The Brain and Emotional Intelligence: New Insights

by Daniel Goleman

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Introduction

Back in 1995, just before my book Emotional Intelligence came out, I remember thinking that I would have succeeded if one day I happened to overhear two strangers talking, and one used the term ‘emotional intelligence’ – and the other knew what it meant. That would signal that the concept of emotional intelligence, or EI (the term I favor instead of the popularization “EQ”) had become a meme, a new idea that had entered the culture. Today EI has far exceeded that expectation, proving a powerful model for education in the form of social/emotional learning, and recognized as a fundamental ingredient of outstanding leadership, as well as an active agent in a fulfilling life.

When I wrote Emotional Intelligence I was harvesting a decade of then-new research on the brain and emotions. I used the concept of emotional intelligence as a framework to highlight a new field: affective neuroscience. Research on the brain and our emotional and social lives didn't stop when I finished the book; if anything, it has accelerated in recent years. I included updates on this research in my books Social Intelligence and Primal Leadership, as well as in a series of articles in the Harvard Business Review.

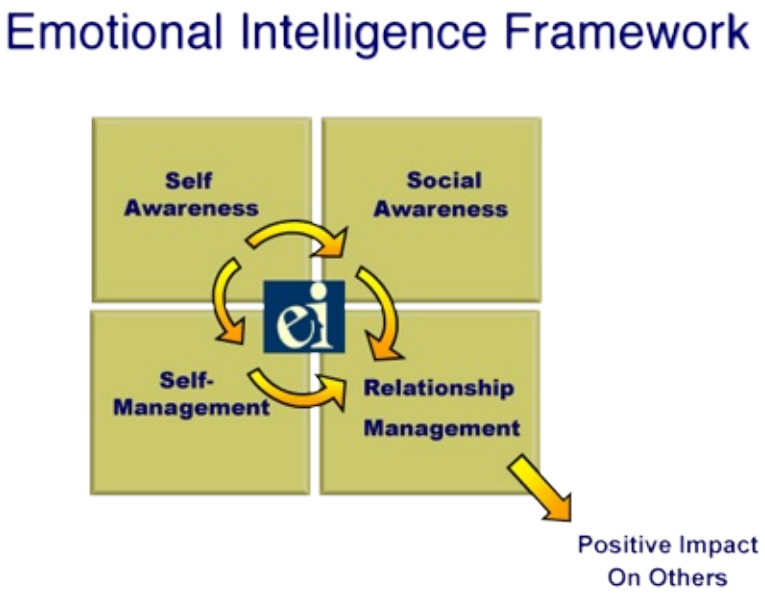
In this book I want to continue those updates, sharing with you some key findings that further inform our understanding of emotional intelligence and how to apply this skill set. This is not an exhaustive, technical review of scientific data – this is a work in progress that focuses on actionable findings, on new insights you can use.

I’ll cover the following topics:

- The Big Question being asked, particularly in academic circles: “Is there such an entity as ‘emotional intelligence’ that differs from IQ?”
- The brain’s ethical radar
- The neural dynamics of creativity
- The brain circuitry for drive, persistence, and motivation
- The brain states underlying optimal performance, and how to enhance them
- The social brain: rapport, resonance, and interpersonal chemistry
- Brain 2.0: our brain on the web
- The varieties of empathy and key gender differences
- The dark side: sociopathy at work

• Neural lessons for coaching and enhancing emotional intelligence abilities

There are three dominant models of emotional intelligence, each associated with its own set of tests and measures. One comes from Peter Salovey and John Mayer, who first proposed the concept of emotional intelligence in their seminal 1990 article[1]. Another is that of Reuven Bar-On who has been quite active in fostering research in this area[2]. The third is my own model, which is most fully developed in Primal Leadership (the book I wrote with my colleagues Annie McKee and Richard Boyatzis). There are several other EI models by now, with more in the works – a sign of the vibrancy of the field[3].



Emotional Intelligence – Goleman Model

Most elements of every emotional intelligence model fit within these four generic domains: self-awareness, self-management, social awareness, and relationship management.

Is Emotional Intelligence a Distinct Set of Abilities?

This is the first big question: Is emotional intelligence distinct from IQ?

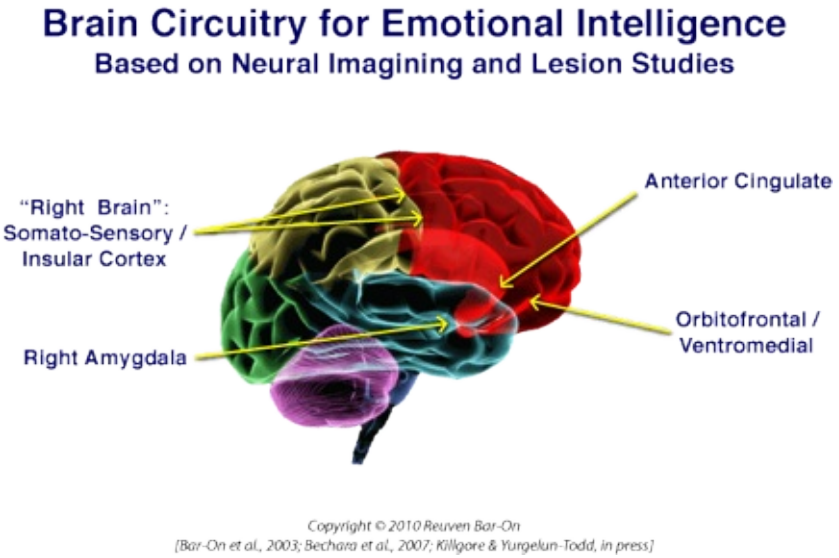
I first got an inkling that perhaps IQ alone did not explain all of career success during my freshman year in college. There was a guy down the hall from me in the dormitory who had perfect scores on his SATs, plus perfect scores on five advanced placement tests. From an academic point of view, he was brilliant. But he had a problem: zero motivation. He never got to class, he slept ‘till noon, never finished his assignments. It took him eight years to get his bachelors and today he's self-employed as a consultant. He’s not a star performer, he's not the head of a big organization, he's not an outstanding leader. I now see he lacked some crucial emotional intelligence abilities, particularly self-mastery.

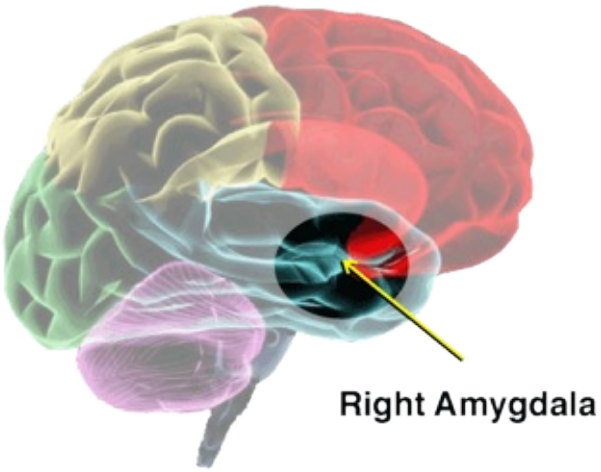
Howard Gardner, a friend from my days in grad school, opened up the conversation about different kinds of intelligence beyond IQ when he wrote about multiple intelligences in the 1980s[4]. Howard’s argument was that for an intelligence to be recognized as a distinct set of capacities there has to be a unique underlying set of brain areas that govern and regulate that intelligence.

Now brain researchers have identified distinct circuitry for emotional intelligence in a landmark study by another old friend, Reuven Bar-on (by some unlikely coincidence, his mother was my fourth grade Sunday school teacher). Bar-On worked with one of today’s outstanding brain research groups, headed by Antonio Damasio at the University of Iowa medical school[5]. They used the gold standard method in neuropsychology for identifying the brain areas associated with specific behaviors and mental functions: lesion studies. That is, they studied patients who have brain injuries in clearly defined areas, correlating the site of the injury with the resulting specific diminished or lost capacities in the patient. On the basis of this tried-and-true methodology in neurology, Bar-on and his associates identified several brain areas crucial for the abilities of emotional and social intelligence.

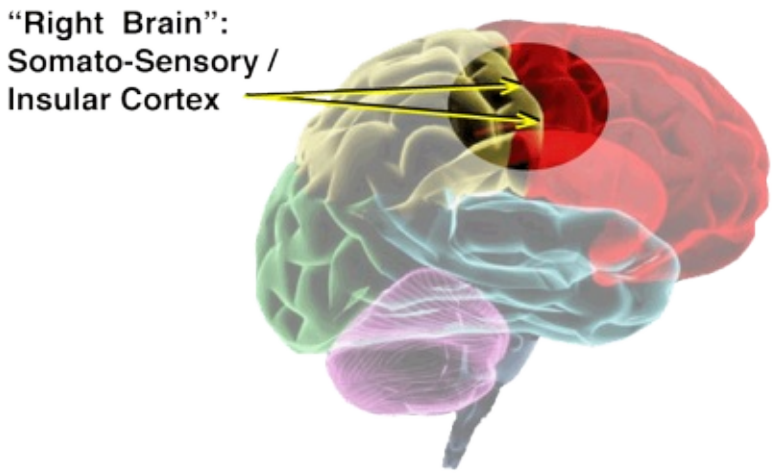
The Bar-On study is one of the more convincing proofs that emotional intelligence resides in brain areas distinct from those for IQ. Other findings using different methods support the same conclusion[6]. Taken together, this data tells us there are unique brain centers that govern emotional intelligence, which distinguishes this set of human skills from academic (that is, verbal, math, and spatial) intelligence – or IQ, as these purely cognitive skills are

known – as well as from personality traits.

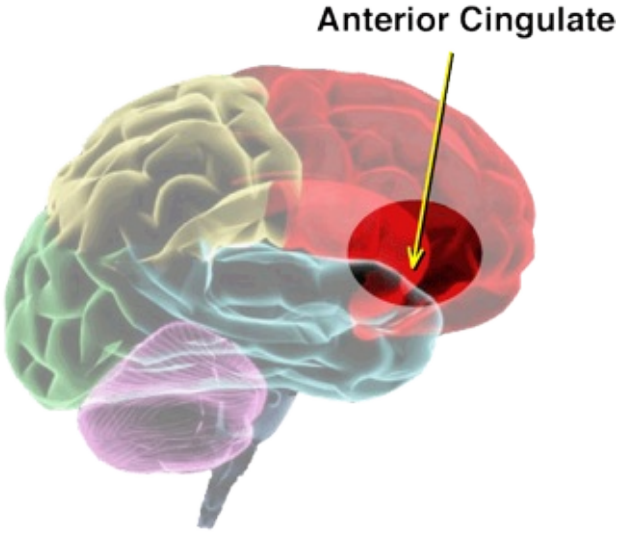




The right amygdala (we have two, one in each brain hemisphere) is a neural hub for emotion located in the midbrain. In Emotional Intelligence I wrote about Joseph LeDoux's landmark research on the role of the amygdala in our emotional reactions and memories. Patients with lesions or other injuries to the right amygdala, the Bar-On study found, showed a loss in emotional self-awareness – the ability to be aware of and understand our own feelings.

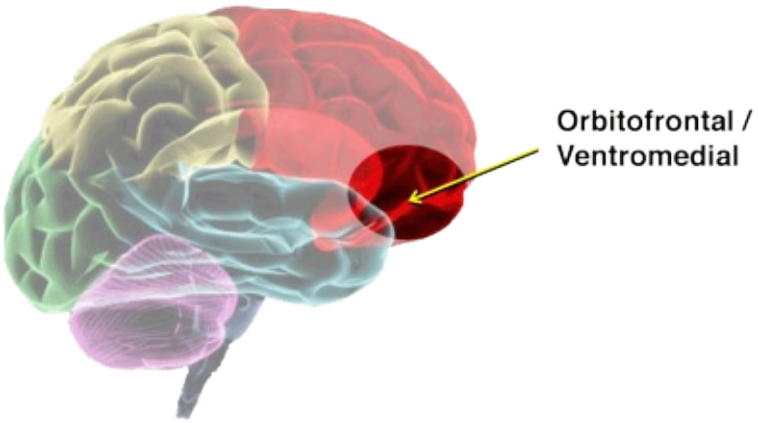


Another area crucial for emotional intelligence is also on the right side of the brain. It's the right somatosensory cortex; injury here also creates a deficiency in self-awareness, as well as in empathy – awareness of emotions in other people. The ability to understand and feel our own emotions is critical for understanding and empathizing with the emotions of others. Empathy also depends on another structure in the right hemisphere, the insula, a node for brain circuitry that senses our entire bodily state and tells us how we're feeling. Tuning in to how we're feeling ourselves plays a central role in how we sense and understand what someone else is feeling.



