A Glass You Can Drink From

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Abstract

This paper explores a psychobiological model of psychotherapy. An emotion-centered history of the evolution of the brain is followed by a review of the basic psychobiology of emotion, attachment, and memory. Because human beings are social mammals, we regulate each other's physiology and brain development through social contact. This process is likely to be causative not only in the generation of emotional pathology, but also in the therapeutic change that takes place in a successful psychotherapy. As neuroscience elucidates the nature of the brain, insight appears less important to emotional learning than the gradual alteration of intuition through the operation of implicit memory.

The aim of this essay is to review the basis for a secular theory of psychotherapy. By *secular*, I refer to the fact that most existing theories of psychotherapy are indistinguishable, on pragmatic grounds, from religious sects: a charismatic founder lays down axioms, which remain incontrovertible; one or more sacred texts are held to delineate and embody the truth about psychotherapy; and therapeutic mastery within such a framework is held to coincide with the restatement of orthodoxy. You can always spot a psychotherapy paper that emerges from within such a paradigm, because it inevitably begins with a quotation from or a reference to the charismatic founder or the sacred text. This is not one of those papers.

I'd like to see practitioners move away from religious models of psychotherapy, for three reasons. First, such models are unduly limiting. They restrict how we can conceptualise what afflicts patients and what helps them. Second, the proliferation of competing sects, each convinced of the singular truth of its dogma, promotes insularity and false certainty rather than the sharing of knowledge and discovery. And third, religious models of psychotherapy frequently make assertions and predictions that are demonstrably incorrect.

Therapists practise an art that is bounded, as is everything in the natural world, by discoverable but immutable laws. Throughout history, painters have struggled to learn what they could about the physics of light and colour and perspective, because that is their medium. We therapists must devote ourselves to learning about the neural basis of the self, because that is our medium. Every theory of human nature is, at its heart, a theory about the brain. Consequently, a rational theory of psychotherapy must not run afoul of basic scientific findings about the brain and how it operates. Where neuroscience refutes even our fondest ideas about human nature, we must revise our prior speculation. Within our willingness to do so lies the fundamental difference between science and religion. The former changes (albeit slowly) in response to incoming information; the latter does not.

The notion of an art bounded by scientific limits is not new. Medicine is one such art, and so are physics, and chemistry, and mathematics. Ample room exists in these fields for intuition, discovery, and the gradual acquisition of mastery. Excluded from a scientific domain are dogma, wishful thinking, and a blind insistence on the validity of beliefs that cannot be substantiated, however appealing we may find them. As therapists, we shouldn't feel too bad about relinquishing our hold on this last group. Since we regularly encourage our patients to face reality, no matter how painful and difficult that may be, it's only fair that we ask the same of ourselves and our profession.

If we therapists are to understand how the brain generates the self, we must know a bit about the neuroscience of emotion, relationships, and how the brain learns.

A brief tour of the evolution of the brain

To understand the emotional parts of the brain, it helps to understand where they came from and why they exist at all.

If we compare our world to the Earth of three hundred million years ago, a number of the same species alive then still thrive: plants and insects, fish, and a host of invertebrate life forms in the ocean. Before three hundred million years ago, no vertebrates existed on land; all of the animals with brains and spinal cords were fish. About that time, some of these fish began to evolve organs that could extract the oxygen from air, and, eventually, they crawled out from the sea. In time, when their transition to a land-dwelling life was more complete, they became the animals that dominated the planet during the Age of the Reptiles.

Reptiles have a particular reproductive strategy: they lay eggs, which are often tough and durable. And then they leave. Reptile progenitors typically perform no parenting duties whatsoever; the young, when hatched, fend for themselves.

The vast majority die before reaching adulthood. No emotional bond between parent and offspring exists: no affiliation, no loyalty, no nurturance, no protection, no monitoring, no feeding, no communication. This method of reproduction, although it strikes us mammals as scandalously neglectful, is nonetheless quite successful, as evidenced by the persistence of the reptilian line today. For two hundred million years, their domination of the land was complete.

A hundred million years ago, the mammals split off from the reptilian line. In school, you may have been taught that mammals differ from reptiles in that they have hair instead of scales, are warm-blooded instead of cold, and give birth instead of lay eggs. From our point of view, the major difference between mammals and reptiles is this: *instead of laying resilient eggs that hatch self-sufficient young, mammals give birth to neurologically immature, largely helpless young, who must be given extensive parental care, or they will die.* Young mammals must be sheltered from extremes of heat and cold. They must be protected from predators. They must be fed. They must be bathed. They must be provided with water. Mammalian young require a number of distinctly different things, and each of the young must be given what it needs when it needs it, or it will die.

Parental mammals must therefore be able to tell what the offspring need, and they must be disposed to provide for those needs – or they will not pass their genes on to the next generation. They must not only care for the young – they must care *about* the young in a way never before seen in evolution. The mammalian way of life thus depends intrinsically upon the existence of emotional traits and behaviours such as loyalty, affiliation, nurturance, and communication between parent and young.

