ARTICLE

How power affects the brain

Ian H. Robertson on what he has dubbed 'the winner effect'

The 'winner effect' is a term used in biology to describe how an animal that has won a few fights against weak opponents is much more likely to win later bouts against stronger contenders. It is a key element in the establishment of dominance hierarchies which are a feature of most animal species, including humans.

One's place in social dominance hierarchies is one of the strongest, and yet underestimated, shapers of the structure and function of the human brain. When power is unconstrained by democratic controls or good systems of governance, then power-holders may show undesirable distortions in judgment, cognition and behaviour as a results of its drug-like effects on the brain. The article begins with a notorious example.

questions

Do we underestimate the effects of social relationships on cognitive function?

Have we tended to neglect the assessment of how power affects an individual when selecting leaders?

resources

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Keltner, D., Gruenfeld, D. & Anderson, C. (2003). Power, approach, and inhibition. *Psychological Review, 110,* 265–284.

The boss was in a rage. After the incident he ordered an e-mail to be sent threatening disciplinary action if this happened again. A chief executive, after all, is paid to be tough: it's his job to make sure staff don't screw up.

How could this happen, particularly in his newly opened headquarters? The offices, each a breathtakingly glassed suite, were bathed in the soft green light of the nearby hills they overlooked so nobly. He had taken so much trouble with the architects – he even chose the silk wallpaper – to make sure that directors were insulated in these finest of aesthetically pleasing surroundings, inaccessible to other senior staff, yet still this sort of blunder could occur.

As high-performing executives, they *needed* this isolation from the organisation in order to preserve the brilliance of the strategic leadership that had made this, in terms of assets, the world's biggest corporation. For people at his level, *everything* is important. It took *pedigree* to create this, and a boss of such quality needed things to be just right in his organisation. That's why he allegedly threatened disciplinary action to the staff who allowed those cheap pink wafers to be included among the morning coffee snacks in the director's board room (*The Times*, 22 March 2009).

The boss didn't appreciate criticism – why should he when the company's share price rocketed over the course of his tenure? He insisted that his executives wear the same tie – one with the company's logo on it – and he was not at all happy when one senior financial analyst, James Eden, had the temerity to describe him as a 'megalomaniac' (*The Times*, 20 January, 2009).

It was not long after Fred Goodwin's rage over the pink wafer that his bank, the Royal Bank of Scotland, reported losses of around £24 billion. Soon after, his company was effectively nationalised by the UK government at a cost of £53.5 billion of taxpayer's money, and Sir Fred was out of a job.

Royal Bank of Scotland was a very profitable bank until it recklessly overreached in 2007 by purchasing, against the scepticism of financial journalists, part of the Dutch bank ABN Amro. RBS would very likely have survived the 2008 crash were it not for that decision, which was made around the same time that its chief executive, isolated from the rest of the company and from the world in his luxury Edinburgh office suite, was preoccupied with wallpaper and pink wafers.

Fred Goodwin was only one of many, many people in leading positions who seemed to get carried away during the years leading up to the 2008 Lehman crash. Does psychology have anything to say about this phenomenon? Yes it does, and the crucial ingredient in that explanation is *power*.

The fundamental stuff

Power, according to the philosopher Bertrand Russell, is the fundamental stuff of human relationships in the way that energy is the fundamental concept in physics. And having power over others – defined as controlling resources that they want, need or fear – has profound effects on mind and brain, as does being in the power of others. Fred Goodwin's behaviour can in part be explained by the effects on his cognitive and emotional functions of wielding enormous power. This has been a topic of psychological research.

Pamela Smith and her colleagues at Radboud University in Nijmegen, Holland, studied cognitive function in people made temporarily powerful or powerless in an

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experiment (Smith et al., 2008). The participants were randomly assigned to be a 'superior' or a 'subordinate' in a computer-based task. The superior would not only direct the subordinate, but would also evaluate them. This evaluation formed the basis for how much subordinates would be paid for taking part in the study, the superiors being paid a fixed amount. Even though this was an experiment, the subordinates really did experience some powerlessness, and the superiors, power.