Another critical area is the anterior cingulate, located at the front

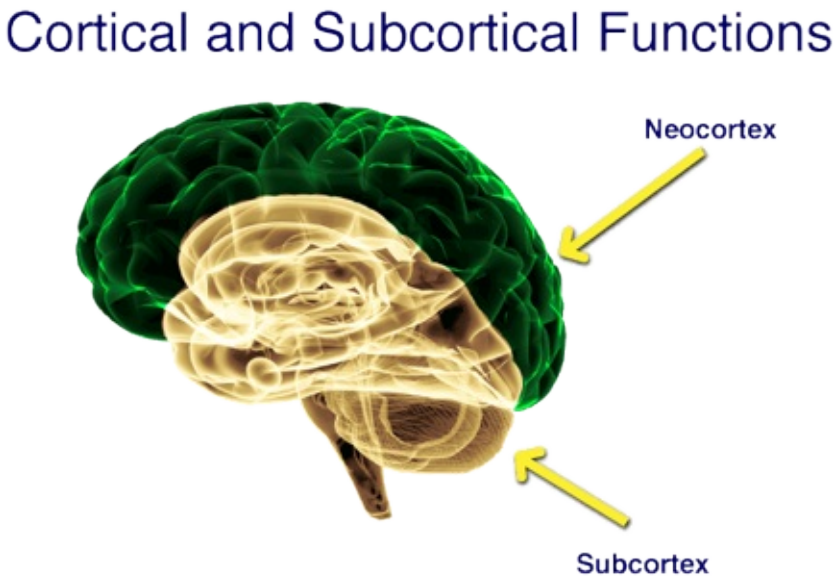
of a band of brain fibers that surround the corpus callosum, which ties together the two halves of the brain. The anterior cingulate is an area that manages impulse control, the ability to handle our emotions, particularly distressing emotions, and strong feelings.



Finally, there's the ventral medial strip of the prefrontal cortex. The prefrontal cortex is just behind the forehead, and is the last part of the brain to become fully grown. This is the brain's executive center; here reside the abilities to solve personal and interpersonal problems, to manage our impulses, to express our feelings effectively, and to relate well with others.

Self-Awareness

New findings suggest how brain regions involved in self-awareness help us with ethics and with decision making in general. The key to understanding this neural dynamic is to distinguish between the thinking brain (neocortex), and the subcortical areas.



The neocortex – the wavy areas in green – contains centers for cognition and other complex mental operations. The subcortical areas, shown here in blue, are where more basic mental processes occur. Just below the thinking brain, and projecting into the cortex, are the limbic centers, the brain's main areas for emotion. These areas are also found in the brains of other mammals. The more ancient parts of the subcortex extend down to the brainstem, known as the "reptilian brain" because we share this basic architecture with reptiles.

Antonio Damasio (the neuroscientist in whose lab Bar-On's work on the brain basics of EI was done) has written about a telling neurological case. There was a brilliant corporate lawyer who, unfortunately, had a brain tumor. Luckily that tumor was diagnosed early and operated on successfully. But during the operation the surgeon had to cut circuits that connect key areas of the prefrontal cortex, the brain's executive center, and the amygdala in the midbrain's area for emotions.

After the surgery there was a very puzzling clinical picture. On every test

of IQ, memory, and attention, this lawyer was absolutely as smart as he had been before the surgery. But he couldn't do his job any more. He lost his job. He couldn't keep any job. His marriage broke up. He lost his house. He ended up living in his brother's spare bedroom and, in despair, he went to Damasio to find out what was wrong.

At first Damasio was completely puzzled, because on every neurological test, the lawyer was fine. But the clue came when Damasio asked the lawyer, "When shall we have our next appointment?"

It was then that Damasio realized the lawyer could give him the rational pros and cons of every hour for the next two weeks – but he didn't know which was best. Damasio says that in order to make a good decision, we need to have feelings about our thoughts – and that lesion created during the surgery for the lawyer's tumor meant he could no longer connect his thoughts with the emotional pros and cons.

Such feelings come from the emotional centers in the midbrain, interacting with a specific area in the prefrontal cortex[7]. When we have a thought it's immediately valenced by these brain centers, positive or negative. This is what helps us shuffle our thoughts into priorities – like when would be the best time for an appointment. Lacking that input, we don't know what to feel about our thoughts, so we can't make good decisions.

Cortical-subcortical circuitry also offers an ethical rudder. Lower in the brain, below the limbic areas, lies a neural network called the basal ganglia. This is a very primitive part of the brain, but it does something extraordinarily important for navigating the modern world.

As we go through every situation in life, the basal ganglia extracts decision rules: when I did that, that worked well; when I said this, it bombed, and so on. Our accumulated life wisdom is stored in this primitive circuitry. However, when we face a decision, it's our verbal cortex that generates our thoughts about it. But to more fully access our life experience on the matter at hand, we need to access further inputs from that subcortical circuitry. While the basal ganglia have some direct connection to the verbal areas, it turns out also to have very rich connections to the gastrointestinal tract – the gut. So in making the decision, a gut sense of it being right or wrong is important information, too[8]. It's not that you should ignore the data, but if it doesn't fit what you're feeling, maybe you should think twice about it.

That rule-of-thumb seemed to be at play in a study of highly successful California entrepreneurs who were asked how they made crucial business decisions. They all reported more or less the same strategy. First, they were

voracious consumers of any data or information that might bear on their decision, casting a wide net. But second, they all tested their rational decision against their gut feeling – if a deal didn’t feel right they might not go ahead, even if it looked good on paper.

The answer to the question, “Is what I'm about to do in keeping with my sense of purpose, meaning, or ethics?” doesn't come to us in words; it comes to us via this gut sense. Then we put it into words.

The Right Brain State for the Job

Self-mastery requires self-awareness plus self-regulation, key components of emotional intelligence. One value of self-mastery is being in the right brain state for the job[9].

When it comes to personal effectiveness, we need to be in the best internal state for the task at hand, and every internal state has its advantages and downsides. For instance, research shows that the plusses of being in a positive mood are that we're more creative, we're better at problem solving, we have better mental flexibility, and we can be more efficient in decision making in many ways.

The negatives, though, include a tendency to be less discriminating in distinguishing weak from strong arguments, or making a decision too quickly, or paying too little attention to detail on a task that demands it.

On the other hand, there are some plusses to being in a sour mood – or at least more somber. These include a greater capacity to pay attention to detail, even in boring tasks – which suggests it’s best to get serious before reading a contract. In a negative mood we’re more skeptical, so, for example, we are less likely to simply rely on the opinions of experts, we ask searching questions, and come to our own conclusions. One theory about the utility of anger is that it mobilizes energy and focuses our attention on removing obstacles that thwart a goal – which can fuel, say, a drive to beat a competitor on the next round who has just won a victory over us (whether that competitor is a school team or another business).

The prime negative of being in a bad mood is, of course, that it’s unpleasant for us and those around us. But there are more subtle costs: At the cognitive level, we're more pessimistic, and therefore more likely to give up more quickly when things go wrong than if we were in an optimistic state. Bad moods give us a negative bias toward whatever we might be considering, and so put a negative skew on our judgments. And because we’re less pleasant to be around we can be disruptive to the harmony of a team – a cranky team member can lower effectiveness for everyone.

Then there’s a perhaps surprising case in point for the right brain state for the job: creativity.

The Creative Brain

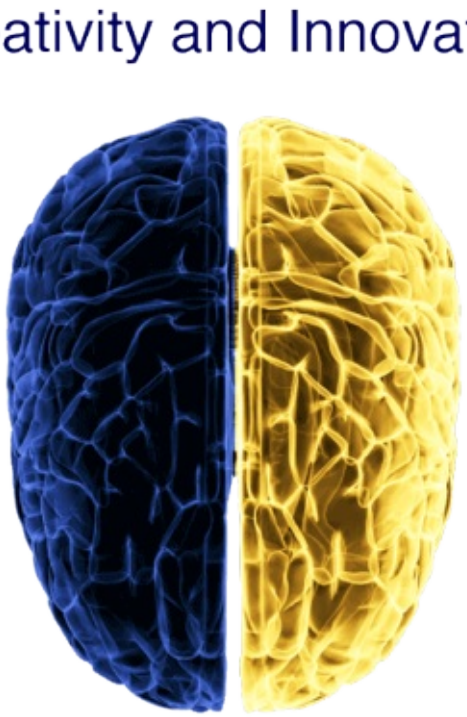
“Right brain good, left brain bad.” That belief about creativity and the right and left hemispheres of the brain dates back to the Seventies, and reflects a very outdated bit of neuromythology. The new understanding about left and right hemispheres is more specific to the topography of the brain: when it comes to left versus right, do you mean left front, left middle, left rear?

We now understand that when it comes to creativity it’s not just left-right, it’s also up-down – it’s the whole brain. Here, it’s important to understand a structural difference between the right hemisphere and the left hemisphere.

The right hemisphere has more neural connections both within itself and throughout the brain. It has strong connections to emotional centers like the amygdala and to subcortical regions throughout the lower parts of the brain.

The left side has far fewer connections within itself and beyond to the rest of the brain. The left hemisphere is made of neatly stacked vertical columns, which allows the clear differentiation of separate mental functions, but less integration of those functions. By comparison, the right hemisphere is more of a mix structurally.

The creative brain is not just right-brain: it involves the whole-brain, left-right-top-bottom, as the creative brain state accesses a large web of connections.



The right hemisphere has longer branches that make more connections to other parts of the brain than does the left side; during a flash of creative insight a new circuit of connectivity arises.

Let’s look at how that maps across the dominant thinking about creativity. You may have heard a classic model of the four stages of creativity (it’s more than a century old):

Step one, you define and frame the problem. Many people say that one of the signs of geniuses in a field is the ability to see problems and challenges and ask questions that no one else sees or asks. So first find and frame the creative challenge.

Second, immerse yourself, dig deep. Gather ideas, data, information, anything that's going to help you with a creative breakthrough.

The third phase is a little counter-intuitive for some people: let it all go. Just relax. The best ideas come while you're taking a long hot shower, going for a walk, or on vacation[10]. Here, the self-mastery comes in knowing when to let go, and knowing that you need to let go.

The final stage, the fourth, is execution – and, of course, many brilliant ideas fail here, because they aren't implemented well.

This model is accurate to a point – but life is not that simple. I’ve found

that people whose professions demand a stream of creative insights have a more complicated relationship to creativity than a neat four-stage model suggests. George Lucas, for example, says that when he has to write a script or review one, he goes to a cottage behind his house, and just writes. Does he ever just let go into a reverie and see what comes to him? “No,” he says, “I have to keep working all the time.” That's how one creative genius works (but I suspect he has uniquely fluent creative circuitry).

The second creative genius I talked to about this was the composer Phil Glass, one of the world's most renowned contemporary composers. I asked him, “When do you get your creative ideas?” His answer surprised me. He said, “I know exactly when they're going to come: between 11 a.m. and 3 p.m. That's when I work on my new compositions.”

More usual though, might be a third creative expert I talked to: Adrienne Weiss, a woman who does product branding and re-branding. She had an assignment to help rebrand the global ice cream shop chain Baskin-Robbins, including coming up with a fresh logo. She asked herself, “Well, what do we have? Baskin-Robbins is famous for its 31 flavors. How are we going to make that into something new and distinctive?”