In order for mammals to carry out these behaviours, which reptiles lack, they must have brain structures that reptiles don't. The great French neuroanatomist Paul Broca noted that, above what we would call in humans the brainstem, a mammal's brain demonstrates a great arch of brain tissue not found in reptiles. He called this the *great limbic lobe*, drawing upon the Latin *limn*, meaning *line*, because he felt that this innovation was the fundamental line of division between mammals and lower animals. Inside the *limbic system* we find the neural hardware for just about all of the brain's tasks related to emotion and relationships.

The third and final stage in the evolution of the human brain began several million years ago on the African plains. A few primate species gradually evolved to be smarter and smarter, and as they did evolution witnessed the rise of the neocortex, which in humans is quite massive. The neocortex makes us smart: the ability to use logic and reason, the power to represent ideas symbolically in language and mathematics, the ability to imagine hypothetical events that have not yet occurred – these are all neocortical innovations. Whatever our shortcomings, human beings possess extremely advanced cognitive hardware. However, the neocortex does not make us any more emotionally skilled than other mammals. Many relatively unintelligent mammals (rats, mice, prairie dogs) are nonetheless fully capable limbic parents, carrying out a variety of complex emotional and relationship-based tasks.

This tripartite evolutionary model of the brain is called the *triune brain* model, devised by neuroscientist and comparative neuroanatomist Paul MacLean. I encourage you to read more about it in his book, *The Triune Brain in Evolution* (1990).

The limbic brain endows mammals with three particular attributes: emotion, attachment, and a particular kind of slow, inefficient learning. It's worth learning a bit about each of them.

Emotion

The first scientific theory of emotion was proposed by Charles Darwin. Not long after the publication of *On the Origin of Species* (1859) , Darwin wrote *On the Expression of the Emotions in Man and Animals* (1872). That book is still in print, and you can order it from Amazon.com. It's an excellent read.

Darwin's basic thesis was that emotions are a physical attribute of certain organisms, just as beaks and fangs and stingers are physical attributes of certain organisms. He proposed that emotions arose (like any physical attribute) in the course of evolution to serve a specific purpose that advances the reproductive fitness of the animals so equipped. If we studied emotions, he thought, we could discover what particular fitness advantage they confer. Darwin proposed that the eyes widen in fear, for instance, so that a person can take in more of the visual field, which may be advantageous in conditions of danger. He proposed that the mouth opens in surprise to better facilitate the intake of breath, which may be necessary if the surprise should become a reason for flight.

Darwin also proposed that animals that are closely related should display similar emotional expressions, just as related animals (e.g. bats and humans) display close similarities in physical structures like the bony architecture of the hand and wrist. For this reason, he felt that some of the emotional expressions of animals should be similar enough to be recognisable by humans, and vice versa. And, using similar reasoning, he proposed that just as basic human anatomy is identical for all human beings, basic emotional anatomy must be identical as well. Darwin postulated that the basic conformations of facial expressions would be identical in all human beings, irrespective of culture.

One of Darwin's key ideas is that emotional expressions constitute an *innate and universal language.* To test this hypothesis, researcher Paul Ekman and colleagues journeyed to New Guinea, and they showed the natives (who had never before seen people from another culture) pictures of American emotional expressions, and asked them to match them with a one-line description: the person who has just lost a child, the person who is ready to fight, the person who has just seen a dead pig lying in the road. Ekman found that although they had never seen Americans before, the New Guinea natives had no trouble interpreting American expressions of emotion. We know now that the basic form of emotional expressions is identical, all over the planet. Infants are born with this knowledge encoded in the structure of their nervous systems.

Every normal person possesses, in his or her limbic brain, neural hardware dedicated to the task of analysing the facial expressions, body posture, vocal intonations, and perhaps even the olfactory cues that other mammals produce. This hardware analyses the communicative signals that mammals give off, and it arrives at a conclusion as to the nature of the internal state of the mammals in its environment. This system is quite old and extremely quick.

Just as our visual cortex gives us a rich experience pertaining to electromagnetic radiation in our environment, and our auditory cortex gives an experience derived from changes in air density near our heads, our emotional hardware gives us an experience derived from analysis of signals that other mammals give off: we know what's going on inside them because we can *feel* it, just as we can *see* colours and *hear* music.

The plot thickens a bit when we realize that detecting an emotion is not solely a sensory experience. Detecting an emotion changes the observer's own emotional tone in the direction of the emotion he's observing. For instance, if you show a picture of an angry face to an observer, it's easy to demonstrate that the facial muscles of the observer begin to adopt the conformation of anger: brows knit, lips pursed, and so on. In fact, as more recent brain-imaging data demonstrate, observing someone else *doing* just about anything – moving fingers, picking up a box, exhibiting a sad expression, exhibiting fearful body language – activates the parts of an observer's brain that would be activated if *he himself were doing the thing he is observing.* Mammals, including normal human beings, run an internal modelling programme when they view behaviour. In effect, the mammalian brain engages in the internal neural simulation of behaviour it observes in others, and the simulation asks this question: "What if *I* were doing that?" This internal modelling of anger is what causes an observer's facial expression to change in the direction of anger when he sees an angry person. In a more general sense, this internal modelling process is the neurobiological basis of empathy. It is how we *know* what another person is feeling – our brains model his behaviour, including his emotional expressions, and so we feel some portion of *his* feeling in our own minds.