Intriguingly, the subordinates performed significantly worse on tests of executive function – power and the lack of it had, in other words, crucially altered these most high level and human of cognitive functions. Smith and her colleagues went on to show that just thinking about a time when you had a little power over someone makes you more likely to think in more abstract, and even more creative, ways (Smith & Trope, 2006)

There are also emotional effects. Dana Carney and her colleagues (Carney et al., 2010) asked volunteers to strike poses for one minute at a time that were either expansive power poses, or contracted poses. An expansive, 'high power' pose would be leaning back on a chair with feet on the table, and the explanation given to the participants was that the researchers needed to have the legs raised above the heart so as to get proper physiological recordings. A contracted 'low power' pose would be standing with head slightly bowed and arms folded tightly across the chest. Even though they only held these positions for one minute at a time, the groups who took the high power poses rated themselves as significantly more 'in charge' and 'powerful' than those who took the low power poses.

This could seem like a pretty trivial finding – a minute of standing in a particular position makes both men and women rate themselves as feeling more 'in charge'. But among the 26 women and 16 men who took part, those who struck the brief high power poses showed significant increases in testosterone to match their increased 'I feel in charge' feelings, while those in the low power poses showed an equivalent *decrease* in testosterone which was in line with their lowered 'in charge' feelings. Furthermore, levels of a the stress hormone cortisol decreased after the high power poses and increased after the low power poses.

Power, then, may not only be a cognitive enhancer – it may also have anxiolytic and mood-enhancing properties and this may be a factor in the famous Whitehall study results (Marmot et al., 1991) showing higher morbidity and mortality in more junior civil service grades, irrespective of health behaviours.

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Royal Bank of Scotland was a very profitable bank until it recklessly overreached in 2007

But power's effects are not all positive. Even small, experimentally induced power levels increase hypocrisy, moral exceptionalism, egocentricity and lack of empathy for others. Take the example of gambling. It is folly of may gamblers to believe that they can somehow control the roll of the dice. Whether mediated by superstitious pre-bet rituals, or by a belief in luck or destiny, fortunes have been lost under the illusion that a person has personal control over events, which are in reality randomly determined – like the spin of the roulette wheel. Nathanael Fast and Deborah Gruenfeld of Stanford University found that even tiny elevations of experienced power increase susceptibility to this illusion (Fast et al., 2009). It seems a strong possibility that more dramatic illusions of control affected financiers and bankers betting on a massively complex global financial system whose derivative and other bets, which were traded, had a combined value greater than the total world GDP.

Power also increase egocentricity. Adam Galinsky and colleagues of Northwestern University primed power or powerlessness in participants and asked them to draw a capital E on their forehead with a washable marker (Galinsky et al., 2006). Those who had thought about a time they had power over someone tended to draw an E on their forehead which was correct from *their* point of view, but appeared mirror reversed from the point of view of someone standing opposite them.

One consequence of lack of empathy and egocentricity is that it inclines us to see people as a means to our ends – more as *instruments* of our own goals. Deborah Gruenfeld and colleagues at Stanford University have found evidence for precisely this: if we arouse power feelings in otherwise ordinary people, they begin to see others as objects. When students were primed into a power mode by reliving a situation from their past where they had power over someone, they were also inclined to see others in terms of how useful they were to them. They were, for instance, more likely to report that they contacted people when they needed something from them and they were less likely to report that they really liked a colleague independently of how useful that person was to them (Gruenfeld et al., 2008).

If brief memories of low-grade power in artificial experiments can make people more egocentric and socially uninhibited, and more inclined to see other people as objects, what effects does long-term, large-

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scale power over thousands of people have on the human mind – as in the case of Fred Goodwin for instance? Gruenfeld had a unique opportunity to answer this question at a gathering of high-level business executives who had long experience of wielding power. True to her predictions, Gruenfeld showed that power-wielding senior business executives were more likely than business students to view people – whether underlings or peers – in terms of their usefulness to them rather than in terms of their non-utilitarian personal qualities.