After getting nowhere just by thinking about this, one night as she was sleeping she woke up from a dream in which she saw the name ‘Baskin-Robbins’. Highlighted in the loop of the “B” in Baskin was a “3,” and in the stem of the “R” was a “1.” That’s “31,” the number of their flavors. If you look at the new logo of Baskin-Robbins you'll see that 31 pop out of the B and the R. And it came to her in a dream.

Brain studies on creativity reveal what goes on at that “Aha!” moment, when we get a sudden insight. If you measure EEG brain waves during a creative moment, it turns out there is very high gamma activity that spikes 300 milliseconds before the answer comes to us. Gamma activity indicates the binding together of neurons, as far-flung brain cells connect in a new neural network – as when a new association emerges. Immediately after that gamma spike, the new idea enters our consciousness.

This heightened activity focuses on the temporal area, a center on the side of the right neocortex. This is the same brain area that interprets metaphor and “gets” jokes. It understands the language of the unconscious, what Freud called the “primary process”: the language of poems, of art, of myth. It’s the logic of dreams, where anything goes and the impossible is possible.

That high gamma spike signals that the brain has a new insight. At that moment, right hemisphere cells are using these longer branches and

connections to other parts of the brain. They've collected more information and put it together in a novel organization.

What’s the best way to mobilize this brain ability? It’s first to concentrate intently on the goal or problem, and then relax into stage three: let go.

The converse of letting go – trying to force an insight – can inadvertently stifle creative breakthrough. If you're thinking and thinking about it, you may just be getting more tense and not coming up with fresh ways of seeing things, let alone a truly creative insight.

So to get to the next stage, you just let go. Unlike the intense focus of grappling with a problem head-on, the third stage is characterized by a high alpha rhythm, which signals mental relaxation, a state of openness, of daydreaming and drifting, where we're more receptive to new ideas. This sets the stage for the novel connections that occur during the gamma spike.

Those moments of out-of-the-blue, spontaneous creative insights may seem to come out of nowhere. But we can assume that the same process has gone on, where there was some degree of engagement in a creative problem, and then during “down time” neural circuits make novel associations and connections. Even when creative insights seem to arise on their own, the brain may be going through the same moves as during the three classical stages.

On the other hand, I would guess that the three or four classical stages of creativity are somewhat of a useful fiction – the creative spirit is more freewheeling than that. I think the main neural action is between intense focus on the problem and then relaxing about it.

And when that creative idea arrives, it’s almost certain that the brain has gone through that same heightened pitch of gamma activity that was found in the lab.

Is there a way to create the conditions whereby the gamma spike is more likely to occur? Gamma spikes normally come at random – they can’t be forced. But the mental stage can be set. The pre-work for the gamma spike includes defining the problem, then immersing yourself in it. And then you let it all go – and it’s during the let-go period that that gamma spike is most likely to arise, along with that “Aha!” moment, the light bulb over the head of a cartoon figure. There’s a physical marker we sometimes feel during a gamma spike: pleasure. With the “Aha!” comes joy.

Then there's that fourth stage, implementation, where a good idea will either sink or swim. I remember talking to the director of a huge research lab. He had about 4,000 scientists and engineers working for him. He told me,

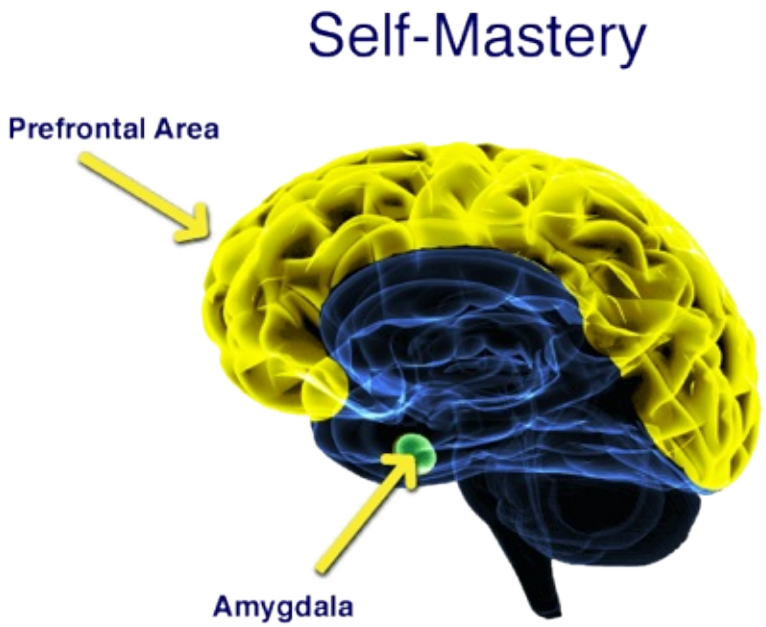
“We have a rule about a creative insight: if somebody offers a novel idea, instead of the next person who speaks shooting it down – which happens all too often in organizational life – the next person who speaks must be an ‘angel’s advocate,’ someone who says, ‘that's a good idea and here's why.’” Creative ideas are like a fragile bud – they’ve got to be nurtured so they can blossom.

Self-Mastery

The two left-hand quadrants in the generic emotional intelligence model are about the self: self-awareness and self-management.

These are the basis for self-mastery: awareness of our internal states, and management of those states. These domains of skill are what make someone an outstanding individual performer in any domain of performance – and in business an outstanding individual contributor, or lone star.

Competencies like managing emotions, focused drive to achieve goals, adaptability and initiative are based on emotional self-management.



Self-regulation of emotion and impulse relies greatly on the interaction between the prefrontal cortex – the brain's executive center – and the emotional centers in the midbrain, particularly circuitry converging on the amygdala.

The key neural area for self-regulation is the prefrontal cortex, which is, in a sense, the brain's "good boss," guiding us when we are at our best. The dorsolateral zone of the prefrontal area is the seat of cognitive control, regulating attention, decision-making, voluntary action, reasoning, and flexibility in response.

The amygdala is a trigger point for emotional distress, anger, impulse, fear, and so on. When this circuitry takes over, it acts as the "bad boss," leading us

to take actions we might regret later.

The interaction between these two neural areas creates a neural highway that, when in balance, is the basis for self-mastery. For the most part, we cannot dictate what emotions we are going to feel, when we're going to feel them, nor how strongly we feel them. They come unbidden from the amygdala and other subcortical areas. Our choice point comes once we feel a certain way. What do we do then? How do we express it? If your prefrontal cortex has its inhibitory circuits going full blast, you'll be able to have a decision point that will make you more artful in guiding how you respond, and in turn how you drive other people's emotions, for better or worse, in that situation. At the neural level, this is what "self-regulation" means.

The amygdala is the brain's radar for threat. Our brain was designed as a tool for survival. In the brain's blueprint the amygdala holds a privileged position. If the amygdala detects a threat, in an instant it can take over the rest of the brain – particularly the prefrontal cortex – and we have what's called an amygdala hijack.

The hijack captures our attention, beaming it in on the threat at hand. If you're at work when you have an amygdala hijack, you can't focus on what your job demands – you can only think about what's troubling you. Our memory shuffles, too, so that we remember most readily what's relevant to the threat – but can't remember other things so well. During a hijack, we can't learn, and we rely on over-learned habits, ways we've behaved time and time again. We can't innovate or be flexible during a hijack.

Neural imaging when someone is really upset shows that the right amygdala in particular is highly active, along with the right prefrontal cortex. The amygdala has captured this prefrontal area, driving it in terms of the imperatives of dealing with the perceived danger at hand. When this alarm system triggers, we get the classic fight-flight-or-freeze response, which from a brain point of view means that the amygdala has set off the HPA axis (the hypothalamic pituitary adrenal axis) and the body gets a flood of stress hormones, mainly cortisol and adrenaline.

There's one big problem with all this: the amygdala often makes mistakes. The reason is that while the amygdala gets its data on what we see and hear in a single neuron from the eye and ear – that's super-fast in brain time – it only receives a small fraction of the signals those senses receive. The vast majority goes to other parts of the brain that take longer to analyze these inputs – and get a more accurate reading. The amygdala, in contrast, gets a sloppy picture and has to react instantly. It often makes mistakes, particularly in modern life,

where the “dangers” are symbolic, not physical threats. So we overreact in ways we often regret later.

Here are the five top amygdala triggers in the workplace[11]:

1. Condescension and lack of respect.
2. Being treated unfairly.
3. Being unappreciated.
4. Feeling that you're not being listened to or heard.
5. Being held to unrealistic deadlines.

In an economic atmosphere with great uncertainty there’s lots of free-floating fear in the air. People fear for their jobs, for their family’s financial security, and all the other problems that a bad economy brings. And anxiety hijacks workers who have to do more with less. So in such a climate there are many people operating day-to-day in what amounts to a chronic, low-grade amygdala hijack.

How can we minimize hijacks? First of all, pay attention. If you don't notice that you're in the midst of an amygdala hijack and stay carried away by it, you haven't a chance of getting back to emotional equilibrium and left prefrontal dominance until you let the hijack run its course. Better to realize what’s going on and disengage. The steps to ending or short-circuiting a hijack start with monitoring what’s going on in your own mind and brain, and noticing, “I'm really over-reacting,” or “I'm really upset now,” or “I’m starting to get upset.” It’s much better if you can notice familiar feelings that a hijack is beginning – like butterflies in your stomach, or whatever signals that might reveal you're about to have an episode. It’s easier to short-circuit it the earlier you are in the cycle of the hijack. Best is to head it off at the bare beginning of a coming hijack.

What can you do if you are caught in the grip of an amygdala hijack? First, you have to realize you're in it at all. Hijacks can last for seconds or minutes or hours or days or weeks. For some people it may seem their “normal” – people who have gotten used to always being angry or always being fearful. This shades over into clinical conditions like anxiety disorders or depression, or post-traumatic stress disorder, which is an unfortunate disease of the amygdala induced by a traumatic experience where the amygdala shifts into a hair-trigger mode of instant, extreme hijack.

There are lots of ways to get out of a hijack if we first can realize we’re caught, and also have the intention to cool down. One is a cognitive approach:

talk yourself out of the hijack. Reason with yourself, and challenge what you are telling yourself in the hijack –This guy isn't always an S.O.B. I can remember times when he was actually very thoughtful and even kind, and maybe I should give him another chance.

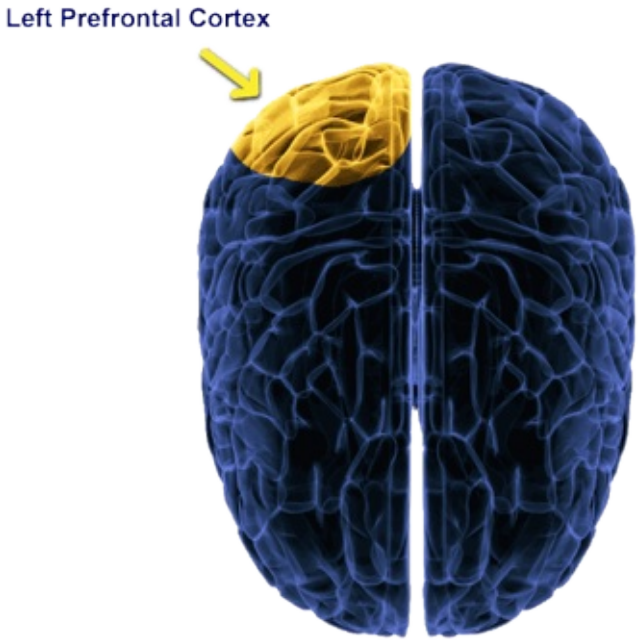
Or you can apply some empathy, and imagine yourself in that person’s position. This might work in those very common instances where the hijack trigger was something someone else did or said to us. You might have an empathic thought: Maybe he treated me that way because he is under such great pressure.

In addition to such cognitive interventions, there are also biological interventions. We can use a method like meditation or relaxation to calm down our body. But a relaxation or meditation technique works best during the hijack when you have practiced it regularly, at best daily. Unless these methods have become a strong habit of the mind, you can't just invoke them out of the blue. But a strong habit of calming the body with a well-practiced method can make a huge difference when you're hijacked and need it the most.

