Why do we gamble and take needless risks?

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We perhaps sometimes tend to regard risk taking behaviours as abnormal and likely to threaten rather than promote survival. Or perhaps alternatively we think that for us humans risk taking is a relic of times when our very survival was threatened However, risk taking is entirely normal and actually has evolved to promote survival. This is summarised rather well by an anonymous poem:

To laugh is to risk appearing the fool.

To weep is to risk appearing sentimental

To reach out for another is to risk involvement.

To expose feelings is to risk exposing your true self.

To place your dreams before a crowd is to risk ridicule.

To love is to risk not being loved in return.

To live is to risk dying.

To hope is to risk despair.

To go forward in the face of overwhelming odds is to risk failure

But to risk we must, because the greatest hazard in life is to risk nothing.

The person who risks nothing is one who does nothing, has nothing, is nothing.

He may avoid suffering and sorrows, but he cannot learn, feel, change, grow, or love.

Chained by his certitudes, he is a slave - he has forfeited his freedom.

Only a person who takes risks is FREE

and by numerous quotations from the great and the good:

"It is not because things are difficult that we do not dare, it is because we do not dare that they are difficult." Seneca

"Only those who risk going too far can possibly find out how far they can go." T.S. Elliot

"Behold the turtle. He makes progress only when he sticks his neck out." James Bryant Conant

However over 80% of us indulge in some kind of gambling activity for financial gain during the course of normal lives. In the US nearly 5 million adults a year are considered to be problem gamblers and the consequences of gambling contribute to nearly 20% of suicides. Overall 1.6% of the US population have been diagnosed as pathological gamblers. So this risk taking side of our nature has a serious down side, at least for humans.

What is risk?

Risk for us is a conscious perception of the chance that something could happen to us which is both unwanted and represents a potential loss. Some would qualify this to say that risk also involves the perception that there is a possible gain; however the feelings associated with risk taking behaviour are more about what might be lost rather than gained.

What does taking a risk feel like?

This is summarised really well on a web site (www.risktaking.co.uk) which describes the experience of risk when you are about to throw yourself out of a plane and parachute down to earth:

“The ground seems so ridiculously far away. As your brain’s amygdala recognises the clear and present danger your heart begins to beat wildly (up to three times faster), your blood pressure increases, your mouth becomes uncomfortably dry and you have an almost irresistible urge to avoid what is about to happen. You experience the universal emotion of fear, and the perception of risk has sent your system into top gear producing a massive surge of adrenalin, noradrenalin and growth hormone. In milliseconds the brain’s hypothalamus begins to give out corticotrophin-releasing hormone (CRH), which triggers the brain’s pituitary gland to pump out adrenocorticotropin (ACTH), which in turn persuades the adrenal glands near your kidneys to start producing cortisol. You are breathing much faster now and blood surges around your body, draining away from unimportant areas like your stomach into your muscles, and giving you “butterflies”. After all there is little point in diverting precious energy to digest your breakfast when you may need every ounce of energy just to survive! Adrenalin, noradrenalin, growth hormone and cortisol continue to be released into your blood as your pupils dilate allowing you to perceive movement around you more clearly, and see into the shadows and darkness (which may conceal further threat). Your immune system gears up to deal with any potential injuries, and emergency reserves of the energy source glucose are released in order to prepare for intense busts of muscular activity. In the blink of an eye your mind and body have geared up to act in response to the perceived risk, the so-called 'fight or flight' response. Whether or not you decide to jump out of the aeroplane and go parachuting depends upon you overcoming the natural fear of falling to your death.”

So why do we put ourselves through this at all? The simple fact is that the biology of risk is very similar to that for stress, anxiety and fear, although the latter have an important difference in that they are usually the result of something unavoidable that is happening to you (i.e. something you do not want to do). However, risk taking is something we normally chose to do and can therefore actually make us feel good. What distinguishes individuals who are happy to take risks and those who are averse to taking them is simply whether taking risks makes you feel good or not. If it risk taking does not make you feel good then the experience is pretty similar to having an attack of anxiety or fear.

The evolution of risk taking

Arguably modern humans are by far the most risk-taking species on the planet and we owe that to the lifestyles that our ancestors had to adopt in order to survive. They needed to hone their success in hunting by experiencing the risk taking involved as a thrill. The same would also have applied to their ability to fight one another – human history of course being often more about war than peace. The initial itinerant lifestyle of our forebears which saw them populate most of the planet within 100,000 years also involved them in having to take on constant risks that coping with new and often hostile environments would have entailed. We are undoubtedly descendants of a war like, exploring species for whom extreme risk taking has been a way of life.

