

## **After Freud: What do neuroscience advances tell us about human nature?**

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*“Reason is, and ought only to be the slave of the passions, and can never pretend to any other office than to serve and obey them”*

David Hume: Treatise on Human Nature II.3.3. (1739-40)

They are among mankind’s most profound questions. What places us apart from the animal herd? What is distinct in human nature? What binds our social order? How best to live? It is of no surprise that in the hope of answering such perennial puzzles -- once the exclusive study of theologians and philosophers -- we have conscripted now the gurus of modern neuroscience: indeed, a fascination with what we might learn about ourselves from the study of brain and behavior is increasingly a part of popular culture.

In my professional lifetime, something over three decades, we have learned more about the brain than in the whole of human history. We know for example that there are upward of one hundred billion nerve cells in the human brain, more than the number of stars that exist in the Milky Way galaxy, and that each of these cells has many thousands of synaptic connections - portals of chemical communication - with its neighbors. We know too an increasing amount about the anatomy of the different functional centers that make up the brain, what responsibilities they have, how they execute their duties and why and how they have evolved. We have learned much about the superhighways that maintain communication among these centers, and the physical and chemical processes that sustain that communication. We are beginning to understand how memory, which lies at the core of the subjective self, is dependent upon the strength of the networks that are forged among brain cells by what we experience, think and feel, a field to which Friedrich Hayek made a seminal contribution with his book *The Sensory Order* first published in 1952. It is even becoming generally accepted that brain gives rise to mind, to the agency that supports the ability of each of us to act as a unique person. And while we have yet to truly understand how consciousness and an awareness of being emerges from the brain’s amalgam of machinery, chemistry and experience, what we do know is that this is an organ of

extraordinary complexity - a transducer between the body and the environment - that has flexibility and great adaptive power, but also built-in biological limits.

In this rapid advance increasingly the handmaiden to our creativity is technology. Without the revolution that computer technology has brought to the processing of information, for example, the brain's genomic instruction kit would have remained beyond dissection; we would have only a primitive understanding the dynamics of cellular metabolism; and the ability to image the living brain would not exist. In the face of such wizardry and the knowledge it has delivered Enlightenment deliberations upon why we behave the way we do are easily forgotten. To forget, however, is to blur the focus of our quest for as I shall outline it was the seminal thinkers of the Enlightenment - among them John Locke, David Hume, Francis Hutcheson and Adam Smith - who in championing individual liberty and natural science first laid the conceptual foundation for our ongoing inquiry into moral philosophy and human nature. While today their tools of introspection and observation may seem primitive their thinking was profound and continues to offer insights as we frame what neuroscience can teach us.

What behavioral neuroscience *cannot* teach us is how to live but placed within the appropriate cultural context it can help explain why we do the things we do and offer potential guidance. In broad terms there are two interwoven threads of human culture: a cumulative technological understanding - knowledge about how the world works - of which biological science is a key component; and the development of social norms - of conventions on how to live based on shared intention - which ideally in the building of a civil society also should be cumulative. This woven tapestry of technological advance and social convention interacts with the biological parameters that have been laid down over the course of our evolution as creatures of this planet and together they shape our behavior. To take a simple example it is not within our capacity to fly; evolution has not equipped us for such activity. So to be swept rapidly across time zones, by the technological wonder that is the modern airliner, disrupts the biological clocks within our brain that monitor the light-dark cycle and orchestrate the physiology of the body. The result is "jet-lag," where those harmonies of behavior and body that in our familiar habitat we take for granted become dysregulated. Many of us will experience such a disruption in making our way to Sydney for the MPS meetings. But because it is a phenomenon known to us we will dismiss the lethargy and

appetite disturbance as inconsequential - once adaptation to the new sun time is made and the dynamic balance between brain clocks and body is restored.

In this essay and in my presentation in Sydney, which will be complementary to the ideas that I put forth here, I shall explore another, more complex, confluence where the threads of modern culture and the brain sciences intersect to offer an intriguing lesson about human nature. Your society's good President, Deepak Lal, in his invitation to me issued a broad challenge indeed - *After Freud: What do neuroscience advances tell us about human nature?* That topic might be a symposium in itself so rather than offer a compendium from genetics to neuropsychology I have decided to concentrate on something that recently has intrigued me and which I believe will provoke some energetic discussion among those of you who are economists. Specifically, based upon recent advances in neuroscience, I shall propose that in our nature - from an evolutionary viewpoint - we are biologically ill-suited to the affluence of the modern consumer society: that just as jet-lag has the capacity to dysregulate our biological clocks and impair the body's physiological homeostasis so can material affluence disrupt the natural balance of our market behaviors with unintended socio-biological consequence.

So, in keeping with the overarching Enlightenment theme of the symposium, I shall begin by revisiting some of the ideas of those gentlemen of the Scottish Enlightenment that I mentioned earlier, great thinkers who in their writings have done much to stimulate my musings.