Attachment

Attachment is so intrinsic to the motivation of mammals that it is extremely hard for most people to imagine life without it. Because mammals get so easily attached, we might assume that all animals do, but this is not the case. Take the African tree frog, for instance: if two frogs have spent a good deal of time together, and we remove one of them, the remaining frog will evidence no reaction whatsoever.

In vivid contrast, mammals demonstrate dramatic behavioural and neurophysiologic changes when a relationship bond is severed. As an example, witness the fate of Damini, a 72-year-old elephant. Several years ago, Damini was housed at the Prince of Wales Zoo in Lucknow, India. A pregnant female elephant, Champakali, was housed with her, and the two became close companions. When Champakali died in childbirth, Damini appeared inconsolable. She shed tears, showed no interest in her food and water, and collapsed and died shortly thereafter. *Mammals form complex behavioural bonds with each other, and these bonds have powerful physiologic effects.* This mammalian attribute is dramatically different from anything we see in the reptilian world.

Emotional contact is so necessary for mammals that human infants will die if deprived of it. As a number of deliberate and naturalistic experiments have demonstrated, if human infants are given food, water, and shelter, but are deprived of emotional contact, nearly all of them will die. Why should this be?

The complex neurophysiologic underpinnings of relationship bonds were first studied by Myron Hofer, now director of the Sackler Institute for Developmental Psychobiology at Columbia University. For decades, Hofer studied the nature of the relationship between rat pups and a mother rat. He concluded the mother-pup relationship is a complex web of physiologic regulation, in which an astonishing array of maternal attributes and behaviours regulates the physiology of the rat pups – including cardiovascular parameters like heart rate and blood pressure, neurophysiologic parameters like levels of neurotransmitters and sleep patterns, metabolic and hormonal parameters like cortisol and growth hormone secretion. If one removes the mother rat, the ordered physiology of the rat pups dissolves into unregulated chaos.

Subsequent research has strongly supported the contention that *relationships regulate physiology* – not only in rats, but in all social mammals. Like the rat pup, when deprived of parental input, a human infant's physiology devolves into chaos, the major difference being that human infants are sufficiently vulnerable that the unregulated state, if allowed to go on for very long, is frequently fatal. Infants are maximally dependent upon relationships for physiologic regulation, but even adult human beings remain embedded in a social web of physiologic regulation, of which they are often minimally aware. We can observe adult relationships regulating physiology in the common phenomenon of *menstrual synchrony*, for instance, wherein the hormonal rhythms in two women who share an emotional bond spontaneously align so that their cycles frequently begin on the same day. We can observe relationships regulating physiology in the many studies that have observed increased morbidity and mortality from a host of diseases in socially isolated people. We can even observe relationships regulating physiology in studies demonstrating that dog ownership has a substantially beneficial effect on blood pressure in those with hypertension, a strongly positive effect on survival in those who have suffered a heart attack, and can vastly reduce seizure frequency in patients with epilepsy.

One important aspect of physiology is brain function, and so if relationships regulate physiology, we should expect to find that *relationships regulate brain function*. And we do. The children of mothers who are depressed exhibit significantly lower levels of neuronal activity in the cerebral cortex, for instance, when compared with children of normal mothers.

In the first few years of life, a child's brain undergoes a tremendous amount of growth and development. At birth, the brain is only about one-quarter of its final size, and in the first 18 months of life, the brain is forming neuronal connections at the rate of 1.8 million per *second*. Because relationships regulate physiology, including brain function, and because the juvenile brain undergoes so much growth and development in childhood, we should expect to find that *relationships regulate brain development in young mammals*. And so we do.

An enormous and fascinating body of research demonstrates that relationships regulate brain development in mammals. Children raised in Romanian orphanages possess measurably smaller brains than normal children, and brain imaging in the orphanage-raised children reveals large-scale atrophy and neuronal death. Rhesus monkeys raised in social isolation grow to become adults that are highly abnormal, in behaviour as well as in neuroanatomy and neurophysiology. A series of experiments at Emory University in Atlanta has demonstrated that interfering with maternal nurturance by making monkey mothers stressed and slightly neglectful produces permanent brain changes in the *baby* monkeys those mothers are attempting to care for. And an elegant series of experiments by Michael Meaney at McGill University has shown that in rats, altering the kind of parental care young rats get (as by depriving them of the mother rat for 15 minutes a day, for instance) produces long-lasting changes in neuronal gene regulation. This is an experimental result that should really catch our attention: in rats, the juvenile experience of nurturance *turns genes on and off inside the neurons of the baby rat's developing brain* – thereby profoundly altering the long-term behaviour of those neurons, and the brain that houses them.