An important immediate take home message is that for any species to survive natural selection will favour individuals prepared to take risks in order to promote their survival and that of their offspring. This is such a fundamental survival trait that you would expect it to have a strong genetic basis, and indeed it does. The down side to this is that when species that have evolved strong risk taking phenotypes create stable social and well resourced environments where life can involve minimal risk taking, then those with the strongest predisposition towards risk behaviour may need to find non-adaptive ways to express this characteristic – mountain climbing, off-piste skiing, bungee jumping, and other extreme sports and leisure pursuits immediately spring to mind. One could add to these of course criminal activities!

All of us do take hundreds of risks every day however, although the successful risk taker is the person who can conduct the optimum cost-benefit analysis that tries to determine when potential benefits are so great that they are worth obtaining even after huge personal risk, as opposed to when they are less great and do not justify this. Pathological risk taking is simply a reflection of changes in the brain which impair either judgements of the benefits that a particular risk behaviour might accrue, or the perception of the level of risk involved. A further complication is that we and other species have evolved brain mechanisms that motivate us to take acceptable risks by making us feel good when we take them and achieve a successful outcome. As with all motivated behaviours this can lead to a form of addiction where progressively greater and greater risks need to be taken to experience the required pleasurable “buzz” from the experience. This is what can often lie at the heart of extreme sensation seeking and gambling behaviours.

In essence risk taking is at the heart of acquiring new knowledge. True you can sit here in the audience at Gresham or watch a TV documentary or read a book and learn many new things without risking life or limb, although there are plentiful examples where academic pursuit of the knowledge being communicated has been achieved at great personal risk. In short we do not acquire new knowledge without taking the risk of delving into the unknown. Evolution has given us the perfect balanced set of tools for doing this. In the first place we generally prefer to explore novel things more than those we already know and find novelty exciting. However, in the second place we have an initial phobia for novel things so we don’t immediately rush in without doing at least a little bit of prior risk assessment. In short we and other species are a curious mix of inveterate explorers of the unknown coupled with health and safety experts.

This interest in novelty can be seen right from the way our brains have evolved to process sensory information through to those governing out attention and ultimately those that mediate our feelings of reward and pleasure. So, for example, in a previous lecture I gave entitled “So just how does a brain work, and can we design machines the same way?” (26th May 2005) I showed that the way encoding is carried out by the neural networks it means that as processing of familiar smells becomes more efficient and involves less and less of the network, so the network becomes more and more efficient at detecting any new smells. Similarly, we pay far more attention to any changes that occur in the environment around us than to things that are relatively constant.

Finally, in the basement of our brain dealing with motivated behaviours such as hunger, thirst and sex and pleasure, novelty also presses all the right buttons more effectively than what we know. Hence, we may eat a novel palatable food even when we feel completely full but will not eat more of the food we have just been eating. Or alternatively, and in a somewhat more dangerous context, when a male has just had sex with a female and the later does not seem to be able to reawaken his interest the chances are that if a new female comes onto the scene he will undergo a miraculous recovery of his ardour. This latter effect is even named after a previous US President with a reputation for having a roving eye – the “Coolidge effect”. Unsurprisingly, of course the greater impact that the sensory cues from novel objects have on sensory, attentional and motivational brain centres translates into a corresponding increased activation of the pleasure palaces of the brain which are linked to them.

Of course by now you have probably worked out that if this was the way the brain worked we would all be pretty much be hedonic, novelty junkies with no control of any kind. But of course that is not the case. Brains have evolved higher centres that can control and regulate these processes through risk-evaluation, cognitive decision making and emotion control. These are at their most advanced in the human brain although the increased sophistication may have brought with it a greater chance that these control systems do not always do the optimal job.

Revealing the controlling brain: The case of Phineas Gage

On the 13 th September 1848 an accidental explosion of a charge set by a railway construction foreman, Phineas Gage, drove a tamping iron 3 feet seven inches long, 1¼ inches wide (tapered to ¼ inch) and weighing 13½ lbs up through his left cheek into the front of his brain and out through the top of his head. The force of the blast was such that the iron landed 25-30 yards behind him. He did not lose consciousness even though most of the front of his brain on the left side was destroyed and amazingly was successfully treated by a young physician, Dr John Martyn Harlow. He went back to work in the middle of 1849 but his personality had changed so much that the contractors would not give him his job back. Before the accident he had been their most capable and efficient foreman who was considered to have a well balanced mind and to be a shrewd and careful businessman. Now he had become impatient and obstinate, capricious and vacillating, unable to plan future actions properly and had become impulsive and would take

stupid risks. Similar personality changes were subsequently reported in frontal lobotomy patients in the 1930s. It seems from these, and many other studied involving both humans and other species, that one of the key functions of the frontal cortex of the brain is to provide control over our impulses and to help us make decisions about appropriate courses of action after weighing up the pros and cons of any particular situation.