But I must begin with an Englishman. We are indebted, of course, to John Locke (1632-1704), rightly considered by many to be the first empiricist, for his seminal contributions. A physician, who in his thirties had worked with the great clinician Thomas Sydenham, Locke brought to the study of mind the rigorous skills of observation, analysis and comparison that he had honed in his medical practice. It is to Locke that we owe the modern concept of the self - "that conscious thinking thing" - and of the importance of experience in shaping individual identity. For Locke the mind in the beginning is a blank slate, *a tabula rasa*. We create ourselves and in doing so we draw upon the world around us: every step we take is connected to the past and to the future. Thus is each individual unique in personality, experience and contribution. The right to be so was to become the foundation of Locke's reasoning on liberty, religious freedom and the

value of labor and property, as reflected in his political theory and in his writings on the nature of the social contract in civil society.

David Hume (1711-1776) drew heavily on these ideas and developed them further. In the understanding of human behavior Hume, perhaps more so than any other, led the thinking of the time away from superstition and idolatry toward the natural sciences. Hume was particularly concerned with a psychology of action - with why we behave as we do - and the relative roles of reason and the passions. For Hume passion – what we might now label as emotion – was a perception of mind that motivated action: reason alone was insufficient. For Hume to feel passion was to be moved to act by a change in self-awareness, be that a basic desire for food or sex or the more complex behaviors of curiosity and ambition. Reason as “the slave of the passions” was only of instrumental use, serving to connect various ideas into a system of belief.

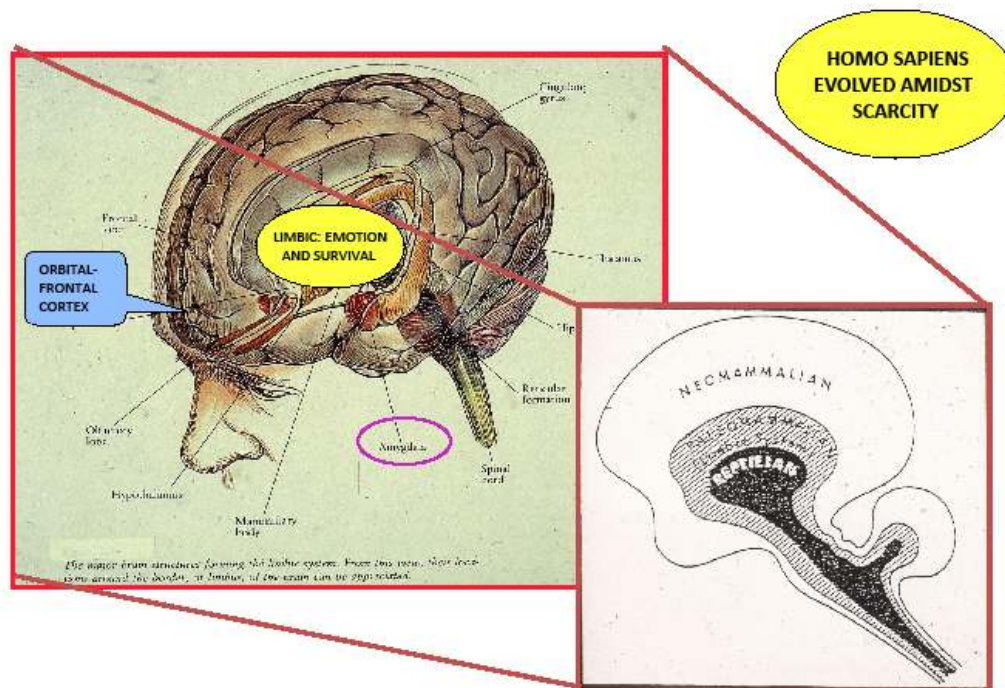
In the 18<sup>th</sup> century the use of the word emotion, literally meaning physical disturbance, was closer to its root than it is now. No distinction was made, as we do today, between the primary emotions of fear, disgust, anger and joy that are expressed in infancy, driven by the instinct for survival and hard wired into the brain, and secondary emotions such as pride, shame and guilt that are dependent upon reasoned judgment made against a moral standard. These secondary, reflective emotions are comparable to the “moral sentiments” described by Hume, and by the influential Francis Hutcheson, as calmer states susceptible to social cultivation and capable of reining in the excesses of the more violent passions. The moral sentiments were integral to Hume’s theory of mind. Like Hutcheson, Hume considered sentiments to be those judgments apparent in the interaction of an individual with others and shaped by society. Through these mechanisms of other directed emotions – first towards family and kin and later through convention toward others – sympathetic understanding comes to benefit society at large. In this social context passion is molded by reason, which in turn shapes action. Thus for Hume the self - Locke’s “conscious thinking thing” - is not a single thing at all but rather “a kind of theatre, where several perceptions successively make their appearance, re-pass, glide away, and mingle in an infinite variety of postures and situations.”

Hume’s description is one of extraordinary prescience for essentially he is describing the continuous appraisal that we now recognize as characteristic of higher cortical function – the dynamic give and take of information and the formulation of ideas in the service of planning and abstract thinking. These functions are largely the responsibility of the orbital-frontal cortex,

which is the most recently evolved and distinctive region of the human brain wedged in behind the forehead of the skull and above the eye-sockets.