Memory

> Canst thou not minister to a mind diseased,
> Pluck from the memory a rooted sorrow,
> Raze out the written troubles of the brain
> And with some sweet oblivious antidote
> Cleanse the stuff'd bosom of that perilous stuff
> Which weighs upon the heart?
>
> *Macbeth*, Act V, Scene 3

Macbeth's plaintive request to his physician has only grown in relevance in the four centuries since Shakespeare wrote these lines. We *do* have some antidotes to emotional dysfunction in our time, in the form of powerful antidepressant and mood-stabilizing medications. Even with these aids, it's *still* not so easy to pluck a rooted sorrow from the memory wherein it dwells, for the very reason that Shakespeare suggests: emotional dysfunction is, in many cases, not a smear on the window of feeling that can be wiped away, but instead it appears to be inextricably intertwined with the same stuff the self is made of. A mind afflicted by certain kinds of emotional dysfunction must, in some sense, be re-written before it can function more normally. Making these revisions is the task of psychotherapy – a task made all the harder by our own ignorance of the mechanisms of memory that underlie the construction of the self. Psychotherapy existed for most of the twentieth century, but an understanding of the workings of memory did not, and that single fact has been responsible for much hardship.

For centuries, people have been aware that human memory is a tricky affair: people often behave as if they have knowledge of which they are unaware; at other times they 'remember' events that never actually happened, and at other times they do not remember other events that clearly did. Devising a model of memory consistent with these phenomena and with the known physiology of the brain proved dead easy at the beginning of the twentieth century, because almost nothing was known about the brain. So extensive was the data vacuum that the early models of memory could include almost any proposition without fear of contradiction. As the century wore on, however, it became increasingly clear that the models of memory forged during that speculative phase, when the brain was a black box, were (and are) fundamentally incompatible with scientific fact.

Our field has inherited a model of memory from those early days of free-wheeling speculation. Let us call that early paradigm *Model A.* Model A goes as follows: information comes in on the mind's bottom floor, through the doors of perception, and from there wafts upward to the level of the *unconscious* (that which we cannot will ourselves to know), and then the *preconscious* (that which we do not currently know, but could, such as the sensation on the bottom of the left foot), and then the *conscious* (that which we know). At any point along this journey, information can be interrupted from progressing upward by the barrier of *repression*, which dictates that things too awful to be aware of must not be known. The difference, in this model, between conscious and unconscious memory is the repression barrier, floating like a glass ceiling between the knowable and the unknowable.

The scientific study of the brain has yielded a radically different model of memory, which we may call *Model B.* Model B posits that the brain possesses two fundamentally different memory mechanisms, each operating continuously and in tandem. The products of one memory mechanism are potentially available to consciousness; the products of the second never are. This model postulates unconscious learning and memory as a normal feature of the mundane operation of the brain. The barrier between what is knowable and not knowable has nothing to do with the emotional impact of the material itself, but instead springs from the brain's basic design, which includes a pair of distinctly different learning mechanisms.

One of these models has a future, and one of them does not. Let us take a closer look at the model - Model B - that has not yet suffered a fatal collision with fact. According to this latter model, two memory mechanisms operate in tandem – one potentially conscious, one not. The potentially conscious memory is called *explicit* memory, and its shadow is called *implicit*.

Explicit memory

In the explicit memory system, information comes into the brain, is processed by a circuit involving the hippocampus and the cortex, and some parts of that information may be available for conscious recall later. This is the kind of memory that one utilises to remember a phone number, or to recall the details of a past event: the name of your high school geometry teacher, or the plot of the movie you saw last night. Explicit memory has two properties that concern us here:

1. Explicit memory yields up an account of the past that is extraordinarily inaccurate, unreliable, and changeable, while supplying an utterly false impression of unswervable authenticity to the person doing the remembering.
2. Children are not very good at it.

A huge amount of data has accumulated to indict explicit memory as a wholly unreliable witness of fact. In study after study under controlled conditions, people have demonstrated that, in general, they are remarkably poor at remembering what actually occurred. Instead, their memories slip and stretch like a malleable fabric, including elements that never occurred, excluding ones that did, and incorporating later information, suggestions, and experiences. Explicit memory continues to change slowly over time, like a kaleidoscope that rotates with infinitesimal slowness, presenting a slightly different version of events each time a particular memory is queried. And explicit memory is an extraordinarily gullible recorder – authentic-feeling 'memories' for events that never occurred are remarkably easy to create.

In one study, for instance, investigators met with children once weekly, and asked them this question: "Think real hard, and tell me if this ever happened to you. Can you remember going to the hospital with a mousetrap on your foot?" By the tenth week, 60 per cent of the children reported that they *did* remember this incident, and were more than willing to tell an involved story about it, complete with embellished details, all of them false. In addition, child psychologists and psychiatrists watching these children could not distinguish a child recounting a fabricated memory, from one describing an event that actually occurred. And a substantial fraction of the children in the study could not subsequently be convinced that the mousetrap incident had never happened.