Power can also bring out the bully in a person – but only in some people under certain circumstances. Nathanael Fast and colleagues of Stanford University discovered something that will send a shiver of appalled recognition down the spine of all who have worked in an organisation. Power makes bullies of people who feel inadequate in the role of boss (Fast & Chen, 2009). It is a dismaying implication of the famous Peter principle, which states: 'in a hierarchy every employee tends to rise to his level of incompetence' (Peter & Hull, 1969). With power comes the demand to perform under the close and critical scrutiny of underlings, peers and bosses. Such power energises and smartens some people, but it stresses out others who might have functioned well in a less powerful position.

Darach Keltner and his colleagues (2003) have proposed that power enhances approach-related behaviours (Behavioural Activation System in Jeffrey Gray's 1987 model), such as reward seeking, while low power enhances inhibitory processes (Behavioural Inhibition System, in Gray's terminology). Given power's effects on the neurotransmitter dopamine, it is interesting to note that there may be hemispheric – particularly prefrontal – asymmetries in dopamine (Toga & Thompson, 2003), with a left dominance for dopaminergic activity, and a right hemispheric dominance for noradrenergic activity. In the context of rewards, there is evidence that while dopamine signals the value of the current action, noradrenalin may signal the psychological cost of the action (Bouret et al., 2012). If this is indeed the case, then one could speculate that a little more noradrenalin and a little less dopamine may have moderated the bullish tendencies of the bankers who nearly brought down the capitalist world in 2008.

> "Power makes bullies of people who feel inadequate in the role of boss"

So holding power – say a job promotion for instance – will likely increase testosterone levels, which in turn will upregulate dopaminergic activity in the striatal reward networks but also possibly in left prefrontal regions. Evidence for this comes from studies showing increased left prefrontal activation in individuals primed to think about a situation where they had power over another person (Boksem et al., 2012), compared to remembering a situation when they were relatively powerless.

There but for the grace of God?

So would any of us, given sufficient power, have behaved like the Fred Goodwin's of this world? Probably not because some of us are, it appears, more motivated to seek power than others.

D.G. Winter of the University of Michigan (Winter, 1973) devised a method for assessing people's motives through analysing the images contained in short stories written in response to emotionally ambiguous drawings. He found that it was possible, with a reasonable degree of reliability (Winter & Stewart, 1977), to assess the degree of need for power by content analysis of the language based on the following categories:

- Carry out strong, psychologically or physically forceful, actions;
- Provide help or advice without being asked for it;
- Try to regulate or control what others are doing;
- Try to influence, bribe or argue with another person;
- Seek to impress;
- Arouse strong reactions or emotions in others in a one-sided way;
- Are concerned with prestige and/or reputation.

While there have been some concerns about the reliability of such assessments, the introduction of automated content analysis systems at least takes some of the potential bias out of the process. There are also studies suggesting the approach has validity. For example, Michelle Wirth and her colleagues at the University of Michigan (2006) measured need for power using Winter's methods, and combined this with a reaction time competition game with a group of male and female volunteers. They rigged the results so that individuals were – via false, feedback – allocated to a winner or a loser group. High power need people responded to the rigged wins by significant drops in cortisol, while losing caused increases in cortisol. Losing was much less stressful for those with lower power needs, however, but most intriguing is what happened to the stress hormone levels of low power need individuals when they *won*. Winning made their cortisol levels *rise* – for them, victory was apparently in some sense stressful.

It is possible, speculatively speaking, that this is something like the sporting 'killer instinct' at play and that people who have a low need for power may, probably unconsciously, sabotage their own performance because of the anticipated stress of winning.

Power-needy people are particularly attuned to facial signals of the impact they are having, and Oliver Schultheiss and his colleagues at the University of Michigan have further elucidated the brain processes that underpin these different levels of power motivation (Schultheiss et al., 2008). Schultheiss used fMRI to study the reaction of men and women with different

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levels of power need to pictures of angry, surprised and neutral faces. True to the prediction, the people with a high need for power showed a much stronger activation of brain areas responsible for emotion, bodily sensations and reward. The angry faces seemed to cause a much stronger 'gut reaction' in the high power need individuals, and activated areas in the striatum and orbital surface of the frontal lobes which encode the reward value of things and situations.