The human brain is not a single organ but a hybrid: an evolved hierarchy of three-brains-in-one. Thus human behavior is best understood when brain anatomy is placed within an evolutionary context. A primitive “lizard” brain, designed millennia ago for survival, lies at the core of the human brain and cradles the roots of ancient dopamine reward pathways that are the superhighways of pleasure, curiosity and desire. When the dinosaurs still roamed, around this reptilian pith there evolved the limbic cortex - literally the “border crust” - of the early mammalian brain. This is the root of kinship behavior and the nurturance of the young that is characteristic of all mammalian species and particularly evident in our own social behavior. Subsequent evolution within the mammalian species is marked by a continuous expansion of this cortex and in the emergence of *Homo sapiens*, within the last two hundred thousand years, by extraordinary growth of the orbital-frontal region that distinguishes us within the primate lineage.

#### BEHAVIOR IS BEST UNDERSTOOD THROUGH THE LENS OF EVOLUTION

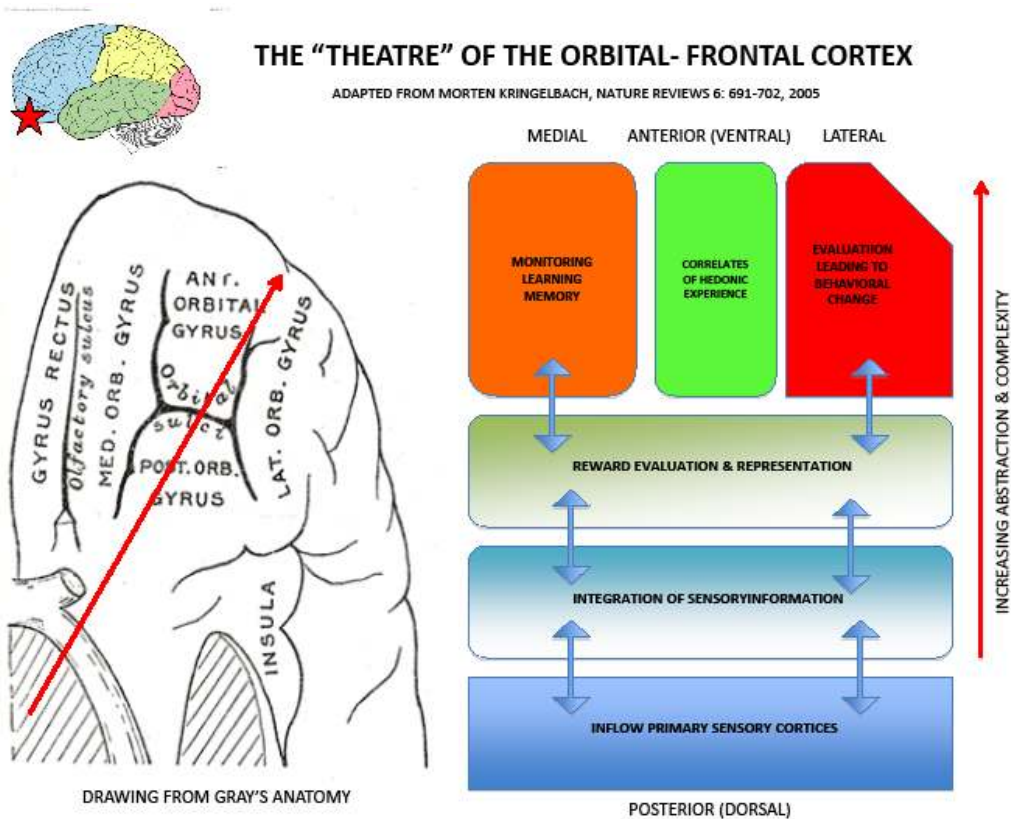


Paul MacClean: *The Triune Brain in Evolution*, Plenum Press, 1990

As is conjured in Hume’s compelling metaphor it is here in the “theatre” of the pre-frontal cortex that information from the three brains is brought together, analyzed and distilled. When working in harmony this hybrid apparatus, blending emotion and reasoning, has extraordinary adaptive

advantage – an advantage that is evident from the success we have achieved as a species. Through a process of continuous learning and exchange the risks, opportunities and rewards inherent in the kaleidoscope of life are carefully assessed and the emotional and social consequence of what we do is remembered to future benefit. We call this knowledge, which sounds grand but when all is said and done is merely the product of careful observation and the combining and arranging in the mind of ideas that we get from experience: as Hume noted, “nothing can be in the intellect which was not first in the senses.”

So what do we know about the functional anatomy of the orbital frontal cortex? Using modern physiological and imaging technologies again we find an uncanny resonance with Hume’s ideas; essentially we find that the orbital-frontal cortex is the “stage set” for his “theatre” of the mindful self.



It is a useful generalization that gathering perceptions about the world and monitoring the senses of the body are the responsibilities of the back – the posterior part - of the brain while the frontal regions are where the analyses of the incoming information are performed and action plans built. Joachim Fuster, a Semel Institute colleague at UCLA, has described this integrative process as the perception-action cycle, and in it the orbital-frontal cortex plays a critical role. In grasping how

the integration occurs the schematic drawing above, based on the work of Morten Kringelbach at Queen's College, Oxford may be helpful. The primary sensory cortices [the brain regions of perception] decode the gathered facts arriving from the eyes, ears and other sensory organs and the information so derived travels forward to the posterior parts of the frontal lobe. Here it mingles with instinctual input from the limbic structures and the emotional valence of the information is evaluated before the consolidated knowledge is passed forward again to the anterior cortex for further analysis and action.