Managing Stress

A friend told me, “My worst time at work was just after a merger when people were disappearing daily, with lying memos about what had happened.” She added, “Nobody could focus on their work.” These days what was just an episode for her has become a chronic reality in too many businesses.

Ups and downs of the economy aside, organizational life is rife with toxic moments – impossible directives from headquarters, unreasonable people in positions of power, abrasive workmates, and on and on. So, how can we manage such constant stress, or outright distress? One strategy for managing our reactions to hassles and upsets takes advantage of another dynamic between the prefrontal area and the amygdala circuitry.



The prefrontal cortex holds circuitry that can inhibit amygdala-driven impulses, helping us maintain emotional balance. The left prefrontal area also contains circuits active during positive states like enthusiasm, energy, and engagement.

Richard Davidson, who directs the Laboratory for Affective Neuroscience at the University of Wisconsin, has done seminal research on the left versus right prefrontal areas. His research group has found that when we're in the grip of a hijack or under the sway of distressing emotions, there are relatively high levels of activity in the right prefrontal cortex. But when we're feeling

great – enthused, energized, like we could take on anything – the left prefrontal area lights up.

The Davidson group found that each of us has a left-to-right ratio of prefrontal activity (measured when we're just resting, not doing anything in particular) that accurately predicts our typical mood range day to day. This left-to-right ratio gauges our emotional setpoint[12].

People who have more activity on the left than right are more likely to have more positive emotions, and the more positive their emotions day to day. Those with more activity on the right are prone to having more negative emotions.

There is a “Bell Curve” for this ratio, like the well-known upside-down U curve for IQ. Most of us are in the middle – we have good and bad days. Some people are at the extreme right – they may be clinically depressed or chronically anxious. In contrast, those people at the extreme left on the Bell Curve bounce back from setbacks with extraordinary rapidity.

Davidson has also done research on what he calls “emotional styles” – which are really brain styles. One brain style tracks how readily we become upset: where we are on the spectrum from a hair-trigger amygdala – people who easily become upset, frustrated or angered – versus people who are unflappable.

A second style looks at how quickly we recover from our distress. Some people recover quickly once they get upset, while others are very slow. At the extreme of slowness to recover are people who continually ruminate or worry about things – in effect, who suffer from ongoing low-grade amygdala hijacks. Chronic worry keeps the amygdala primed, so you remain in a distress state as long as you ruminate.

Given the many realistic stresses we face, those first two styles – being unflappable and capable of quick recovery – are the most effective in navigating the troubles of the world of work.

The third style assesses a person’s depth of feeling. Some people experience their feelings quite intensely, some people quite shallowly. Those who have stronger feelings may be better able to authentically communicate them more powerfully – to move people.

There's another piece of suggestive data about the left-right ratio. Barbara Fredrickson at the University of North Carolina finds that people who flourish in life – who have rich relationships, rewarding work, who feel that their life is meaningful – have at least three positive emotional events for every

negative one[13]. A similar positive-to-negative ratio in emotions has also been documented in top teams, where it's five-to-one; the ratio for flourishing seems to operate at the collective level too.

When we're pitched into an amygdala hijack, whether intense or low level but ongoing, we're in sympathetic nervous system arousal. As a chronic condition that's not a good state. While we're hijacked, the alarm circuits trigger the fight-flight-or-freeze response that pumps stress hormones into the body with a range of negative results, such as lowering the effectiveness of our immune response. The opposite state, parasympathetic arousal, occurs when we're relaxed. Biologically and neurologically this is the mode of restoration and recovery, and it is associated with left prefrontal arousal.

If you want to cultivate greater strength of activity in the left prefrontal areas that generate positive emotions, you can try a few strategies. One is to take regular time off from a hectic, hassled routine to rest and restore. Schedule time to "do nothing": walk your dog, take a long shower, whatever allows you to let go of leaning forward into the next thing in your on-the-go state.

Another is called mindfulness; Daniel Siegel has an elegant analysis of the brain areas this involves[14]. In the most popular form of mindfulness you cultivate an even-hovering presence to your experience in the moment, an awareness that is non-judgmental and non-reactive to whatever thoughts or feelings arise in the mind. It's a very effective method for decompressing and getting into a relaxed and balanced state.

"Mindfulness-Based Stress Reduction," the method Jon Kabat-Zinn developed, is widely used in medical settings to help people manage chronic symptoms, because it alleviates the emotional suffering that usually attends them, and so improves patients' quality of life.

Richard Davidson teamed up with Kabat-Zinn, then at the University of Massachusetts Medical Center, to help people at work learn how to get into a relaxed mode via mindfulness[15]. Kabat-Zinn taught mindfulness to people working in a high-stress setting, a biotech start-up where they were going all-out, 24/7. He taught them an eight-week program where they practiced mindfulness an average of 30 minutes a day.

Davidson did brain studies before and after the mindfulness program. Before, most people's emotional setpoint was tipped to the right, indicating they were hassled. After eight weeks of mindfulness, they had begun to tip back to the left. And their own reports made clear that with this shift toward the more positive zone of emotions their enthusiasm, energy, and joy in their

work surfaced.

Mindfulness seems a good choice for strengthening the dominance of critical zones in the prefrontal cortex. Davidson tells me – this is good news – that the biggest bang for your buck from mindfulness in terms of shifting the brain's emotional setpoint comes at the beginning of the practice. You don't have to wait for years to feel the improvement – though you probably need to continue practicing daily to maintain the shift.

Along with this shift toward a more positive mood range comes another neural tool for managing stress: a faster recovery time. Traditionally people end their daily mindfulness session with a period of loving thoughts toward other people – the practice of lovingkindness. This intentional generation of a positive mood enhances "vagal nerve tone," the body's ability to mobilize to meet a challenge and then to recover quickly. The vagus nerve regulates the heartbeat and other organ functions, and plays a major role in calming down the body when we get distressed. Better vagal tone enhances our ability to arouse ourselves to meet a challenge and then to cool down rather than staying in high gear.

Having good vagal tone helps us not just recover from stress, but also sleep better and guard against the negative health impacts of chronic stress in life. The key to building better vagal tone is to find a method we enjoy, and practice it daily – like a workout for the vagus nerve. These methods include everything from simply remembering to count slowly to ten when you are starting to get ticked off at someone, to systematic muscle relaxation, to meditation.

Sometimes when I talk about meditation – a topic I've been writing about for decades – I'm asked if we might get the same effects through psychopharmacology[16]. I prefer to use the mind to intervene in brain states; it's a natural way to manage our brain.

There are many kinds of meditation, each using a different mental strategy: concentration, mindfulness, and visualization, to name a few. Each meditation method has specific impacts on our mental states. For example, visualization activates centers in the spatial visual cortex, while concentration involves the attention circuitry in the prefrontal cortex but not the visual area. A new scientific field, "contemplative neuroscience," has begun mapping exactly how meditation A versus meditation B engages the brain, which brain centers it activates, and what the specific benefits might be.

Motivation: What Moves Us

The word ‘motivation’ shares its root with ‘emotion’: both come from the Latin motere, to move. Our motives give us our aims and the drive to achieve them. Anything that’s motivating makes us feel good. As one scientist put it to me, “The way nature gets us to do what it wants is by making it a pleasure.”

Our motives dictate where we find our pleasures. But when it comes to pursuing those goals, life so often presents difficulties. And when we face setbacks and obstacles in reaching the goals our motives drive us toward, circuitry converging on a zone in the left prefrontal cortex comes alive to remind us of the good feelings we will have once we reach that goal. When things go wrong, this helps us keep going through tough times.

People whose emotional setpoint tips toward the left side tend to be more positive in their emotional outlook. But, Davidson finds, they are susceptible to anger, mainly when a worthy goal gets thwarted. Then they get frustrated and irritated – which is good, because it mobilizes their energy and focuses their attention in working to overcome the obstacles and achieve that goal.

By contrast, Davidson says, right prefrontal activation acts as what’s called a “behavioral inhibitor”: people give up more easily when things get tough. They're also too risk-averse – not smart risk-averse, but overly cautious. They have low motivation, they're generally more anxious and fearful and have increased vigilance for threats.

Davidson’s research has found that the left hemisphere lights up even at the mere thought of achieving a meaningful goal. Left prefrontal activity is also associated with something bigger than any single target: this is a sense of purpose in life, the grand goals that give our lives meaning.

Howard Gardner has written about what he calls “Good Work,” a combination of excellence, where you're doing work that calls on your best talents; of engagement, where you're enthusiastic, energized, and love what you do; and ethics, where work is aligned with your sense of purpose, meaning, and where you want to go in life. No one has done this research yet, but I’d predict that if you studied the brains of people while engaged in good work, you’d find relatively more left prefrontal activation.

When I was a graduate student at Harvard, my mentor was a psychologist named David McClelland, who at the time was a major theorist of motivation. McClelland proposed three main motivators for people (there are other models of motivation that list dozens of motivators). I think of each kind of

motivation as a different path to activating the left prefrontal cortex and the brain’s reward centers which increases our drive and persistence, and makes us feel good.

The first of the three motives is the need for power, in the sense of influencing or impacting other people. McClelland distinguished between two kinds of power. One is selfish, ego-centered power, without caring whether the impact is good or bad – the kind of power displayed by narcissists, for example. The other is a socially beneficial power, where you take pleasure in influencing people for the better or for the common good.

The second is the need to affiliate; taking pleasure in being with people. Those who are high in this affiliation motive, for instance, are motivated by the sheer pleasure of doing things together with people they like. When we’re working toward a common goal, people motivated by affiliation find energy in how good we'll all feel when we reach that goal. Great team members may be driven by the affiliative motive.

And then there's the need for achievement, reaching toward a meaningful goal. Those high in the need for achievement love to keep score, to get feedback on how they are doing, whether this means just hitting their numbers for a quarterly target or raising millions for a charity. People who are strong in the achievement drive continually strive to improve; they’re relentless learners. No matter how good they are today, they're not satisfied with the status quo; they're always trying to do better.

There can be a downside to the achievement drive: some people become workaholics, completely focused on their work goals and neglecting to live a full life. You can see this in students who are “grinds,” driven to get the highest grades at the sacrifice of everything else in their lives, just as you see it in those successful executives who work 18-hour days all through the week – and in anyone who has perfectionistic standards. The key to a healthy drive to achieve is having a very high internal standard for performance that you hold yourself to – but if that standard is too high, you fail to appreciate your accomplishments while obsessing about any little imperfection. It’s the drive to achieve gone into overdrive.

In reviewing their performance on anything, perfectionists only focus on what they could have done better, not what they did well. They may already be at 110% compared to other people, but they're madly trying to get to 112% or 115%. This striving is very strongly rewarded both in the educational system and in the world of work today. But it has a human cost, whether for a kid in school or someone in the workplace: your life suffers. The price you

pay may be in a series of failed relationships, or never taking time out for things you enjoy, or the health costs of chronic stress.

How can you help a person who's caught in that predicament? I think first you have to help them understand that there's a negative side to trying to be overly successful. The second is to point out to them that you don't have to be hitting 110 percent all the time – sometimes just being at 80 or 90% means you're doing well enough – and you can have a life and enjoy yourself, too.

McClelland discovered that you could rate people on their level of the achievement motivation with a simple kid's game: the ring toss. In the ring toss you can choose where to place a standup peg out in front of you on the floor – 3 feet, 6 feet, 9 feet or 12 feet. You have a plastic ring, and you have to see if you can toss it on the peg – the further out it is, the higher your score. People who are high in the need to achieve are very good at guessing the furthest out they can put the peg and still get the ring on it. They take smart risks. They may do things that look very risky to other people but they've done the right research and have the data, or they've mastered the pertinent know-how, the skills they know will help them hit that goal. McClelland found this trait to be very strong in highly successful entrepreneurs.

