We introduce a “Neutral” state, to describe an employee in a balance between threat and reward averages. In addition, we propose adding ‘Deeply Engaged’ to take into account a higher level of engagement that may be necessary to offset the deep levels of the threat response that leaders experience, called ‘power stress’ (Boyatzis, Smith & Blaize 2006). By experiencing Deep Engagement, which is a strong average reward response, leaders develop a type of resilience to power stress, similar to the ideas of Psychological Capital (Luthans, Youssef & Avolio, 2007). Deep Engagement is a level of engagement often seen in entrepreneurs who are inspirational, visionary leaders, or people who are highly successful at engaging others.

We propose that Deep engagement is an experience that occurs when people experience rewards from all five domains of SCARF. This may be explained by the ‘multiplier effect’ whereby the impact of a reward in one domain is significantly increased by rewards in other domains (Rock *et.al*, 2010). An example of this, from an organizational perspective, might be when an individual

or group undertakes a task that is perceived as improving the greater good, in connection with some kind of social condition in the surrounding community. In this way, the individuals involved are improving their status in their own eyes and, by implication, in others.

Deep Engagement is a level of engagement often seen in entrepreneurs who are inspirational, visionary leaders...

They are increasing their certainty, by solving some kind of social problem that hitherto did not have a solution. They are acting autonomously, and making choices about the solution of the social problem. They are connecting with other people to facilitate change, and feel that they are reducing unfairness in the world in some way. These ‘social problems’ could be as simple and local as improving the way people communicate in a lunchroom, such that people start to share personal histories and connect more, or they can be projects that deeply affect the wellbeing of wider communities. From a leader’s perspective, the introduction and encouragement of these type of initiatives can increase employees’ sense of engagement. Simply knowing the threat/reward impact of their actions can increase the leader’s positive effect on employee engagement.

This idea of socially-valuable projects being deeply rewarding, links to organizational research on high performing cultures, showing that organizations committed to improving the world achieve more than those with a vision to just beat the competition (Logan, King & Fischer-Wright, 2008).

Table 1: Engagement levels

| Rock et.al | Definition | Gallup Equivalent |
|---------------------|---|---------------------|
| Actively Disengaged | <i>A high average threat state</i> | Actively Disengaged |
| Disengaged | <i>An average threat state</i> | Not Engaged |
| Neutral | <i>Balance between threat and reward averages</i> | |
| Engaged | <i>An average a reward state</i> | Engaged |
| Deeply Engaged | <i>A high average reward state</i> | |

There are also links to research on ‘socialized visionary communication’ (Brown & Trevino, 2006), and the concept of leaders being more inspiring when they focus people on a social change (Brown & Trevino, 2006). We propose that the Deep Engagement that occurs in some social justice projects may emerge from an effect of having rewards from many domains of SCARF, in particular the fairness domain, being addressed.

The multiplier effect, mentioned earlier, (Rock et al, 2010) also applies to threat states, where individual threats are significantly increased if there are threats in other domains. So if, for example, there is a threat to an employee’s status, it is going to be received worse if there is uncertainty and no autonomy. The same attack on status, certainty and autonomy would be worse again if there is no sense of relatedness. This multiplier effect could easily be the cause for employees becoming Actively Disengaged. In contrast to the multiplier effect, Rock et al (2010) propose the offsetting effect whereby a threat may be reduced by activating rewards in other domains, to offset that threat. Using this principle, for example, in a time of change, when employee’s certainty decreases, a leader might increase the opportunities for employees to get together, in order to increase their sense of relatedness, thus reducing the overall threat. This intervention might take the employee’s state from Disengaged to Neutral or Engaged.

...organizations committed to improving the world achieve more than those with a vision to just beat the competition...

The sensitivity to each of the five domains of the SCARF model appears to vary from individual, and, most likely, from group to group and culture to culture. Our preliminary research indicates that when asked, people are able to quickly identify the order of importance of the five SCARF domains to them, after an explanation of the model of just a few minutes. In addition, this early research indicates that, overall, there is an equal distribution across all five domains, although we have not collected enough data to assertively state this yet. Again, our early research shows tendencies within groups; for example,

consultants value autonomy highly and certainty fairly low, and HR staff value both relatedness and fairness high. In a recent cross cultural assessment (Freeman et al, 2009) American individuals showed activation of the reward circuitry when shown ‘dominant’ pictures, which response was not shared by their Japanese counterparts. On the other hand, the reward circuitry of the Japanese individuals was activated by ‘subordinate’ pictures, but this response was not shared by their American counterparts. Clearly, there is more research to be done in these arenas, but leaders would do well to understand likely differences in order to be able to more finely adjust their approach to different individuals, groups and cultures.

...people are able to quickly identify the order of importance of the five SCARF domains...