Thus the emotions – the passions - play their leading role in shaping deliberation, just as Hume postulated. How we feel [for example if we are hungry] influences the analysis [is this something good to eat?] and shapes the action plan. Throughout the process the potential pay-off from the immediate opportunity is monitored against past experience and committed to memory when appropriate [this chocolate cake I find tastier than toffee pudding]. When an action is considered advantageous, or a change in behavior is required, the outermost region of the frontal lobe, known as the lateral orbital-frontal cortex, initiates it. So we eat the piece of cake, the hunger diminishes and as the perception-action cycle continues the ancient reward pathways are activated resulting in a subjective sense of pleasure. To push Hume's metaphor to its limit, applause ripples through the "theatre" as satiation occurs. The feedback loop promoting homeostasis - physiological balance - is complete.

However, of importance here is that the lateral orbital-frontal cortex can also inhibit behavioral action. We can decide that although we are hungry what we are doing in the moment is more important and thus we inhibit the drive to eat until a more appropriate or convenient time. Thus while, as Hume asserted, reasoned analysis rarely initiates behavior without an emotional driver nonetheless it can be a powerful modifier of action through the *lateral* area of the orbital-frontal cortex, which acts as the cortex of constraint. For centuries, in absence of any precise understanding of brain science, we have referred to the capacity for such constraint as willpower. And as I shall outline, it is the *social reinforcement* of this capacity for constraint – this willpower - that is of vital importance in the development and maintenance of social norms. For the roots of these insights we must turn to a consideration of Adam Smith's writings and his contributions both to moral philosophy and also to our understanding of market behavior.

Adam Smith (1723-1790), while reclusive in habit, was throughout his life a careful student of human behavior. This is apparent in the reasoned argument of his first compendium *The Theory*

*of Moral Sentiments*, published in 1759. There, building upon the work of Hume and greatly influenced by his teacher Francis Hutcheson, Smith offered a sophisticated analysis of the sentiments and social sympathy that was later to become a cornerstone of his economic theory as set forth in *The Wealth of Nations*. For Smith sentiment went beyond a mental mechanism that served to communicate one's own passion to others, as Hume essentially had characterized it, to the capacity to feel what others feel – to what today we call empathic understanding. Smith then went one stage further to argue that as the capacity for social sympathy matures a further awareness emerges of how one's own behavior is judged by others. Thus, through sympathetic social interaction, ultimately we achieve the self-awareness of an objective conscience - of an "impartial spectator" – through which we may monitor our own behavior toward other individuals. Thus, in Smith's optimistic vision of the civil society, the development of social sentiment is the foundation of moral judgment. Through the give-and-take of everyday experience we learn to navigate as citizens within a social order and in so doing to thrive as individuals. Or, in the parlance of neuroscience, as the executive judgment of the orbital-frontal cortex grows in sophistication we strive increasingly for objectivity – for an "impartial spectator" –that balances individual need and social complexity in the long term interests of the self.

Empathic understanding is principally learned behavior, shaped by cultural norms. As a species we function effectively, however, in many different self-built cultural worlds. This suggests that as in the development of language there is a facilitating template upon which empathic behaviors are laid down to be shaped subsequently by experience – essentially a capacity for guided mimicry where we learn from others and exploit that learning in our own interest. And indeed, recent findings in neuroscience reveal that there is a set of brain cells - appropriately called mirror neurons – that are dedicated to this activity. Mirror neurons have the interesting property of firing both when an action is taken (for example, raising food to one's mouth) *and* when such an action is merely observed being undertaken by another individual. Professor Rizzolatti in Parma, Italy, inadvertently discovered the existence of these special neurons when he was recording from single brain cells in the monkey. Subsequently through brain imaging studies evidence has accumulated that mirror neurons are present in the human pre-motor region and also in the parietal lobe, an area of the brain that works together with the orbital-frontal cortex to integrate sensory input in the perception-action cycle. However, as I shall illustrate in my presentation, human mimicry goes well beyond the perception of the simple motor actions others perform to an empathic understanding of facial expression and sundry pre-verbal behaviors that are the



cement of human culture. Most recently, in confirmation of the imaging findings, Itzhak Fried, a neurosurgeon at the Semel Institute, has directly recorded from single mirror neurons in his patients undergoing surgery to alleviate epilepsy, suggesting that such cells are widely distributed. Taken together these research findings provide neural validation of Adam Smith's assertion two and a half centuries ago, achieved through painstaking observation and deduction, that social sentiment – empathic understanding – is a vital ingredient in building and sustaining human culture.