In another study, investigators interviewed a number of 14-year-old boys, and asked them questions about their emotional lives, such as, "What is your mother's best trait?" and "What is the nicest thing about your home life?" When they were 44 years old, the same individuals were asked to recall their earlier lives, and were asked the same questions: "When you were fourteen, what was your mother's best trait?" And so forth. Remarkably enough, the correlation between the attitudes recounted at age fourteen and recalled at age 44 was *no better than chance.* When we ask our patients about what their lives were like as children, how they felt and what they thought, we should keep in mind that we may well be retrieving information that has little or no factual relationship to what actually happened in their pasts. Asking these kinds of questions may tell us something about what is going on in the patient's mind *now,* but it does not necessarily tell us *anything* about what was going on in the patient's mind *then.*

Why is explicit memory so unreliable? The answer is relatively simple, although most people find it difficult to convince themselves that their own minds function according to this principle. If we show an apple to a person, and then later ask him to recall it while we scan his brain, we'll find that the same brain areas light up when we ask someone simply to *imagine* an apple without having seen it. A sensory experience and imagining that sensory experience are extremely similar in the brain, and *the brain does not do a good job of keeping track of the distinction between what it imagined and what it experienced.*

If we invite someone to imagine something, we should expect that a fair amount of the time, the person will come to have a memory of the imagined scenario, a memory that will be indistinguishable (to that person, at least) from a memory of an actual experience. Repeated studies have demonstrated this to be so. In one study, subjects attended a séance supervised by a medium, who was actually a professional magician. During the séance, he told the participants to levitate the table with their minds, and said: "That's good. Lift the table up. That's good. Keep concentrating. Keep the table in the air." When questioned two weeks later, 345 of the participants recalled having actually *seen* the table levitate, although it had done no such thing. In another study, 44 per cent of British television viewers claimed to have seen the footage of Princess Diana's fatal accident in which her chauffeur-driven sedan crashed into a pylon in Paris. No such footage exists, but the viewers had imagined the scenario many times in the course of hearing the event described, and eventually, these imaginings became filed in the brain under the heading 'Memory'.

In therapy, when we ask patients who have normal-feeling memories about their childhood to relate them, it's highly doubtful that we get information that is wholly accurate about what the past was like. If a patient doesn't remember what happened in the first place, the overwhelming likelihood is that he will never know what happened. If we invite patients to fill in the blanks by imagining one scenario or another, we can easily instil in them a memory that feels genuine and real, and we can imbue it with just about any content we choose. In the 1980s and 1990s (in the United States at least), a good many therapists did just that, and the results were appalling. We can learn the lesson of those years, so we do not have to repeat it. As voiced by Brandon et al. in *TheBritish Journal of Psychiatry* in 1998: "We concluded that when memories are 'recovered' after long periods of amnesia, particularly when extraordinary means were used to secure the recovery of memory, there is a high probability that the memories are false."

The fallibility of explicit memory poses a grave but not insuperable problem for practitioners of psychotherapy. We would like to know what a patient has learned about relationships, because many of our patients have been exposed to emotional adversity and have learned specific and highly disadvantageous lessons from their experience. But if we cannot ask them about their emotional pasts and get anything like a reliable answer, where can we turn for access to this information?

Implicit memory

The study of individuals who lost their capacity for explicit memory has revealed that they can still learn, in interesting and specific ways. While they cannot recall new facts or new events, they can acquire skills and habits – new motor skills like knitting, and new habits of thought like expectation. The brain has two separate and independent memory systems, one for facts and events (the *explicit* memory system) and one for skills and habits (the *implicit* system.) The first is potentially accessible by the conscious mind, and the second is not.

The *implicit memory system* scans the world for recurring regularities and patterns, and it does this without informing the conscious mind about the content of the patterns it finds. Once implicit memory has detected an underlying pattern within a series of experiences, that pattern then serves as the basis for shortcuts in perception, expectation and action.

Consider language acquisition, for instance. In school, children learn the meanings of certain words in an *explicit* fashion, through effortful memorisation of vocabulary lists. But they learn *how to understand* speech and *how to speak* implicitly, and they learn these skills at a much younger age. No child has to be taught anything about how to understand or use speech; they have only to be exposed to many instances of speech, and the brain automatically acquires knowledge about the underlying grammatical, syntactical, and phonological rules that lie at the heart of any language. The process happens without any effort on the part of the learner. If a normal child hears (or sees) language, his brain gradually extracts the underlying patterns, and he becomes able to comprehend and produce speech without any effort at all.

Implicit knowledge of those underlying rules informs perception, expectation and action. A child does not have to learn the singular and the plural forms of every noun in the English language, for instance – instead, he learns one underlying *rule*, which serves as a shortcut. In this particular case, the rule can be stated thus: *singular + s = plural.* One cat, two cats. One dog, two dogs. The rule itself is neat, compact and efficient. A few exceptions fall outside the rule (one radius, two radii), and the exceptions can be acquired manually. Children acquire knowledge of what we might call *the plural rule* at a very young age. If we show a four year old a picture of an imaginary creature (for which English lacks a word) and we call it a *blan*, and we then we ask him to describe what he see when we show him a picture of two such creatures, we will obtain a reliable answer: "*Two blans*". This answer cannot occur on the basis of direct experience, because the child cannot have heard the word "blan" before our experiment. He has no *actual* basis upon which to predict the plural form of this word. Implicit knowledge of the appropriate *rule*, however, guides his expectation and his action, and his reply will be unhesitating.