The effect of increasing or decreasing engagement on the brain and our biology

We propose that five brain networks are impacted by the threat and reward response and thus by engagement levels. These are:

- 1. Cognitive networks:** Lateral PFC and ACC provide the capacity for clear thinking and better executive attention suggesting these have optimal cognitive function during engagement (Posner *et.al*, 2007).
- 2. Limbic system:** The reward experience and positive emotion require the involvement of the central and autonomic nervous system, indexed by higher immune function and body coordination (Tang *et.al*, 2009).
- 3. Social network:** In the workplace, collaboration and understanding others are the vital abilities for success and survival. In this regard, the MPFC will be a core region affected by engagement levels (Fair *et.al*, 2008).
- 4. Self-regulation network:** The ACC is responsible for the regulation of both cognition and emotion (Tang & Posner, 2008). The Dorsal ACC serves for cognitive regulation and conflict resolution whereas ventral ACC is involved in emotional regulation (Posner *et.al*, 2007).
- 5. Learning and habit circuits:** Positive experience of engagement facilitates and enhances and strengthens working memory (WM). Repeated use of WM forms long-term memory and habits via circuits including the basal ganglia/striatum and PFC, and ACC (Tang 2009).

Table 2: Engagement levels, networks and functions

| States | Brain networks | Functions |
|---------------------|--------------------------|------------------------------------|
| Actively Disengaged | Amygdala, limbic system | Negative emotional feelings |
| Disengaged | | |
| Neutral | mPFC, ACC, PCC | Self-referential and interoception |
| Engaged | | |
| Deeply Engaged | PFC, ACC, striatum, mPFC | Reward, attention, flow |

In sum, we propose the brain networks including PFC, ACC, mPFC and striatum as the main engagement circuits, and these brain networks are regulated or impacted by various levels of engagement.

Let’s explore the states of deep engagement, neutral and disengagement as examples to link the related networks with mental experiences involved in engagement. During the Deep Engagement state, a person accomplishes a task or goal with the absence of subjective effort, which might at another time, or by another person, seem effortful. The person feels totally occupied with the present task so as to suspend evaluations, and has strong pleasure and reward feelings, which involves being completely in the current moment. During a neutral state, we propose the person is more in the default mode, or brain resting state, involving the ACC, mPFC and PCC circuits (Raichle et al, 2001). This state maintains self-referential, introspective mental activity.

In contrast, disengagement includes fear or other negative emotions. This will involve amygdala-related networks. This state occupies a large amount of brain resources and decreases attentional efficiency. Meanwhile, it activates the autonomic and central nervous system, which triggers the stress response. As a consequence, it will reduce the creativity and productivity, induce mental fatigue (Tang & Posner, 2009) and comes with long-term health problems.

In this threat state, people are likely to want to stay doing the same things, as change is harder due to overall less prefrontal resources. Insights are harder (Subramaniam *et.al*, 2009), making difficult problems seem insurmountable. It will be harder to stay cool under pressure with a high baseline threat level. Others may be less inclined to collaborate.

Clearly the level of engagement or otherwise of an individual, a team, an organization or even a country can impact performance in tangible ways. The level of engagement, or otherwise, has a very real impact on one’s ability to solve problems, make decisions, stay cool under pressure, collaborate with others and deal with change, the four domains of NeuroLeadership (Ringleb & Rock, 2008).

A numeric scale for measuring engagement?

In order to provide a more objective foundation for these engagement levels, we propose the creation of a numeric scale that can be used to summarize average engagement levels for a project, an individual in their role, or a team or larger organization (see table below). Such an agreed upon scale would facilitate more accurate research about the impact of engagement. Clearly further work needs to be done to link these levels to specific biological markers, and to develop a reliable taxonomy for such scale. We propose that this framework will enable more accurate thinking about engagement in the future. For example, we are at a time when various biological markers (e.g. cortisol levels, skin conductance response and heart rate variability – See Appendix 3) can be measured easily and cheaply in the workplace. These measurements could be taken before and after interventions, which, together with the availability of such an objective scale would make subsequent field research all the more reliable.

Clearly the level of engagement or otherwise of an individual, a team, an organization or even a country can impact performance in tangible ways.

| Actively disengaged | Disengaged | Neutral | Engaged | Deeply engaged |
|---------------------|------------|---------|---------|----------------|
| -100 | -50 | 0 | 50 | 100 |

What biological markers might be used to more accurately measure engagement, and the effects of engagement interventions?

As mentioned above, engagement involves diverse central and autonomic nervous system including cognitive networks (lateral PFC), Limbic system (ACC, insula, etc), Social network (mPFC), Self-regulation network (PFC and ACC) and Learning and habit circuits (striatum). To measure the engagement state accurately and test the effects of engagement interventions, we propose the following brain and body biological markers (Tang *et.al.*, 2009; Tang & Posner, 2009).