We are intensely social animals. Our ability to co-operate with each other is the secret to our worldwide success – that plus the trans-generational cultural accumulation of technologies and behavioral practice that have enabled us to survive regardless of local climate. For example, should we find ourselves suddenly transported north of the Arctic Circle few would argue that most individuals would have some difficulty accommodating to the new habitat if it were not for the many earlier generations that have developed artifacts and behavioral methods to accommodate living in such climates. A similar evolution has occurred in our creation of social institutions, of which the behavioral give and take of market practice is a perfect example. Markets have emerged wherever people congregate: indeed the barter and exchange of goods is older than the practice of agriculture. Once we outgrew the economy of the nomadic hunting band and began to live in larger, relatively stable groups then trade among communities became essential. Rarely could a single aggregation of individuals, however talented, provide everything that was needed even at a subsistence level; thus as human settlements grew trade became a necessity and a culture of market behavior evolved.

Now let me turn briefly to the dynamics of market behavior from the neuroscience perspective. The compelling attraction of market interaction is that it harnesses the competitive human instincts for survival and preservation, particularly curiosity and self-interest, and promotes through a division of labor those who are innovative in their adaptation. This is the truth that Adam Smith - a practical thinker well ahead of his time - recognized in formulating of his economic philosophy a century or so before Darwin published the *Origin of Species*. In fact there is evidence that Darwin developed his ideas about natural selection in part through an interest in Smith's writings. We know from Darwin's diaries that in 1839 he was reading *Moral Sentiments* and was particularly impressed with Smith's argument that individuals in their self-interest sought to maximize their place in the world, suggesting to Darwin that in their evolution market economies and the differentiation of species obey similar dynamic

laws.

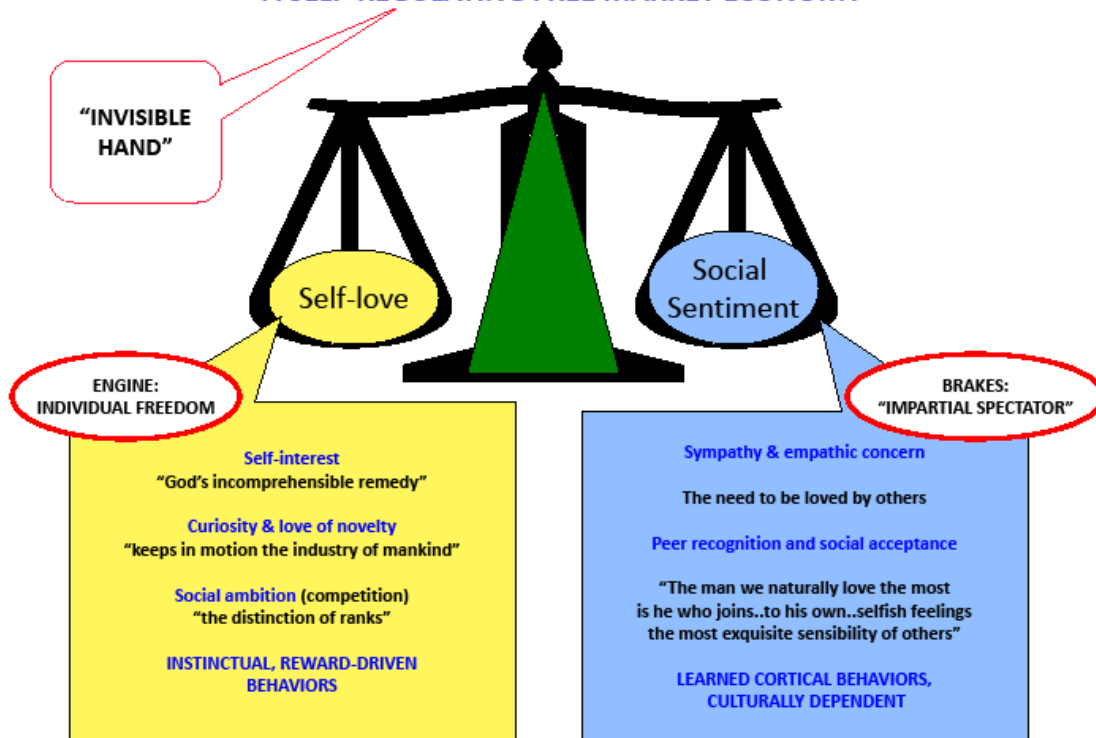
In the natural struggle for survival, Smith asserted, self-love – what we call self-interest today – was God’s “incomprehensible remedy” through which human society could achieve a balanced social order. Such self-interest, argued Smith, when appropriately shaped through the give-and-take of the market made possible a society where the products of individual labor are fairly traded placing a decent life within the reach of all. It was self-love together with the instinctual drives of curiosity and ambition that fueled the engine of the marketplace.