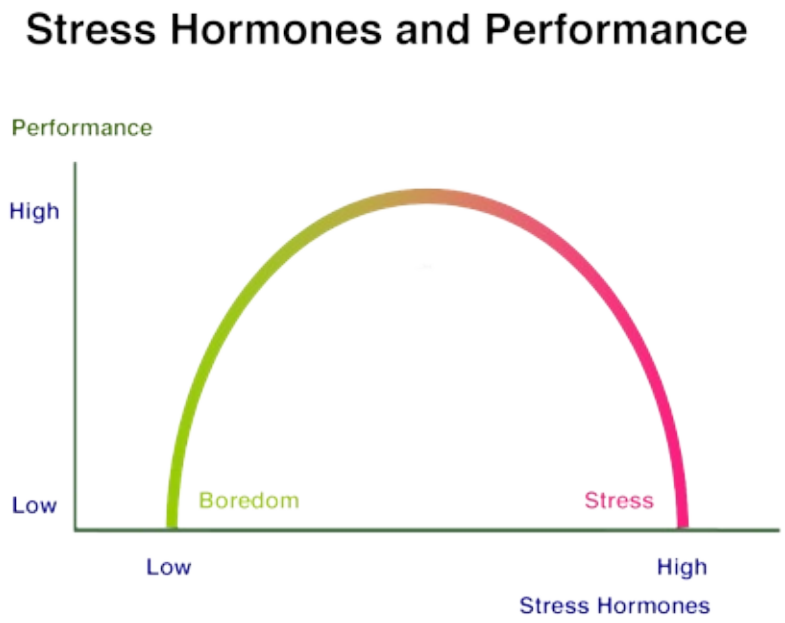
I remember some years ago I was taking part in a business forum and was on a panel with young techies, each of whom headed a start up. One was called Razorfish, a buyer of interactive ad space on this then-new thing called the "Web". Everyone was excited about Razorfish at the time – which was the beginning of the Tech Bubble of the 90s – and this fledgling company was gaining in market value quite rapidly. Back then Razorfish had a large market cap, which evaporated when the bubble burst. It's been bought and sold a few times over the years since.

But I was more intrigued by the other young tech entrepreneur on that panel, whose new company was getting less attention than Razorfish back then. As I spoke to him, I realized he was a classic example of McClelland's profile of an entrepreneur with a high drive to achieve: he seemed to take pleasure in continually learning to improve performance, and while still in college had mastered an arcane math that guided ultra-advanced algorithms that few others understood, but which had potentially powerful applications on the Web. He was taking what looked to others like a huge risk in his startup built around an application of an untested and little-know method – but he had high confidence it would work. He had done his homework well. Few had heard of his little startup at the time, and I just happened to remember it because of its funny name. The company was called "Google," and his name was Sergei Brin.

Optimal Performance

The relationship between stress and performance has been known for about a century in psychology. It's called the Yerkes-Dodson Law. While the psychologists Yerkes and Dodson could not have known it 100 years ago, they were actually tracking the impacts of the HPA axis, the circuitry that secretes stress hormones when the amygdala gets triggered.

This is a different way of thinking about how the brain operates to help or hurt our performance – whether at work, in learning, in a sport, in any domain of ability. There are three main states depicted in the Yerkes-Dodson Law: disengagement, flow, and frazzle. Each of these has powerful impacts on a person's ability to perform at their best: disengagement and frazzle torpedo our efforts, while flow lets them soar.



The impact of stress arousal on performance.
The relationship of stress to performance, captured in the Yerkes-Dodson Law, shows that boredom and disengagement trigger too little of the stress hormones secreted by the HPA axis – and performance lags. As we get more motivated and engaged, "good stress" brings us to the optimal zone, where we perform at our best. If the challenges get too great and we become overwhelmed, we go into the zone of burnout, where stress hormone levels get too high and hamper performance.

Disengagement

Workplaces the world over are rife with people stuck in disengagement: they're bored with their jobs, uninspired and disinterested. They have little to no motivation to give their best, instead just doing well enough to keep the job. Studies of employee engagement find that in top-performing organizations, there are ten times more fully engaged workers than disengaged, while in average-performing outfits there are just two engaged employees for every disengaged one[17]. Engaged employees are more productive, give better attention to customers, and are more loyal to the organization.

As we move from boredom toward the optimal zone on the performance arc, the brain triggers increasing levels of stress hormones, and we enter the range of "good stress," where our performance picks up. Challenges – like getting motivated to reach a goal, or being called on to exhibit your best skills, or a team's race to meet a deadline – focus our attention and elicit our best efforts on the job at hand. Good stress gets us engaged, enthused and motivated, and mobilizes just enough of the stress hormones cortisol and adrenaline – along with beneficial brain chemicals like dopamine – to do the job effectively. Cortisol and adrenaline have both protective and harmful impacts, and good stress mobilizes their benefits.

Frazzle

But when demands become too great for us to handle, when the pressure overwhelms us – too much to do with too little time or support – we enter the zone of bad stress. Just beyond the optimal zone at the top or the performance arc there is a tipping point where the brain secretes too many stress hormones, and they start to interfere with our ability to work well, to learn, to innovate, to listen, and to plan effectively.

The costs of chronic stress go well beyond performance. In this zone what's technically called "allostatic load" means the damaging effects of stress hormones predominate. Too-high levels of those hormones over too long a period throw neuroendocrine function off-kilter, and create imbalances in the immune and nervous systems – so we are more susceptible to illness, and have trouble thinking clearly. Our body clock becomes confused and we sleep poorly.

Long before I had heard of the HPA axis, back in my graduate school days, my doctoral dissertation documented this. I measured people's physiology –

monitoring their heart rate and sweat response – while they watched a film that had been made to inspire wood workers to use their safety devices. There are three accidents portrayed in this film, each accident is due to the woodworker's failure to use a safety device. In the first accident you see Mack pushing a huge piece of plywood into a gigantic circle saw that has scarily spiky teeth -- and he hasn't put his safety device on. His thumb is heading straight for that saw. But Mack is talking to his pal, George, and doesn't notice. As Mack's thumb gets closer to the saw, apprehension builds, as I could see by the heart rate and sweat response of people watching that film. I knew exactly when the thumb hit the saw by watching people's readouts go higher and higher, as their amygdala went into overdrive.

Once the accident is over, heart rates and sweat would lessen as people started to recover. But then the next accident gets set up, and because they haven't recovered all that much, their reactivity goes even higher during the second accident. By the third one, they literally went off the chart – in those days we used pen and paper, something like on a polygraph – and the needle would fly off the paper by the third accident.

That is the anatomy of a bad day. That escalating stress reaction is what happens inside on those days when you oversleep because your alarm didn't go off, so off the bat you're going to be late for some important meeting. Then the kids don't cooperate or you have a tussle with your partner, so you leave home upset and grumpy. Then your car won't start, and it's just one frustrating thing after another – and all this even before you get to work. Your stress hormones are pumping.

That scenario fits ongoing hassles, one of the classic causes of allostatic load, which, if it becomes a chronic fixture in our life, can make us more susceptible to disease. Scientists find that repeatedly having to face a range of different stressful events will do it. So will one chronic source of stress – like an abrasive co-worker – that we never adjust to. Another cause is when we keep ruminating about the things that upset us – for example, waking up in the middle of the night and obsessing about it – and so fail to turn down the volume on the stress response[18].

Scientists who study HPA arousal find one of the most dependable ways to trigger cortisol and adrenaline is a simulation of a real-life job application. People who are out of work are told they can get coaching in how to apply for a job. They come in to a psych lab and have their physiology measured as they go through what they think is a practice job interview. Actually the person they're talking to is a confederate of the experimenter, who starts giving negative nonverbal feedback, like looks of disgust, as the applicant

starts talking, and then goes on to give the poor applicant outright criticism. Understandably, this reliably activates that HPA axis. Managers and supervisors should be aware that this can be what happens to people if you focus in performance feedback solely on what they did wrong, rather than how they can improve and what they did well.

At the maximal output of stress hormone, you enter the state of being overwhelmed, which greatly impairs our cognitive abilities -- for example, performance in math and language can drop fifty percent. While frazzled you respond in a rigid and flexible way. You can't adapt to new situations. You can't concentrate – you're easily distracted.

Chronic overwhelm can harm the hippocampus, which is crucial for learning: this is where short-term memories, like what we've just heard or read, are converted to long-term memories, so we can recall them later. The hippocampus is extraordinarily rich in receptors for cortisol, so our capacity to learn is very vulnerable to stress. If we have constant stress in our lives, this flood of cortisol actually disconnects existing neural networks; we can have memory loss. This kind of extreme memory loss has been seen in clinical conditions, like post-traumatic stress disorder and extreme depression.

More recent research reveals how the biological effects of such bad stress endanger our health in many ways[19]. There's an increase in abdominal fat, and insulin resistance goes up. The body becomes more prone to diabetes, heart disease, and artery blockages. The effectiveness of the immune system plummets. Cortisol degrades the myelin sheath that coats nerve pathways, impairing the transmission of signals from one brain area to another. In short, the neural, cognitive and biological effects of extreme stress are even worse than had been thought.

Flow

Where we want to be on the Yerkes-Dodson arc is the zone of optimal performance, known as "flow" in the research of Mihaly Csikszentmihalyi at the University of Chicago. Flow represents a peak of self-regulation, the maximal harnessing of emotions in the service of performance or learning. In flow we channel positive emotions in an energized pursuit of the task at hand. Our focus is undistracted, and we feel a spontaneous joy, even rapture.

The flow concept emerged from research where people were asked to describe a time they outdid themselves and achieved their personal best. People described moments from a wide range of domains of expertise, from basketball and ballet to chess and brain surgery. And no matter the specifics, the underlying state they described was one and the same.

The chief characteristics of flow include rapt, unbreakable concentration; a nimble flexibility in responding to changing challenges; executing at the top of your skill level; and taking pleasure in what you're doing – joy. That last hallmark strongly suggests that if brain scans were done of people while in flow we might expect to see notable left prefrontal activation; if brain chemistry were assayed, we would likely find higher levels of mood and performance enhancing compounds like dopamine.

This optimal performance zone has been called a state of neural harmony where the disparate areas of the brain are in synch, working together. This is also seen as a state of maximum cognitive efficiency[20]. Getting into flow lets you use whatever talent you may have at peak levels.

People who have mastered a domain of expertise and who operate at the top of their game typically have practiced a minimum of 10,000 hours – and are often world class in their performance[21]. Tellingly, when such experts are engaged in their skill, whatever it may be, their overall levels of brain arousal tend to become lower, suggesting that for them this particular activity has become relatively effortless, even at its peak.

An early brain study suggested that while people are in flow, only those brain areas relevant to the activity at hand are activated. This contrasts with the brain of a person who is bored; then you see randomly scattered neural activation, rather than a sharp delineation of activity in the areas relevant to the task. In the brain of a person who is stressed, you find lots of activity in the emotional circuitry which is irrelevant to the task at hand, and which suggests an anxious distractedness.

An organization will be top-performing to the extent to which its employees can contribute their best skills at full force. The more moments of flow – or even just staying in the zone of engagement and motivation – the better. There are several pathways to flow:

- Adjust demands to fit the person's skills. If you manage people's work, try to gauge their optimal level of challenge. If they're under-engaged, increase the challenge in ways that make their work more interesting – for instance by giving a stretch assignment. If they are overwhelmed, reduce the demand and give them more support (whether emotional or logistic)
- Practice the relevant expertise to raise skills to meet a higher level of demand
- Enhance concentration abilities so you can pay more attention, because attention itself is a pathway into the flow stage.

Finally, we need to notice when we – or others – have left the zone of positive stress and peak performance, so we can apply the apt remedy. There are several indicators to watch for. The most obvious is performance decline: you can't do the task as well, whatever the metric may be for measuring it. Another is wandering attention, loss of focus, or boredom. And there are more subtle clues that can show up before a noticeable performance decrement. For example, someone who seems “off” compared to how they normally do things, or who seems very rigid in how they respond rather than considering alternatives, or who is cranky and easily perturbed – any of which might signal that anxiety is impairing their cognitive efficiency.