Henry Kissinger famously observed that power is an aphrodisiac, and indeed, people with a high need for power – both men and women – on average have sexual intercourse more often than their low-power-need friends (Schultheiss et al., 2003). Both men and women with higher levels of power are more likely to be unfaithful in their relationships (Lammers et al., 2011), because power increases confidence in the ability to attract partners.

This is very likely also mediated by power's up-regulation of the dopaminergic reward network, and this is supported by a number of genomic studies. The 10 repeat allele of the DAT1 gene affects how much dopamine is available in the striatum, a critical part of the reward network. Guang Guo and colleagues from the University of North Carolina (Guo et al., 2007) studied the effects of the DAT1 gene in 2500 adolescents whom they studied and interviewed over a period of approximately seven years into early adulthood. Guo's team were interested in the question of sexually transmitted diseases in this age group, and so wanted to understand why some adolescents had more sexual partners than others.

The results were remarkable: in 18- to 23-year-old men, those with *no* copies of the high risk DAT1 allele reported that they had had sexual intercourse with an average of *two* different people since they were first interviewed several years earlier. When it came to the young men who had two copies of the high-risk allele, they reported an average of over *five* different sexual partners in the same period. But this was only true for men – women's number of sexual partners was unrelated to their DAT1 profile.

On its own, however, power is not automatically sexually arousing for most men. But for those with tolerant attitudes to sexual harassment – for instance saying that they would consider asking for sexual favours of a woman in exchange for giving her a lucrative contract – thoughts of power turn them on sexually. When small amounts of power are unconsciously primed by getting them to complete fragmented words which have (unknown to the men) power connotations, they find a female stranger in the same room to be more attractive than if they are subliminally exposed to neutral words (Bargh et al., 1995). This is true even though the power-words – for example 'boss', 'control' and 'executive' – have nothing obviously to do with sex. Men who do not have attitudes favourable to sexual harassment, on the other hand, don't show any increase in the rated attractiveness of the woman stranger when they are similarly unconsciously primed with thoughts of power.

Both men and women with higher levels of power are more likely to be unfaithful in their relationships

Power and social networks

My research over several decades into how experience and learning can change brain function (O'Connell et al., 2008; Robertson et al., 1998; Robertson & Murre, 1999) focused very much on the individual, as has been the convention in most cognitive neuroscience since the cognitive revolution of the 1950s. But humans evolved as a group species, and it seems likely that the most potent type of experience impacting on brain function should be social relationships.

In a study of social networks and neurodegeneration for instance, Bennett et al. (2006) found that while post-mortem Alzheimer's disease-linked pathology and cognition several years before death showed a reasonable correlation among individuals with relatively sparse social networks, the cognition–pathology correlation disappeared among groups with relatively rich social networks. This shows how social variables impact on the biology of the brain and the expression of that biology in cognition.

Dominance hierarchies within humans and other species – and the power and powerlessness that go with them – are a particularly potent element of social relationships, and have immense effects on cognitive and emotional function. Macaques low in a dominance hierarchy, for instance, are much more likely to self-administer cocaine due to the fact that low social power has led to depleted dopamine in their reward networks, thus increasing the attractiveness of cocaine's dopamine-mediated reward effects (Morgan et al., 2002). It seems highly likely that the socio-economic gradient that exists in human drug use (Daniel et al., 2009) may in part be attributable to such mechanisms, as indeed may be the wider range of morbidities and mortality associated with low socio economic status.

It was this realisation of the social influences on brain function that led me to go beyond my individually based research on brain plasticity and to explore the fascinating story of how power and powerlessness affects cognition, emotions, behaviour and brain structure and function (Robertson, 2012). It has been a fascinating journey.

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