But where was the feedback control in this dynamic system? To draw upon the contemporary example of Watt’s steam engine what element of the self-regulating market system was to play the essential role of the “centrifugal governor” in curbing excessive speed? As I noted earlier Smith was an optimist when it came to human nature. While he accepted the bleak forecast of Thomas Hobbes who believed mankind by nature to be greedy and self absorbed, and further acknowledged that God had not gifted the human animal with absolute goodness, Smith rejected the argument that we are irretrievably evil. Rather he adhered to the beliefs of his old teacher Francis Hutcheson who considered human greed and selfishness to be balanced by a need to be loved by others. For Smith the engine of the market – the collective energy of those participating - was governed by each individual’s sensitivity to social feedback. It was Smith’s optimistic and passionate belief that within the give-and-take of the free-market overweening self-indulgence and similarly undesirable behaviors would be held in check by the powerful human need for peer recognition and by the “social sentiments” (empathic and commonsense behavior) learned from living in community. “The man whom we naturally love the most,” Smith wrote in *Moral Sentiments*, “is he who joins to... his own original and selfish feelings the most exquisite sensibility... and sympathetic feeling of others.”

Thus Smith’s analysis, which I have diagrammed below, is essentially that in a free market society individual desire and healthy ambition are held in *dynamic balance* by social sentiment and an individual’s observing conscience. Translated into the language of neuroscience the *instinctual* reward driven behaviors of self-interest are opposed by the *learned* and culturally reinforced behaviors of social and empathic concern. What we know

as the invisible hand is Smith’s metaphor for this self-regulation. Through the magical control of an “invisible hand” the “barter and exchange” of market behavior offers a prescription for social improvement – indeed for “universal opulence” - ensuring an equitable social order without need for external interference.

### ADAM SMITH’S ANALYSIS OF THE BEHAVIORS THAT BALANCE A SELF-REGULATING FREE MARKET ECONOMY



Smith’s analysis is an idealistic conception. Under certain contingencies, however, as in the predominantly agrarian economy of Smith’s own time, it has considerable integrity. Given the adoption of a few rules – a respect for private property, standard monetary agreements and honesty in exchange - experience tells us that locally capitalized markets do sustain their own rational order, founded as they are upon an interlocking system of self-interested transaction. But Smith lived before the invention of the mega-corporation, before instant global communication, and before the double cheeseburger and hedge funds. Today the tethers that once bound self-interest and social concern into closely-knit economic units have been weakened by remotely controlled commercial ventures that never sleep. Under such rapidly changing cultural parameters our marketplace behavior is changing. Smith’s invisible hand is losing its grip.

For the human hybrid brain, cobbled together over eons to cope with uncertainty and scarce resources, the transition to the Fast New World of the Digital Age has been a profound challenge. Together with erosion of the social contingencies that brought comfort to Adam Smith many of the natural constraints that once shaped and contained our instinctual behavior have been lost. For example, since the 1950s the physical limitations placed upon human activity by darkness, sea and distance have eroded. Across the globe rapidly advancing technologies have diminished such natural barriers speeding the movement of information, goods and people. Within a similar time frame many developed countries, led by the United States, have sought to drive economic growth by stimulating predominantly the instinctual side of Smith's equation, fostering individual competition and limiting social regulation of market practice. Thus, beginning in the late 1980s, as the Soviet Union crumbled and the Internet was commercialized, credit laws were relaxed and extensive borrowing was encouraged. Essentially echoing Smith's goal of "universal opulence" the engine of economic growth—self interest, curiosity and social ambition—was systematically supercharged with the confidence that *Homo economicus*, a presumed rational being, was capable of self-regulation. In the interests of rapid economic growth we proclaimed a "new" economy where personal gain was championed, risk was encouraged and prudence placed aside. For a while it worked: universal opulence, it seemed, was within our grasp. The good life was no longer a promise based upon old notions of toil and patience but one immediate and material. Vast shopping malls and infinite market choice confirmed our growing affluence: temptation was everywhere. The new economy had perfected the consumer driven market society.

Sadly this was a cultural shift that ignored what we know about the dynamics of human behavior. True to our basic survival instincts - over much of the developed world, but particularly so in the US - the human animal was soon focused on a debt-fueled stampede for immediate gratification, ignoring future consequence. At all levels of society we hungered for more: more money, more power, more food and more stuff. As we lurched from one economic bubble to the next and then on to the financial meltdown of 2008 there came the reminder – from Enron to Madoff to Goldman Sachs - that human greed is alive and well. Driven by individual desire a dangerous shift had occurred in the dynamic balance of Smith's classical market model. Hume, Smith's long time friend and mentor, had been validated beyond any measure; in the wake of diminishing social constraint reason was clearly enslaved to the passions.