The formula for eliciting flow includes a balance between the demands of the situation and a person’s skills – very often flow occurs when we are challenged to use our abilities to their utmost. But just where that optimal point will be varies widely from person to person. I was talking about flow and the performance arc with a military jet pilot. He told me that what would be a zone of extreme frazzle for most people is where jet pilots get into flow. But that’s because to qualify as a jet pilot, your reaction time has to be in the 99th percentile – an almost super-human quickness. He said, “We operate on adrenaline,” and that’s where the fun is for them.

A general strategy for enhancing the likelihood of flow is to regularly practice methods that enhance concentration and relax you physiologically. Treat these methods like you would your fitness routine – do them every day, or as many days as you can. For example, I like to meditate every morning, and I think it helps me stay in a positive, calm, and more focused frame of mind through most of the day. If you are in a high-stress job, you can benefit from regularly giving your brain and body the chance to recover and relax. Meditation is only one of many methods for getting relaxed; the key point is to find one you like and practice it regularly.

Anything that truly relaxes you helps. I don't mean you should go jogging while you're worrying about every little thing that's going wrong – that’s not relaxation. I mean playing with kids, or taking the dog for a walk, or a round of golf, or whatever is going to get you in to a relaxed state. The more you can break the cycle of the right prefrontal capture by the amygdala, the freer you'll be to activate the beneficial circuitry of the left prefrontal cortex.

If you do a regular practice like mindfulness, this greater activation of left hemisphere arousal seems to become more prominent over time – and the biggest change seems to be in the first months of practice. So far the strongest data point on this right-to-left prefrontal shift is the research that Davidson did with Jon Kabat-Zinn where they had people in a high-stress workplace

practice mindfulness. They are currently repeating that study to be sure it replicates, and to understand better the conditions that facilitate the benefits of a practice like mindfulness. How often or how long do you need to practice to see neural or physical shifts? Do some kinds of people benefit more than others? These are the kind of questions we need more research to answer.

Another question, apart from the anti-stress benefits, is how can you enhance concentration abilities? Concentration is mental skill, and every skill can be enhanced by practice. But with the escalation in distractions we all face these days, this becomes a crucial issue in the workplace. The more we are distracted, the less effective we become.

Cognitive neuroscientists like Davidson are turning their attention to classical methods of meditation, which are, from the cognitive perspective, training exercises for a keener attentional focus. There are a multitude of meditation methods in the European and Asian spiritual traditions, and many can be seen, essentially, as ways of building concentration (quite apart from their spiritual function). The cardinal rule of all concentration enhancement techniques is to focus on A and whenever your mind wanders off to topic B or C, D, E, F, and you realize that it has wandered, bring it back to A again.

Every time you bring the wandering mind back to a concentrated state you're enhancing the muscle of concentration. It’s like being on a Nautilus machine and doing repetitions for a muscle, only you’re strengthening a muscle of the mind: attention.

The Social Brain

“Mindsight” is the term Dr. Daniel Siegel, director of the MindSight Institute at UCLA, uses for the mind’s ability to see itself. His remarkable work makes a strong case that the brain circuitry we use for self-mastery and to know ourselves is largely identical with that for knowing another person[22]. In other words, our awareness of another person’s inner reality and of our own, are in a sense both acts of empathy. Siegel, a good friend and scientific trailblazer, is a founder of a new field, interpersonal neurobiology, which has emerged only in recent years as science discovered the social brain.

The social brain includes a multitude of circuitry, all designed to attune to and interact with another person’s brain. The social brain is a relatively new discovery in neuroscience because from its start, brain research studied one brain in one body of one person. Only in the last five to ten years have they started to study two brains in two bodies in two people while they interacted – and it’s opened up a vast panoply of discoveries.

One key discovery was “mirror neurons,” which act something like a neural Wifi to connect with another brain. There are several stories about how they were discovered. The one I like has to do with a lab in Italy where they were mapping the motor cortex in monkeys, the part of the brain that moves the body. They were measuring single neurons, one at a time, and they were watching neurons that only did one thing and never fired when the monkey was doing something else. One day they were watching a cell in the monkey’s brain that only fired when that monkey raised its arm, and they were surprised that the brain cell was firing but the monkey hadn't moved.

Then they realized what was going on: it was a hot day, and a lab assistant had gone out to get a gelato. He was standing in front of that cage and every time he raised his arm for a lick the monkey’s neuron for doing the same thing fired. Now we realize that the human brain is peppered with mirror neurons and they activate in us exactly what we see in the other person: Their emotions, their movements, and even their intentions[23].

This discovery may explain why emotions are contagious. We had known about this contagion in psychology for decades because of experiments in which you have two strangers come into a lab, and fill out a mood checklist. Then they sit in silence, looking at each other for two minutes. Afterward, they fill out the same checklist. The person in that pair who’s most expressive emotionally will transmit his or her emotions to the other person in two silent minutes.

But exactly how this could happen was a puzzle. Psychologists wondered what the mechanism for contagion might be. Now we know: it’s done with mirror neurons (and other areas like the insula, which maps sensations throughout the body), via what amounts to a brain-to-brain connection. This subterranean channel means there is an emotional subtext in every one of our interactions that is extremely important to whatever else goes on.

For example, take a study where people were given performance feedback – some negative, some positive. If they were given negative performance feedback in a very warm, positive, and upbeat tone, they came out of there feeling pretty good about the interaction. If they were given positive feedback in a very cold, critical, judgmental tone, they came out feeling negative, even about positive feedback. So the emotional subtext is more powerful in many ways than the overt, ostensible interaction that we're having.

This means that essentially we are constantly impacting the brain states in other people. In my EI model, “Managing relationships” means, at this level, that we're responsible for how we shape the feelings of those we interact with – for better or for worse. In this sense, relationship skills have to do with managing brain states in other people.

This raises a question. Who sends the emotions that pass between people, and who receives them? One answer, for groups of peers, is that the sender tends to be the most emotionally expressive person in the group. But in groups where there are power differences – in the classroom, at work, in organizations generally – it is the most powerful person who is the emotional sender, setting the emotional state for the rest of the group.

In any human group, people pay most attention to – and put most importance on – what the most powerful person in that group says or does. There are many studies that show, for example, that if the leader of a team is in a positive mood, that spreads an upbeat mood to the others and that collective positivity enhances the group’s performance. If the leader projects a negative mood, that spreads in the same way, and the group’s performance suffers. This has been found for groups making business decisions, seeking creative solutions – even erecting a tent together.

Such emotional contagion happens whenever people interact, whether in a pair, a group, or an organization. It’s most obvious at a sporting event or theatrical performance, where the entire crowd goes through the identical emotion at the same time. This contagion can happen because of our social brain, through circuitry like the mirror neuron system. Person-to-person emotional contagion operates automatically, instantly, unconsciously and out

of our intentional control.

There was a study done at Massachusetts General Hospital of doctors and patients during a psychotherapy session. The interaction was videotaped and their physiology was monitored. Afterwards, the patients reviewed the tape, identifying moments when they felt the doctor empathized with them – when they felt heard and understood, in rapport with the doctor, versus feeling really disconnected, thinking: “My doctor doesn't get me, doesn't care about me”. In those moments where patients felt disconnected, there was no connection in their physiology, either. But at those moments when the patient said, “Yes, I felt a real connection with the doctor,” their physiologies moved in tandem, like a dance. There was also a physiological entrainment, with the doctor and patient’s heart rates moving in tandem.

That study reflects the physiology of rapport. There are three ingredients to rapport[24]. The first is paying full attention. Both people need to tune in fully to the other, putting aside distractions. The second is being in synch non-verbally. If two people are really connecting well, and you were to observe that interaction without paying attention to what they were saying (like watching a film with no soundtrack), you'll see their moves are almost choreographed, like a dance. Such synchrony is orchestrated by another set of neurons, called oscillators, which regulate how our body moves in relationship to another body (or any object)[25].

The third ingredient of rapport is positive feeling. It’s a kind of micro-flow, an interpersonal high – I would expect you’d see left prefrontal arousal for both people. These moments of interpersonal chemistry, or simpatico, are when things happen at their best – no matter the specifics of what we’re doing together.

An article in the Harvard Business Review calls this kind of interaction a “human moment[26].” How do you have a human moment at work? You have to put aside whatever else you're doing, and pay full attention to the person who’s with you. And that opens the way to rapport, where emotional flow is in tandem. When your physiology is in synchrony with someone else you feel connected, close and warm. You can read this human moment in terms of physiology – but you can also read it experientially, because during those moments of chemistry we feel good about being with the other person. And that person is feeling good about being with us.

The Social Brain Online

Nature designed the social brain for face-to-face interactions – not the online world. So how do social brains interact when we're sitting looking at a video monitor instead of directly at another person? We've had a major clue about the problems with this interface ever since the beginning of the Internet, when it was just scientists emailing on what was called the Arpanet. This clue is flaming. Flaming happens when someone is a little upset – or very upset – and with their amygdala in firm control, furiously types out a message and hits "send" before thinking about it – and that hijack hits the other person in their inbox. Now the more technical term for flaming is "cyber-disinhibition," because we realize that the disconnect between the social brain and the video monitor releases the amygdala from the usual management by the more reasonable prefrontal areas.

The neural dynamic behind flaming is that the social brain has no feedback loop online: unless you are in a live, face-to-face teleconference, the social circuitry has no input. It doesn't know how the other person is reacting so it can't guide our response – do this, don't do that – as it does automatically and instantly in face-to-face interactions. Instead of acting as a social radar, the social brain says nothing – and that unleashes the amygdala to flame if we're having a hijack.

Even a phone call gives these circuits ample emotional cues from tone of voice to understand the emotional nuance of what you say. But email, for instance, lacks all these inputs.

I was talking recently to a consultant in Europe who had been called in by two tech companies who had a working alliance to jointly develop a new product line. There were two sets of engineers, each in their own building in different parts of town. They didn't get together, they just emailed. And it had degenerated into flame wars. The project was going nowhere. So what did the consultant do? He got the two groups together offsite for two days, just to get to know each other person-to-person.

One reason why this personal connection matters so much for online communication has to do with the social brain/video monitor interface. When we're at our keyboard and we think a message is positive, and we hit 'send', what we don't realize at the neural level is that all the nonverbal cues – facial expression, tone of voice, gesture and so on – stay with us. There's a negativity bias to email: when the sender thinks an email was positive, the receiver tends to see it as neutral. When the sender thinks it's neutral, the receiver tends to interpret it as somewhat negative. The big exception is when

you know the person well; that bond overcomes the negativity bias.

Clay Shirky, who studies social networks and the web at New York University, was telling me about an example of a global bank security team that had to operate 24 hours a day. He said in order for them to operate well, it was critical that they use what he calls a banyan tree model, where key members of each group got together and met key members of every other group, so that in an emergency they can contact each other and get a clear sense of how to evaluate the message each group was sending. If someone in the receiving group knows that person well, or has a contact there whom he can ask about the person who sent the message, then the receiving group can better gauge how much to rely on it.

One enormous upside of the web, of course, is what you might call “brain 2.0.” As Shirky points out, the potential for social networking to multiply our intellectual capital is enormous[27]. It’s a sort of super-brain, the extended brain on the web.

The term “group IQ” refers to the sum total of the best talents of each person on a team, or in a group, contributed at full force. It turns out that one factor that makes the actual group IQ less than its potential is lack of interpersonal harmony in the group. Vanessa Druskat at the University of New Hampshire has studied what she calls “group EQ” – things like being able to surface and resolve conflicts among the group, high levels of trust and mutual understanding. Her research shows that groups with the highest collective emotional intelligence outperform the others.

When you apply that to groups working together online, one core operating principle is that the more channels that come into the social brain, the more easily attuned you can be. So if you video-conference, you have visual, body and voice cues. Even if it’s a conference call, the voice is extraordinarily rich in emotional cues. In any case, if you’re working together just through text, it’s best when you know the other person well, or at least have some sense of them in order to have a context for reading their messages, so you can overcome the negativity bias. And best of all is leaving your office or cubicle and getting together to talk with the person.