If we ask a child to explicitly *enunciate* the plural rule he is using, (even if his skill level shows us that he has learned it very well), he will be unable to do so. Because the knowledge is implicit, a child can act on the basis of what he knows about the world's regularities and underlying patterns, but he cannot describe the basis for that action. Knowledge of implicit rules guides behaviour, but it does so without informing conscious awareness or comprehension.

A number of studies convincingly demonstrate that if a series of experiences possess an inherent underlying structure or patterning, then the human brain will gradually extract knowledge of those underlying regularities, regardless of the nature of the experiences or the underlying pattern. While they cannot describe implicit knowledge, and typically have no conscious awareness of it, people can act on it. When human beings act on the basis of knowledge acquired through extensive experience with a particular situation but cannot articulate the reason for acting in the way they do, we often say they are *using their intuition.* The study of implicit memory has uncovered the fact that the acquisition of intuitive knowledge is every bit as legitimate a brain function as vision or hearing. We all possess neural hardware dedicated to the task of forming intuition on the basis of repeated exposure to the world.

Children grow up in a world of relationships. Those relationships have order and regularity to them, just as a language does. The underlying rules regarding relationships vary considerably more from family to family than those regarding language. *If your mother has that tone in her voice, you're going to get slapped. When you tell your father you have done well at something, he gets angry.* And so on. Children acquire implicit knowledge of the rules that underlie relationships in the world they live in – their family. This knowledge, like all implicit knowledge, is acquired automatically, and it gives them a highly specific kind of intuition. It shapes their perception, their expectations, and their actions. Just like a child who says "Two *blans*", a person who has been exposed to a particular relationship environment will, as he lives his daily life, *act* on the basis of rules about which he has no conscious knowledge.

The fact that this kind of unconscious knowledge strongly shapes human behaviour has been recognised for longer than we might suppose. Consider these words, from a prescient observer of human nature:

> The more thoroughly . . . we examine into what may be termed the Mechanism of Thought, the more clear does it become that not only an automatic, but an unconscious action enters largely into all its processes . . . And that these thought patterns can lead to unconscious prejudices which we thus form, [that] are often stronger than the conscious; and they are the more dangerous, because we cannot knowingly guard against them.

The psychologist William Carpenter wrote these lines in 1874.

Emotional pathology

Psychotherapy is the enterprise wherein one person endeavours to change another for the better. Patients come with emotional dysfunction, and they want to get better. What is the nature of the problem from which they suffer?

In the broadest terms possible, emotional dysfunction is the end result of a particular history of genetic vulnerability and environmental influence, operating in tandem. In some patients, genetic vulnerability predominates. Certain people inherit a particular set of genes that makes them vulnerable to bipolar disorder, for instance, or depression. In other patients, pathology is primarily the result of experience: they enter the world with the genetic potential to build a normal emotional brain and to have a normal emotional life, but adversity alters the brain in a way that interferes with normality. Perhaps most commonly, genetic vulnerability and life events conspire to impede the construction of a healthy emotional architecture.

Two broad categories of emotional dysfunction exist: we might call them *nonspecific pathology* and *specific pathology*.

Unlucky genetic inheritance, or environment, or both can produce *nonspecific* pathology: an enhanced vulnerability to generic illness states such as depression, anxiety, mood instability, impulsivity, even criminality. Because the development of the juvenile mammalian brain occurs within an environment of social and emotional regulation, and because this regulatory process is a key determinant of the health of the brain that results, *inadequate nurturance alone can and does result in pathology of the nonspecific variety.* Rats, monkeys, and humans all demonstrate significantly increased vulnerability to depression and anxiety if they receive substandard nurturance during their youth. If they are subsequently stressed, many more of the inadequately nurtured group will develop anxious and/or depressive pathology.

Specific emotional pathology arises from a different mechanism. Because implicit learning mechanisms are operative in the human brain from before birth, infants and young children *extract implicit knowledge of how relationships work* based on their exposure to them. Because implicit knowledge operates without the intervention of the brain systems involved in consciousness, people extract knowledge of the implicit principles that underlie emotional life in their early environment, but they are not aware of having done so and have no conscious access to the implicit information acquired. In other words, as a normal feature of how the brain works, *people behave in relationships in accordance with implicit principles of which they are not aware.* This implicitly acquired pattern affects not only how they behave, but also what they can perceive and what they are capable of expecting.

Exposure to a specific family environment, and the subsequent encoding of implicit knowledge of the regularities within that environment, traps people within the world of the known. They are best able to see what they have already seen most. Their brains distort incoming information such that on an experiential level, the world does not appear ambiguous and full of new information, but instead appears to conform to the patterns and fall into the categories they already know. Human beings do not experience direct reality; instead, we experience an internal model of reality that our brain constructs on the fly. This internal model is based *in some fashion* upon actual sensory information coming from reality, but that sensory information is inevitably distorted by a number of factors, including implicit knowledge already encoded in our neuronal networks.