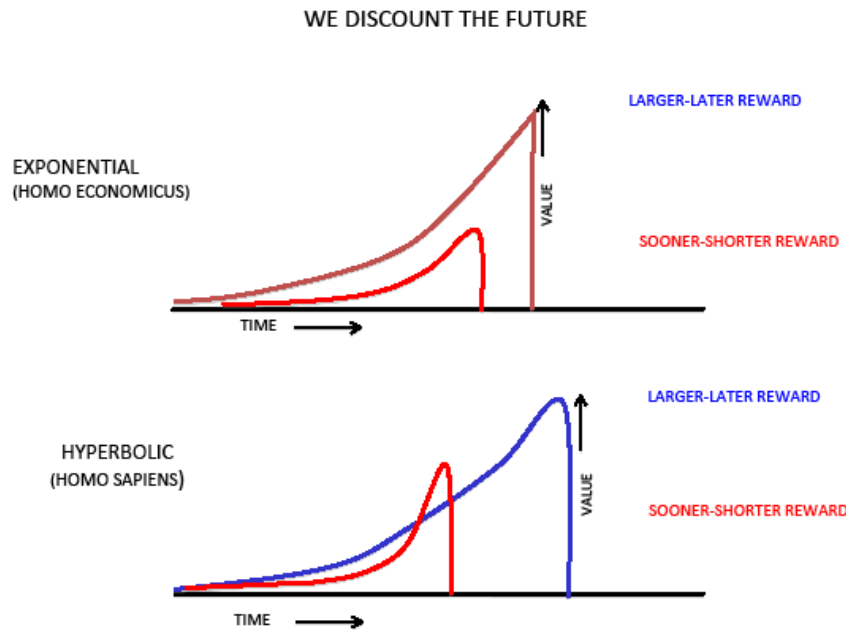
These crises have come as no surprise to the behavioral neuroscientist. Material affluence – succinctly defined by Avner Offer in his book *The Challenge of Affluence* as the relentless flow

of novel and cheaper opportunity - is a prospect both compelling and confusing to the hybrid human brain. As a species we have no familiarity with the seductive prosperity and material riches that exist in the developed world today. Our ancient brain systems of immediate reward were vital to survival millennia ago when finding a fruit tree was a rare delight and dinner had a habit of running away. But living now in relative abundance, when the whole world is a shopping mall and our appetites are no longer constrained by limited resources, our craving for reward - be that for money, the fat and sugar of fast food, or for the novel gadgetry of modern technology - has become a liability and a hunger that has no bounds. Essentially, without social reinforcement, the human brain has no built-in braking system.

We particularly have difficulty restraining ourselves when faced with the prospect of immediate gratification. The orbital-frontal cortex is quickly overwhelmed by affluence and particularly so when it has been poorly schooled in reason. Biologically, when it comes to opportunity, we are short-term discounters - a legacy of the lizard brain that confronts each of us everyday. Consider, for example, the following vignette. In Los Angeles, close to where I live, there is a small French bistro where I regularly go for supper. The owner, Luc, is a delightful man from Montréal and an excellent cook into the bargain. On a recent evening after having eaten well my two friends and I were about to leave when Luc insisted that we sample his new cheesecake – on the house. Thank you, we replied, but we were well satisfied and completely full; and besides two of us were trying to lose a little weight. Luc persisted and despite our continued protestations a slice of cheesecake soon appeared before us, together with three forks. Luc stood smiling, arms crossed, awaiting our response. He was not disappointed: in less than two minutes we had eaten the cheesecake, and with great delight I might add.

Such an experience is no doubt familiar to most of you. To paraphrase Oscar Wilde, most of us can resist everything but immediate temptation. In fact this simple experiment of everyday life, as George Ainslie, a professor of psychiatry at Temple University in Philadelphia has detailed in his book *Breakdown of Will*, tells much about the complexity of the brain's decision-making process. Our experience in the restaurant is confirmed by Ainslie's studies: in resisting temptation the *timing of the reward* is an important variable. In other words we discount the value of a potential reward based upon the expected delay in receiving it. Non-human primates do the same. When we judge that an immediately available option offers a short-term reward (the delicious cheesecake's primal taste of fat and sugar) we give it temporary preference over a more distant goal (that of losing weight).

For most of us, indeed, “a bird in the hand is worth two in the bush”. When faced with temptation the temporal discount curve is hyperbolic rather than exponential.



From AINSLIE: BREAKDOWN OF WILL, Behavioral and Brain Sciences 28, 635-673, 2005

Based on these and similar observations Ainslie argues that it is not reason alone but barter that establishes value when it comes to decision-making in the brain. Perhaps, to update Hume’s metaphor, rather than a theatre it is the give-and-take of a market that in the brain determines our actions. Brain imaging studies comparing patterns of blood flow in response to immediate and longer-term rewards support the importance of timing. When brain activity is seen principally in the limbic area and its associated cortical networks then the behavioral response favors the short-term reward: we consume the cheesecake. When the physiological activity is predominantly in the most lateral and dorsal parts of the orbital frontal cortex (the cortex of constraint) and the brain’s parietal lobe then long-term considerations prevail: the instinctual short-term reward is denied and the cake is refused.

So to summarize: from the neuroscience perspective when the payout for a potential reward is in the distant future the lateral orbital-frontal lobe system is dominant and reasoning is objective with benefits and risks being carefully evaluated before a preference is determined. However, in the short-term, even for rewards perceived to be of lesser value,

the influence of the lateral orbital-frontal cortex diminishes and the (instinctual) focus of the limbic and dopamine reward systems becomes dominant. These reward pathways are lizard brain structures that research has found to be consistently associated with impulsive behavior, which helps explain why other sensory triggers of desire—including taste, touch, smell and sight—are associated with craving and addictive behavior.