The Varieties of Empathy

The core skill in social awareness is empathy – sensing what others are thinking and feeling, without them telling us in words. We are continually sending others signals about our feelings though our tone of voice, facial expression, gestures, and numerous other nonverbal channels. People vary greatly in how well they can read these signals.

There are three kinds of empathy. One is cognitive empathy: I know how you see things; I can take your perspective. Managers high in this kind of empathy are able to get better than expected performance from employees, because they can put things in terms that people can understand – and that motivates them. And executives higher in cognitive empathy do better in foreign postings, because they pick up the unspoken norms of a different culture more quickly.

A second kind is emotional empathy: I feel with you. This is the basis for rapport and chemistry. People who excel in emotional empathy make good counselors, teachers, client managers, and group leaders because of this ability to sense in the moment how others are reacting.

And the third kind is empathic concern: I sense you need some help and I spontaneously am ready to give it. Those with empathic concern are the good citizens in a group, organization, or community, who voluntarily help out as needed.

Empathy is the essential building block for compassion. We have to sense what another person is going through, what they're feeling, in order to spark compassion in us. There's a spectrum that runs from total self-absorption (where we don't notice other people) to noticing them and beginning to tune in, to empathizing, to understanding their needs and having empathic concern – and then comes compassionate action, where we help them out.

Different varieties of empathy seem to rely on distinct brain circuitry. Emotional empathy, for instance, has been studied by Tania Singer, a neuroscientist at the Max Planck Institute in Germany[28]. Singer sees the role of the insula as key to empathy (the insula, remember, was one of the neural areas identified as crucial to emotional intelligence). The insula senses signals from our whole body. When we're empathizing with someone, our mirror neurons mimic within us that persons' state. The anterior area of the insula reads that pattern and tells us what state that is.

Singer finds that reading emotions in others means, at the brain level, first reading those emotions in ourselves; the insula lights up when we tune into

our own sensations[29]. She’s done FMRI studies of couples, for example, where one partner is getting a brain scan while is seeing that the other partner is about to get a shock. At the moment the partner sees this, the part of his or her brain lights up that would do so if he or she were actually getting the shock, rather than just seeing the partner get it.

Paul Ekman, the world's expert on facial expression of emotions, is the scientist on whom the TV show Lie to Me is based; the lead character solves crimes by detecting how people truly feel rather than what they are trying to project. He detects their lies through subtle nonverbal “leakage” of their true feelings. Ekman has designed a training program (which seems aimed at this mirror neuron-insula circuitry) that lets us read facial expressions that flash across a person’s face in a fifth of a second, too fast for us to consciously recognize. Through this training program people can improve their recognition of fleeting – but revealing – emotions on another person’s face, in about an hour.

To develop greater empathy abilities, one route would be to go through the Ekman training. But to develop cognitive empathy, getting feedback on what the other person actually is thinking would be the recommended route – to verify or correct your hunches. Another method for boosting empathy has people watch a video or film without the sound and guess the emotions being depicted onscreen, checking their guesses against the actuality. In other words, giving the neural circuits for empathy feedback on how the other person actually feels or thinks helps this circuitry learn.

Gender Differences

There are many studies of gender differences in EI, but to sum them up, women on average tend to have better emotional intelligence scores than men -- but this is only on average, and there's conflicting data on this.

A caveat: when you're talking about gender differences in the behavioral domain you're speaking about largely overlapping bell curves of ability. For example, one ability women consistently show an advantage in is emotional empathy – but this does not mean that a given man can't be as emotionally empathic as the most empathic woman. The abilities that tend to be greater in men often have to do with emotional self-mastery – but, again, this does not mean that a woman can't be as emotionally self-regulated as the most balanced man. It's just when you're talking about statistical differences that the group trends show up.

The neuroscientist Tania Singer has new brain data that informs these trends. She was looking at two emotional systems, one for cognitive empathy and another for emotional empathy. Singer says that women tend to be more highly developed in the mirror neuron system, and so rely on it more than men do for signals of empathy. Men, in contrast, tend to have a burst of the mirror neuron system and then go into a problem-solving mode.

There's another way of looking at male-female differences in EI. This is the work of Simon Baron-Cohen at Cambridge University, who says that there's an extreme "female brain" which has lots of mirror neuron activity and is high in emotional empathy – but not so good at systems analysis. By contrast, the extreme "male brain" excels in systems thinking and is poor at emotional empathy[30]. These brain types are at the far extremes of a Bell curve, with most of us somewhere in the middle. However, he does not mean that all men have the "male brain", nor all women the "female brain." Many women are adept at systems thinking, and many men excellent at emotional empathy.

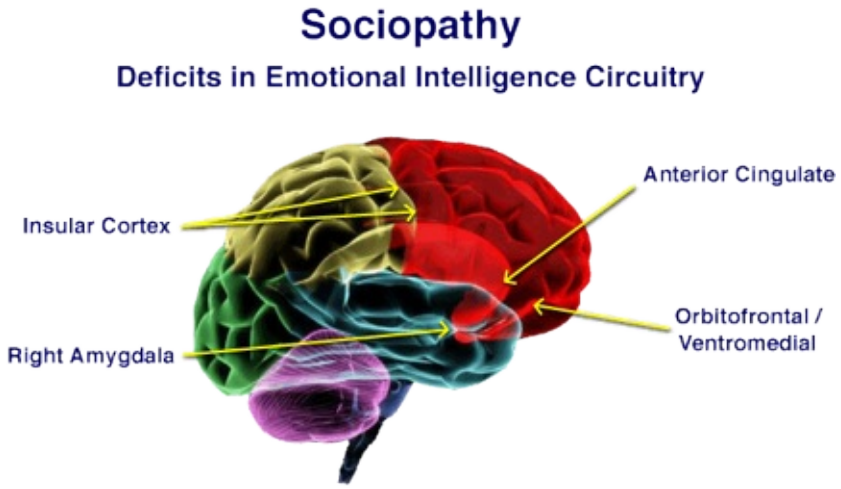
My colleague Ruth Malloy of the Hay Group in Boston has looked at gender differences on the Emotional and Social Competence Inventory (which I co-designed). Her analysis revealed that while in general you find gender differences among the various competencies, when you only look at the pool of star performers (people in the top ten percent of business performance) those differences wash out. The men are as good as the women, the women as good as the men, across the board.

That reminds me of an observation made by Frans de Waal, a scientist who

studies primate behavior at the Yerkes National Primate Center in Atlanta. He's found that when a chimp sees another chimp in distress – either from an injury or a loss of social status – the first chimp mimics the behavior of the distressed chimp, a primal form of empathy. Many chimps will then go over and give some solace to the upset chimp, for example, stroking it to help it calm down. Female chimps offer this kind of solace more often than male chimps do – with one intriguing exception: the alpha males, who are the troupe leaders, give solace even more often than do female chimps. One of the basic functions of a leader, it seems, is to offer appropriate emotional support.

The Dark Side

Psychologists use the phrase “the dark triad” to refer to narcissists, Machiavellians, and sociopaths. These types represent the dark side of emotional intelligence: such people can be very good at cognitive empathy, but lack emotional empathy – not to mention empathic concern. For instance, by definition a sociopath does not care at all about the human consequences of their lie or manipulation, and has no regrets about inflicting cruelty. Their feelings of any kind are very shallow; brain imaging reveals a thinning of the areas that connect the emotional centers to the prefrontal cortex. Their particular deficits map many aspects of the emotional intelligence abilities[31].



The Sociopath’s Brain

Sociopaths have deficits in several areas key to emotional intelligence: the anterior cingulate, the orbitofrontal cortex, the amygdala and insula, and in the connectivity of these regions to other parts of the brain.

While extreme sociopaths are known for their cold-blooded crimes, the sub-clinical types of sociopaths are recognizable in organizational life. One is the bullying, “kiss-up-kick-down” boss, who can be quite charming to superiors, but abusive to direct reports and a petty tyrant in general. Another is the embezzler, an outright crook (think Bernie Madoff). And the third, in a mild form, is the freeloader personified in the comic strip Dilbert by Wally, the guy who always holds a coffee cup and never does a lick of work.

Developing Emotional Intelligence

Finally, I'd like to review the implications of all the foregoing for coaching, and for enhancing emotional intelligence abilities.

You may have heard that we're born with a huge amount of brain cells, and then we lose them steadily until we die. Now, the good news: that’s neuromythology.

The new understanding is what’s called ‘neurogenesis’: Every day the brain generates 10,000 stem cells that split into two. One becomes a daughter line that continues making stem cells, and the other migrates to wherever it’s needed in the brain and becomes that kind of cell. Very often that destination is where the cell is needed for new learning. Over the next four months, that new cell forms about 10,000 connections with others to create new neural circuitry.

The state of the art in mapping this will be coming out of labs like Richard Davidson’s that have massive computing power, because new, innovative software tools for brain imaging can now track and show this new connectivity at the single-cell level.

Neurogenesis adds power to our understanding of neuroplasticity, that the brain continually reshapes itself according to the experiences we have. If we are learning a new golf swing, that circuitry will attract connections and neurons. If we are changing a habit – say trying to get better at listening – then that circuitry will grow accordingly.

On the other hand, when we try to overcome a bad habit, we’re up against the thickness of the circuitry for something we’ve practiced and repeated thousands of times. So what are the brain lessons for coaching, or for working on our own to enhance an emotional intelligence skill?

First, get committed. Mobilize the motivating power in the left prefrontal areas. If you’re a coach, you’ve got to engage the person, get them enthused about achieving the goal of change. Here it helps to draw on their dreams, their vision for themselves, where they want to be in the future. Then work from where they are now on what they might improve to help them get where they want to go in life.

If you can, at this point it’s helpful to get 360-degree feedback on the emotional intelligence competencies. It’s best to use an instrument that measures the emotional intelligence abilities, and lets you ask people whose opinions you value rate you anonymously on specific behaviors that reflect

the competencies of star performers and leaders[32]. A trained consultant can help you use this feedback to determine what competencies you would most benefit from strengthening.

The next step is to get very practical: Don't take on trying to learn too much all at once. Operationalize your goal at the level of a specific behavior. Make it practical, so you know exactly what to do and when. For example, say someone has "Blackberry syndrome": a bad habit of multi-tasking and essentially ignoring others, which undermines the full attention that can lead to rapport and good chemistry. You have to break the habit of multi-tasking. So the person might make up an intentional learning plan that says something like: at every naturally occurring opportunity – when a person walks into your office, say, or you come up to a person – you turn off your cell phone and your beeper, turn away from your computer, turn off your daydream or your preoccupation and pay full attention. That's gives you a precise piece of behavior to try to change.

So what will help with that? Noticing when a moment like that is about to come, and doing the right thing. Doing the wrong thing is a habit that you have become an Olympic level master at – your neural wiring has made it a default option, what you do automatically. The neural connectivity for that is strong. When you start to form the new, better habit you are essentially creating new circuitry that competes with your old habit in a kind of neural Darwinism. To make the new habit strong enough, you're got to use the power of neuroplasticity – you have to do it over and over again.

If you persist in the better habit, that new circuitry will connect and become more and more powerful, until one day you'll do the right thing in the right way without a second thought. That means the circuitry has become so connected and thick that this is the brain's new default option. With that change in the brain, the better habit will become your automatic choice.

For how long and how many times does an action have to be repeated until it's actually hard-wired? A habit begins to be hard-wired the very first time you practice it. The more you practice it, the more connectivity. How often you have to repeat it so that it becomes the new default of the brain depends in part on how strong the old habit is that it will replace. It usually takes three to six months of using all naturally occurring practice opportunities before the new habit comes more naturally than the old.

Another practice opportunity can occur whenever you have a little free time: mental rehearsal. Mental rehearsal activates the same neural circuitry as does the real activity. This is why Olympic athletes spend off-season running

through their moves in their brain – because that counts as practice time, too. It's going to increase their ability to perform when the real moment comes.