Patients who suffer from *specific pathology* behave as if they have learned idiosyncratic and particular lessons about emotional life that have now trapped them within a very particular, inescapable, and self-confirming reality. One patient may act as if every potential relationship partner wants to stifle him and overrun his autonomy, and in every relationship he has, his expectation materialises. Another patient behaves as if pathological liars are the most attractive relationship partners imaginable. The variety of potential patterns within the domain of *specific pathology* is almost infinite. Just about every patient with *specific pathology* has a different story. That makes ours an interesting job.

Because implicit knowledge is not directly accessible to the brain modules responsible for verbalisation or consciousness, most patients do not *know* that they are trapped in an idiosyncratic world or, indeed, that they have learned anything at all. In order to correctly divine the nature of the world that any single patient lives in, we have to study what he *does* more often than what he *says*.

Secular psychotherapy

Using the preceding information from neuroscience, we can set out some general secular principles for the operation of psychotherapy.

1. People are emotional animals. Both therapist and patient will broadcast emotional signals, both will read the emotional signals emitted by the other, and the emotionality of each will be slightly altered in the direction of the other. This will take place whether the participants will it to or not, so we might as well take advantage of the process and use it to help the patient.

If I'm attentive, I should be able to get an emotional 'read' on the patient. To the extent that he is attentive and healthy, my patient should be able to get an emotional read on me. He may suffer from pathology that interferes with his ability to do this in a variety of ways, but if he were perfectly healthy, he would be able to read me as accurately as anybody else. I conclude from this that any attempt on my part to make myself difficult to read is, at best, pointless. The patient is likely to have *enough* trouble reading people correctly without my contributing to his problem by being deliberately obscure. So I make no effort to be obscure.

2. People are social mammals, and so they get attached. Patients get attached to therapists, which may well be helpful to them, both in the domain of *nonspecific* and *specific* pathology.

Several factors help pathology of the *nonspecific* variety. The countermeasures for nonspecific pathology are, unsurprisingly, activities or agents that generally promote neurophysiologic health. Certain medications can reduce vulnerability to anxiety, depression, and emotional instability. Environmental factors like exposure to bright light, regular exercise, or the regular practice of focused relaxation (as in meditation) can reduce these vulnerabilities as well. Perhaps most importantly, because human beings are social mammals, and social mammals rely on social regulation for neurophysiologic stability, *limbic regulation decreases vulnerability to nonspecific pathology.* For this reason, marriage, family, community and other close social affiliations have repeatedly been shown to reduce anxiety and depression, as well as a host of physical illnesses. Pet ownership is similarly helpful.

One aspect of the helpfulness of the therapist derives from the power of social regulation to inhibit pathological vulnerability to depression and anxiety. A therapist, in other words, can serve as a regulator of his patient's neurophysiology. A good therapist, like a good dog, is predictably present, reasonably warm and friendly, and is generally disposed to be nice to the patient. In comparing therapists to dogs I do not derogate therapists; I have a high opinion of dogs and their usefulness. *Companionship makes people feel better.* There is no reason that some portion of the helpfulness intrinsic to a therapeutic relationship cannot or should not come from the regulating aspect of companionship. As long as groundless dogma does not intrude, it's relatively easy to structure the helping environment so that it is friendly to the general requirements of attachment.

Attachment is aided by regular time spent together. This most therapies provide. Attachment is also marked by proximity-seeking when a dependent member is frightened or in pain. Some therapies permit this, and some do not. Attachment is also marked by the strong desire on the part of a dependent member to know the whereabouts of the other while they are separated. Even when the knowledge has little operational value in terms of reestablishing contact, people feel better when they know where their attachment figures are. Some therapies accommodate this, and some do not. I once gave a talk on the psychobiology of psychotherapy at Lake Tahoe, in northern California, about four hours away from the San Francisco Bay area where I live. I had to miss a couple of days of work to make the trip. After I gave the talk, a psychiatrist came up to me. "Did any of your patients ask you where you were going this week?" she asked. "Yes," I said. "What did you tell them?" she asked. "I told them I was going to Lake Tahoe to give a talk at a conference," I said. This answer surprised her. Her surprise, in turn, surprises me still.

3. People have an unreliable explicit memory system that's available to consciousness, and they have a reliable implicit memory system that is not.

Many of us have been taught in our psychotherapy training that insight changes behaviour patterns, but that hypothesis is astonishingly devoid of empirical support, and considerable evidence suggests it is untrue. Third grade children asked to solve a series of addition problems in the form of **X + Y – Y = ?** (e.g. **17 + 25 – 25 = ?**) show an initial solution time of more than 30 seconds, because they carry out each mathematical operation in sequence. After some experience with this particular problem type, children gradually develop implicit knowledge of the underlying rule (**X + Y – Y = X**) and their solution time abruptly drops to less than 10 seconds. At this point, however, although the child is *acting* on the basis of implicit knowledge (solution time < 10 seconds), he has no *conscious* awareness of it, and if queried will deny having figured out the 'trick' to solving the problems quickly. After several more trials, children typically become consciously aware of their discovery and announce it, although they remain unaware that they demonstrated acquisition of the pertinent rule *before* they had insight into the nature of the problem.