In an affluent material environment where opportunities abound this propensity in human nature for “shortsighted” decision-making is a liability. It is a myopia that reaches well beyond macro-economic considerations to the public health, about which I will have more to say during my presentation. A conundrum of modern life is that as choice and material prosperity have increased health and personal satisfaction have declined. Many of our technical innovations, while fascinating in their novelty, no longer promote the optimum human experience. Stress, obesity, anxiety and time urgency are increasingly associated with materially rich, demand driven lifestyles. Again this comes as no surprise. Just as an addict becomes habituated to cocaine, heroin or alcohol, the same neural architecture is present in a “normal” person to promote habituation to the pleasures of shopping, or of competing with the brother-in-law, from gambling stock options for quick profit or the myriad other stimulating activities that the novelties of affluence have on offer.

Most importantly these “ailments of affluence” cannot be understood in isolation. They only make sense when placed within the context of how we live. Take the obesity pandemic, for example. Americans are now among the fattest people in the world. Sixty-eight percent of the population is overweight and of that group some 33% are considered to be obese, which to give some perspective is ten times the obesity rate reported for the Japanese.



**THE AILMENTS OF AFFLUENCE: A CASCADE OF HEALTH CONSEQUENCES**

Careful analysis suggests that Americans have been slowly gaining weight for several decades, but there’s no doubt that beginning sometime in the 1980s the curve began to rise exponentially. As Avner Offer has observed this corresponds in time not only with the promotion of high density prepared foods but also with the worldwide rise of “market-liberal” politics and a dramatic increase in competition in the workplace. In this Fast New World we are each free to work 24/7: to need eight hours of restorative sleep each night was considered lunacy. And yet as I shall explain even a reduction of two hours sleep a night has profound physiological consequence including the promotion of obesity. In the Fast New World eating is something you do on the go. Those most affected are the young, the poor, and individuals who toil long and irregular hours, often for little money, grabbing food when they can. Here our instinctual propensity for the short-term is exploited by the fast food industry, which serves low cost fare high in fat and salt content and laced with corn syrup. Like Luc’s cheesecake fast-food offers a novel gustatory experience—one that has proved irresistible to the short-term ancient drives of the instinctual brain. The obesity pandemic is the unintended, but predictable, consequence of modern day living where a facet of human nature, tuned over millennia to aid survival in a deriving and dangerous habitat, has been hijacked by material affluence.



So, you may be asking yourself, what about Sigmund Freud, the historical figure chosen by your good President as the fulcrum of my discussion. In all honesty I must tell you that Freud's contributions to behavioral science, made almost a century ago, are discussed more frequently today in literary than in neuro-scientific circles. I believe Freud's writings are best understood within the context of his time and culture. Freud made his reputation at the turn of the twentieth century by highlighting what he believed to be the consequence of living in a rigid Victorian society that repressed human instinctual desire, and particularly the sexual imperative. And in support of Freud's position we would do well to remember that when Igor Stravinsky's *The Rite of Spring*, erotically choreographed by Nijinsky, was first performed in Paris in 1913 the audience rioted. The industrial society of the nineteenth century valued reason, industry, thrift, organization and faith - as reflected in the politics of men like Gladstone - as the path to future betterment. In the parlance of modern neuroscience the lateral orbital frontal cortex was in command.

While Freud agreed with the Enlightenment thinkers that reason is the path to knowledge, when it came to understanding human nature he believed that it was the conflict between the cultural constraints imposed by civil society and the natural human instincts that resulted in neurosis. These conflicts, driven by the repressed memories of childhood experience and frequently manifest in dreams, were at the root of irrationality and disordered thinking. Initially Freud employed hypnosis and later the free association of psychoanalysis as the treatment for these disorders revealing the conflict between reason and instinct - conflicts between his construct of the super ego and the id - through an understanding of the transference with the therapist.

For Freud civilization offered no gifts to liberty, as he observed in his essay *Civilization and its Discontents*, published in 1930. But Freud himself was conflicted. Many of the ideas outlined in that short volume were formulated in the wake of the terror and destruction of the First World War and at a time when Fascism was rising across Europe and particularly in Germany. Had he been pressed at that stage of his life Freud would probably have agreed with Hobbes in his thinking: that humans are by nature aggressive and destructive. Nonetheless, while he considered civilization to be a burden to individual freedom he was more fearful of the alternative, which he believed to be chaos.

So what of today? Freud's models of mind were based on a cultural experience that is the flip side of what we now are experiencing in western society, where individual liberty has triumphed over

restrictive social practice. But has the pendulum swung too far? In driving market growth have we erred in placing too great an emphasis on the instinctual side of the equation? Is this the best formula when it comes to the building of balanced human capital, especially in light of what neuroscience is now teaching us about human nature? Should we be seeking to strengthen social responsibility and a balanced self-understanding?

The Enlightenment spawned the rise of classical liberalism and modern capitalism. Reason, freedom and democracy were championed as the primary values of the civil society with reason - systematic thinking – driving the human future. It was an age of revolution but also of experiment. Two hundred years on that experiment is entering an interesting phase. If, at the beginning of the 21<sup>st</sup> century, we are willing to stand back and to reflect upon what the experiment has taught us about the nature of who we are, then there are lessons to be learned. The cultural challenge, however, remains the same: finding the optimum balance between passion and reason and building the social institutions that encourage and sustain that balance. The debate will continue.

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