Richard Boyatzis has used this method with his MBA students for years at the Weatherhead School of Management at Case Western Reserve University. And he's followed these students into their jobs as much as seven years later – and found the competencies they had enhanced in his class were still rated as strong by their co-workers.

Social Emotional Learning

When a global company studied its star performers, they discovered that the emotional intelligence talents that made these executives outstanding had started to emerge very early in life. For instance, a star team leader had first started practicing these skills when she was still in middle school. Her family had moved to a new city, and she figured she could meet new friends by joining a team. So she joined the field hockey team.

As it happens, she was not that good at the game, but she was terrific at showing kids new to the sport how to play. So she became an assistant coach. Right out of college she got a job as a drug rep. No one showed her how to make a cold call at a physician's office, but once she got the hang of it, she started showing new reps how to do it. And she got so good at this that the company made a video of her that they then used with all their new reps.

So emotional intelligence abilities start in our early years, and develop naturally in the curriculum of life. If we need to improve on one or another, we can do it at any point. But why not give every child a head start on these life skills? That's why I'm an advocate of the movement in "social/emotional learning," or SEL, school-based programs that teach the whole spectrum of emotional intelligence abilities. The best programs run from kindergarten through high school, and teach these abilities at every age in a developmentally appropriate way.

All the emotional intelligence skills develop in life's curriculum, from childhood on – but SEL gives every child an equal opportunity to master them. That's why as I was writing Emotional Intelligence I co-founded the Collaborative for Academic, Social and Emotional Learning at Yale (now at the University of Illinois at Chicago)[33].

The brain is the last organ of the body to become anatomically mature. When you see the changes from year to year in how a child thinks, behaves and reacts – the stages children go through – what you're really looking at is how their brain is developing. For example, when it comes to creativity, children are fabulously open and imaginative – particularly young children. But there are two stages in brain growth that change this. The first is called the "five-to-seven-shift," where the emotional circuitry comes under stronger prefrontal control. So children are better able to control their impulses, and to coordinate their imaginative efforts – not to mention be better behaved.

The second landmark is at puberty, when the child's brain goes through a radical "sculpting," losing neurons that aren't used much. This may make

them lose some of the capacity to be wildly imaginative, and then at puberty, there's what's called a sculpting of the brain, a huge loss of under-used neurons. We are actually born with many more neurons than we use later in life, and the principal is use-it-or-lose-it (however, as I said before, this is not the same as a steady deterioration throughout life – neurogenesis still creates new neurons daily, throughout our lives).

Social Emotional Learning programs are designed to give children the neural lessons they need as their brain grows – that's what "developmentally appropriate" means.

I visited an inner-city middle school where there is lots of misbehaving in and out of class, lots of delinquency, and lots of teen crime.

But there is also a SEL program. On the wall in every classroom there's a picture of a stoplight with its red, yellow and green lights. And it says, "When you're getting upset, remember the stop light. Red light, stop! Calm down and think before you act."

What is that teaching? "Stop" is behavioral inhibition: activate the left prefrontal circuitry that can manage your amygdala impulses. "Calm down" shows that you can change your state to a better one. And "Think before you act" teaches a critical lesson: you can't control what you're going to feel, but you can decide what you do next. Then, "Yellow light" – think of a range of things you might do and what their consequences would be, and pick the best alternative. And "Green light:" try it out and see what happens. This is drilled into kids. And this kind of lesson, along with all the others in the SEL program, actually works. The vice principal told me that since the SEL program began a few years earlier, the number of kids sent to him for fighting had steadily decreased.

A study by Roger Weissberg, the psychologist who directs CASEL, looked at over 200 SEL programs that were compared to schools without them, involving a total of 270,000 students[34]. He found that, on average, SEL programs reduce anti-social behavior like misbehaving in class, fights or substance abuse by about ten percent. And they increase pro-social behavior – liking school, attendance, paying attention in class and so on – by about ten percent. And you see the biggest gains in the schools that need it the most.

But the big surprise in the payoff for social and emotional learning: academic achievement scores go up eleven percent. Why would that be? I suspect it has to do in large part with how HPA axis arousal interferes with cognitive efficiency and learning. If you are a kid who's preoccupied by worry, anger, distress, anxiety, or whatever stress causes in you, you're going

to have a diminished capacity to pay attention to what the teacher is telling you. But if you can manage those emotional upsets, your working memory – that is, the capacity of attention to take in information – increases. And SEL teaches you how to manage these disruptive feelings – not just through lessons like the stop light, but through learning how to get along better with other kids (a major source of those turbulent feelings). And that lets you be a better learner.

And of course if you're an adult at work, this identical skill set will make you a better performer. And it's never too late to develop further strengths in emotional intelligence.

Also by Daniel Goleman from More Than Sound

Better Parents, Better Spouses, Better People with Daniel Siegel

Knowing Our Emotions, Improving Our World with Paul Ekman

Training the Brain: Cultivating Emotional Intelligence with Richard Davidson

Good Work: Aligning Skills and Values with Howard Gardner

The Inner Compass for Ethics and Excellence with Naomi Wolf

Socially Intelligent Computing with Clay Shirky

Rethinking Education with George Lucas

Ecological Awareness

Leading the Necessary Revolution with Peter Senge

Of Interest:

Resonant Leadership: Inspiring Others Through Emotional Intelligence by Richard Boyatzis

1 Peter Salovey and John Mayer, “Emotional Intelligence,” Imagination, Cognition, and Personality, 9, 1990, 185-211. .

2 Reuven Bar-On, “The Bar-On model of emotional intelligence: A valid, robust and applicable EI model,” Organisations & People, 14, 2007, 27-34.

3 For an overview of the field:
http://www.eiconsortium.org/reports/what_is_emotional_intelligence.html

4 Howard Gardner, Frames of Mind. New York: Basic Books, 1983.

5 Reuven Bar-On et al, (2003).” Exploring the neurological substrate of emotional and social intelligence,” Brain, 126, 1790-1800; Bechara et al, “The anatomy of emotional intelligence and the implications for educating people to be emotionally intelligent,” in Reuven Bar-On et al (eds.) Educating People to be Emotionally Intelligent. Westport, CT: Praeger, pp 273-90.

6 EI in the brain: see.e.g., T.H. Taki et al., “Regional gray matter density associated with emotional intelligence: Evidence from voxel-based morphometry,” Human Brain Mapping, Aug. 25 2010, posted at:
http://www.ncbi.nlm.nih.gov/pubmed/20140644

7 Emotion and cognition in good and bad choices: see Bechara et al, “Emotion, decision-making, and the orbitofrontal cortex,” Cereb Cortex, 10 (3), 295-307, 2000.

8 See, for example, Larry Squire, “Memory systems of the brain: a brief history and current perspective,” Neurobiol Learn Mem, 82,3,2004.171-177.

9 David R. Caruso and Peter Salovey, The Emotionally Intelligent Manager. San Francisco: Jossey-Bass, 2004.

10 Ap Dijksterhuis et al, “On making the right choice: The deliberation-without-attention effect,” Science.

11 Five common emotional triggers: Tony Schwartz, The Way We're Working Isn't Working: The Four Forgotten Needs that Energize Great Performance,

New York: Simon and Schuster, 2010.

12 Setpoint: R.J. Davidson and W. Irwin, “The functional neuroanatomy of emotion and affective style,” Trends in Cognitive Neuroscience 3, 1999, 11-21. However, there is not an either/or relationship between right and left: both sides of the prefrontal area are active to some degree during amygdala hijacks as well as regulating them. See, for example, A.R. Aron et al, “Inhibition and the right inferior frontal cortex,” Trends in Cognitive Sciences, 8, 4, 2004, 170-177.

13 Barbara Frederickson, Positivity. New York: Crown Publishers, 2009.

14 Daniel Siegel, The Mindful Brain. New York: W.W. Norton, 2007.

15 Richard Davidson et al., “Alterations in brain and immune function Produced by mindfulness meditation,” Psychosomatic Medicine, 65, 2003, 564-570.

16 Trying to intervene in the brain via external methods, like, psychopharmacology, means that you're targeting one outcome, but with a chemical that has a multitude of impacts in the brain -- so you have many side effects. For example, a major class of medication for depression regulates the serotonin system in the brain – but only about five percent of the body’s serotonin receptors are in the brain. A very large percent are in the gastrointestinal tract, which is why common side effects involve problems with digestion. The GI tract in turn helps regulate the immune system, among others, so those side effects can ramify. There are some promising pilot applications of neural feedback where people getting their brains scanned get immediate information about when they are in a desired brain state, and so can experiment to see what might keep them there. But we don't yet understand what the benefits or limits are of neural feedback. My own bias is toward more natural interventions, if only because the brain is the most complicated and densely packed and interconnected mass known in the universe.

17 Engaged versus disengaged: The Gallup Organization, http://www.gallup.com/consulting/52/employee-engagement.aspx

18 McEwen B. S. (2000). "Allostasis and allostatic load: implications for neuropsychopharmacology". Neuropsychopharmacology 22 (2): 108–24. doi:10.1016/S0893-133X(99)00129-3

19 Stress and health: Bruce McEwen, The End of Stress as We Know It. Washington, DC: Joseph Henry Press. 2002.

20 Cognitive efficiency: Antonio Damasio, “Sub-cortical and cortical brain activity during the feeling of self-generated emotions,” Nature Neuroscience, 3, 2002, 1049-1056.

21 Mastery: K. Anders Ericsson, “The search for general abilities and basic capacities: Theoretical implications from the modifiability and complexity of mechanisms mediating expert performance,” in Robert Sternberg and Elena Grigorenko (eds.) The Psychology of Abilities, Expertise, and Competencies. New York: Cambridge University Press, 2003.

22 Daniel Siegel, The Mindful Brain: Reflection and Attunement in the Cultivation of Wellbeing. New York : Norton, 2007.

23 There is debate among neuroscientists with how extensive mirror neurons are within the human brain. Some say they are concentrated in the motor cortex, while others contend they are widely distributed among brain areas..

24 Three ingredients of rapport: Linda Tickle-Degnan and Robert Rosenthal, “The Nature of Rapport and its Nonverbal Correlates,” Psychological Inquiry 1, no. 4 (1990), pp. 285-93.

25 Oscillators: R. Port and T. Van Gelder, Mind as Motion: Explorations in the Dynamics of Cognition. Cambridge:Mass: MIT Press, 1995.

26 Human moment: Edward Hallowell, “The Human Moment at Work,” Harvard Business Review, January 1, 1999.

27 Clay Shirky, Here comes Everybody. New York: Penguin Press, 2008.

28 C. Lamm, C.and T. Singer, T. “The role of anterior insular cortex in social emotions,” Brain Structure & Function, 241(5–6), 579–951. (2010).

29 Tania Singer et al, “A common role of insula in feelings, empathy and uncertainty,” Trends in Cognitive Sciences, 13, 8, 2009, 334-340. Singer suggests the route to emotional empathy seems to be via the insula in tandem with the mirror neurons; this avenue creates interpersonal chemistry and rapport. But when it comes to cognitive empathy, we’d expect to see a greater role for cortical areas, the thinking part of the brain. As for empathic concern, I would expect the same circuits that underlie emotional empathy to be involved, along with some in the premotor or motor areas that drive action.

30 Simon Baron-Cohen, The Essential Difference: Men, Women and the Extreme Male Brain , London: Allen Lane, 2003.

31 Sociopath’s brain: Antonio Damasio, “A Neural Basis for Sociopathy,” Archives of General Psychiatry 57, 2000, 128-129.

32 Richard Boyatzis and I, working with the Hay Group, have designed such an assessment tool, called the Emotional and Social Competence Inventory, or ESCI-360 For information on the ESCI: http://www.haygroup.com/leadershipandtalentondemand/Products/Item_Details.aspx?ItemID=58&type=5

33 To learn more about Social/Emotional learning, see the Collaborative for Academic and Social Learning, www.CASEL.org

34 SEL evaluation: Joseph Durlak and Roger Weissberg, “The Impact of Enhancing Students’ Social and Emotional Learning: A Meta-analysis of School-based Universal Interventions,” to be published in Child Development (In press).