Experience changes implicit knowledge, not insight. Literally hundreds of experimental psychology studies support this assertion, and, as therapists, we ignore such finding at our patients' peril. As a therapist I must confess myself largely uninterested in whether my patients develop insight or not, because I think it irrelevant to their ultimate chance of escaping the confines of their specific pathology. What concerns me is that a patient learns to perceive reality in a way that conforms more closely to the way the world actually is, that he learns to expect from reality what reality generally delivers, and, most importantly, that he finds a way to *take action outside of the unreal paradigm he already knows very well.* "What we must learn to do, we learn by doing," wrote Aristotle. Presumably he did not have therapy in mind, but he might as well have.

The likelihood that therapy proceeds by the gradual acquisition of implicit knowledge, and not the sudden delivery of insight, is strongly suggested anyway by the fact that therapy takes considerable time. Insight learning takes virtually no time at all – if I need to learn a fact that I don't know, your insight can supply me with that piece of information almost instantly. Then I, too, would know it. If I need to learn a skill I don't possess, then that will take time – particularly if I already have pre-existing habits that must be unlearned if they are not to interfere with the acquisition of my new skill. Explicit learning is rapid; implicit learning is slow. "We can be knowledgeable with other men's knowledge, but we cannot be wise with other men's wisdom", wrote Renaissance scholar Michele de Montaigne, highlighting a distinction between explicit and implicit learning that was recognised centuries before our field began.

For some patients, the delivery of insight can serve as a reason to act in a way that their (flawed) intuition tells them is wrong. I concede that insight can be useful in this way, as a tool of persuasion, a means of convincing the patient that the world is other than the way he sees it. But what a pale instrument of persuasion insight is! One good look around the world is enough to tell anyone that much. What in the world motivates patients to act against their own intuition, then, if it is not the cool certainty of reason? Most of the time it's faith, pure and simple – the faith that the patient has in the therapist. A patient finds the courage to move in a direction that is counterintuitive to him because his faith in the therapist's guidance is greater than his faith in himself and his own intuition. Another word that describes this behaviour is *trust.*

I taught a class last year for Buddhists priests at the San Francisco Zen Center, who wished to better understand the process of mentoring and teaching in a one-on-one setting. Many thought that the process they engaged in with their students had little in common with psychotherapy, which they saw as a complex exercise in providing insight to people about their emotional problems. I myself was more convinced that our work and theirs was more fundamentally similar than they supposed. For weeks I struggled to convey what I thought therapy was, and how little intellectual complexity I think is at the heart of it. Finally, I explained it in this way:

"Look," I said, holding up a glass of water and placing it on the table. "The patient wants a drink of water. My job is to get him a drink. Every time he reaches out for the glass where he sees it, his hand closes on nothing, because the glass is *not where he sees it.* I say to the patient, 'The glass isn't over there where you are reaching. Instead, it's over here.' The patient says, 'But I can see the glass right there. I know it's there.' I say, 'Yes, I know you *see* the glass over there, but that's an illusion, a trick of the mind, a habit of perception. Maybe the water *used* to be over there. Your mind has learned a shortcut that misleads you as to the nature of *this* table before us and what's on it. You keep reaching *there*, and you keep winding up with nothing. Reach *here* instead. You'll get some water.' 'But there's nothing over there,' says the patient. 'Nothing at all.' 'I know it *looks* that way,' I say, 'but it really *isn't* that way. Try reaching over here, where the glass *really* is – what have you got to lose?' And eventually, the patient acts against his intuition, and in the direction of mine. He reaches over where his eyes tell him there's nothing. His fingers close around a glass he cannot see, and at first he can't understand how that's even possible. If he stays with it, and if I'm pointing him in the right direction, he's got hold of a glass he can drink from. And then my job is done. That's all there is to it."

More goes into this process, of course, than the this metaphor portrays. A story is told about the painter James Whistler, in which a man once asked Whistler how long it took him to paint one of his masterpieces. "About two hours," Whistler said. "That doesn't seem like much," said the fellow, unimpressed. "Yes, but it took me forty years to learn how to do it in two hours," Whistler replied.

Similarly obscure layers of skill reside in the expert therapist, who, above all, must be *right*: he must be *right* about how he reads the patient emotionally; *right* about where and how the patient is reaching where there is nothing, and *right* about the direction in which to encourage the patient to reach. It takes most of us a long time to learn to be that right. In the pursuit of such exactitude, a therapist is free to make (as indeed most of us make) a good many errors and missteps along the way, but he must be willing to learn enough from them to serve as a useful guide to anyone. He must be content to be a student of each patient until at long last, he learns enough to become a teacher.

"Science," wrote physicist and Nobel laureate Richard Feynman, "is a long history of learning how not to fool ourselves". As a profession, and as individual practitioners, we need as much help in that department as we can get. And so I finish, more or less as I began, by exhorting us all to immerse ourselves to the greatest extent possible in the process of *learning*: studying neuroscience for what it can teach us about human nature and the brain that creates it; studying the lives and stories of our individual patients, each of whom teaches us about his or her very particular nature. We cannot be maximally helpful if we do not do both. And since the study of human nature is very young, we can be confident that much more waits to be discovered than we have learned so far, if we have but the wit and the patience to keep an eye out for the undiscovered.

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