1. **Brain:** the activations of PFC, ACC, mPFC and striatum using neuroimaging (fMRI, PET, SPECT and EEG, MEG) would be the neural markers to measure and evaluate engagement.
2. **Physiology (Body):** the involvement of the autonomic nervous system indexed by heart rate variability (HRV), and skin conductance response (SCR) would be ideal physiological biomarkers to measure engagement (Tang *et al.*, 2009). To measure the stress level in the autonomic system (body), cortisol is one of the best indexes (Tang *et.al.*, 2007; 2009).

Summary

In summary, by looking at engagement through the lens of neuroscience, and by the use of a simple model like SCARF, we can assist leaders in developing a deeper understanding of the impact of levels of engagement on human performance; it may also prove to be possible to measure engagement levels before and after various interventions, across projects, across teams and over time. In time, this approach may shift the idea of employee engagement from a 'soft' metric to something with data behind it that can be more meaningfully measured and therefore managed.

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Appendix 1

The most widespread research about engagement has been done by Gallup and their 'Q12' assessment. This is comprised of these questions, which Gallup believes are the most central to engagement:

- Do you know what is expected of you at work?
- Do you have the materials and equipment you need to do your work right?
- At work, do you have the opportunity to do what you do best every day?
- In the last seven days, have you received recognition or praise for doing good work?
- Does your supervisor, or someone at work, seem to care about you as a person?
- Is there someone at work who encourages your development?
- At work, do your opinions seem to count?
- Does the mission/purpose of your company make you feel your job is important?
- Are your associates (fellow employees) committed to doing quality work?
- Do you have a best friend at work?
- In the last six months, has someone at work talked to you about your progress?
- In the last year, have you had opportunities at work to learn and grow?

Here are Gallup's 12 survey questions, put into SCARF categories:

The most widespread research about engagement has been done by Gallup...

Status – 6

1. In the last seven days, have you received recognition or praise for doing good work?
2. At work, do you have the opportunity to do what you do best every day?
3. Does the mission/purpose of your company make you feel your job is important?
4. In the last six months, has someone at work talked to you about your progress?

5. In the last year, have you had opportunities at work to learn and grow?
6. At work, do your opinions seem to count?

Certainty – 1

1. Do you know what is expected of you at work?

Autonomy – 1

1. Do you have the materials and equipment you need to do your work right?

Relatedness – 3

1. Does your supervisor, or someone at work, seem to care about you as a person?
2. Is there someone at work who encourages your development?
3. Do you have a best friend at work?

Fairness – 1

1. Are your associates (fellow employees) committed to doing quality work?

Appendix 2

The meta study of 12 other large studies by the Conference Board found eight themes for what seems to create engagement, as follows:

- **Trust and integrity**
How well managers communicate and ‘walk the talk’.
- **Nature of the job**
Is it mentally stimulating day-to-day?
- **Line of sight between employee performance and company performance**
Does the employee understand how their work contributes to the company’s performance?
- **Career Growth opportunities**
Are there future opportunities for growth?
- **Pride about the company**
How much self-esteem does the employee feel by being associated with their company?
- **Coworkers/team members**
Significantly influence one’s level of engagement
- **Employee development**
Is the company making an effort to develop the employee’s skills?
- **Relationship with one’s manager**
Does the employee value his or her relationship with his or her manager?

Here are the Conference Board’s survey questions, put into SCARF categories:

Status – 4

1. Employee development

Is the company making an effort to develop the employee’s skills?

2. Career growth opportunities

Are there future opportunities for growth?

3. Pride about the company

How much self-esteem does the employee feel by being associated with their company?

4. Nature of the job

Is it mentally stimulating day-to-day?

Certainty – 1

1. Line of sight between employee performance and company performance

Does the employee understand how their work contributes to the company’s performance?

Autonomy – 0

Relatedness – 2

1. Relationship with one’s manager

Does the employee value his or her relationship with his or her manager?

2. Coworkers/team members

Significantly influence one’s level of engagement

Fairness – 1

1. Trust and integrity

How well managers communicate and ‘walk the talk’.

Appendix 3

1. **Skin conductance response (SCR):** SCR is one of the most robust and well studied physiological responses. It is caused by sympathetic nervous system activation, which changes the levels of sweat in the eccrine sweat glands and has been shown to be linked to measures of emotion, arousal, and attention. The lower score of SCR shows more parasympathetic activity with calm and relaxed state.
2. **Heart rate variability (HRV):** HRV is a noninvasive technique that allows for a reliable and accurate measure of sympathetic and parasympathetic functions. Calculated by heart rate, HRV has three frequencies: high frequency (HF; 0.16–0.45 Hz), low frequency (LF; 0.04–0.15 Hz), and very low frequency (VLF; 0–0.03 Hz). More HF-HRV indicates relaxed and calm state with parasympathetic activity dominance, which is close to engagement state, whereas more LF-HRV indicates the excited and active state with sympathetic activity dominance.