Most of the research investigating the causes of pathological gambling and compulsion, as well as aggression and even hypersexuality, has often suggested that the root cause is some problem with frontal lobe functioning. This structure is also obviously of key importance for the expression of an individual's personality traits and, indeed, Phineas's friends concluded after the accident that he was "No longer Gage".

Subsequent detailed studies have shown that different regions of the frontal cortex are involved in various aspects of linking experiences to feelings of pleasure and reward and in evaluation the sizes of expected rewards and punishments – all of which are of course key in determining whether or not a risk should be taken.

How does an occasional flutter turn into pathological gambling?

There is little doubt that the majority of humans are more than happy to gamble occasionally. The risk of betting on a horse, the outcome of a football match, playing the lottery, buying scratch cards, playing bingo or having a go at slot machines is generally perceived of as being very low. The potential gains are of course extremely high and that is what everyone focuses on. The classic routine gambler's justification is simply "well someone's got to win so why not me?" which of course flies entirely in the face of the more cognitive judgement that the odds of winning are often multiple millions to one and that organisations providing gambling opportunities almost invariably make huge amounts of money from our unfortunate predispositions to have a flutter. Naturally, if we are given similar odds where the consequences of failing to win are higher, such as you would lose your car, or your house or even your life you would not be willing to take them under any circumstances. However, a pathological gambler might. This is because with the latter, their cognitive assessment of the consequences of losing simply doesn't seem to be strong enough to control their risk-taking behaviour. So how can this happen?

The simple answer is that at the root of all gambling is that pretty much any activity where we risk little to gain huge rewards is novel, exciting and enjoyable and the emotional consequences of losing are relatively minor. Many other species also show a clear preference for opting for a very occasional big reward as opposed to a frequent small one. At least one study on monkeys has shown that they will opt for this big gain strategy even when they actually end up getting less of a reward overall (the rewards in this case are usually food of course) (McCoy & Platt, 2005).

The anticipation and excitement of receiving a big pay out of some kind far outweighs that of a smaller one and so very quickly one can see that your propensity to gamble is very much linked to the pleasure that the activity gives you. Many people say of lotteries that it would be so much better if the maximum payouts were less so that far more people could share in winning something of a reasonable size. The reality is that such a strategy would reduce the excitement individuals have of the prospect of winning and the numbers of individuals buying lottery tickets would crash. People who run these kinds of things know the human personality very well and quite probably the same kind of general approach would work with other species as well!

Risk taking as a personality trait

I have already alluded to the fact that some people are pro-risk taking and some are risk averse. Many believe that this reflects differences in an underlying personality trait. A proper discussion of research underlying the postulation of different personality traits is beyond the scope of this particular lecture but right the way back to Greek physicians at the time of Galen this has been considered as being an important way to distinguish between the characteristics of different individuals. Current thinking considers that we all differ along a number of different personality dimensions including: extraversion vs introversion, emotional stability vs neuroticism, psychoticism vs humaneness (suggested by Hans Eysenck) and openness to experience, agreeableness and conscientiousness (suggested by Costa and McCrae). Based on studies of identical twins it is proposed that these personality traits are determined 30-50% genetically. Other sub-dimensions are associated with these and in the 1950s Marvin Zuckerman proposed the existence of a

risk-taking personality.

Zuckerman's idea is based on a personality trait he calls "sensation-seeking" which is pursuit of novel, intense and complex sensations and experiences and the willingness to take risks for the sake of such experience. He considers that risk taking is not the main point of sensation seeking behaviour but the price you pay for having to engage in activities that satisfy the need for novelty, change and excitement. Indeed, many things that sensation seekers do are not that risky – listening to loud rock music, partying (without drugs), viewing extreme horror and sex films, travelling to exotic places etc etc. Sensation-seeking can obviously extend to extreme physical sports where the primary drive is for thrill and adventure-seeking.

Other kinds of sensation-seeking he defines are casting off inhibitions in a social setting (disinhibition) or through deviant lifestyles (experience-seeking) and through pursuit of change for change's sake (boredom susceptibility). These varieties of sensation seeking are related to six areas of risky activities - smoking, drinking alcohol, taking drugs of abuse, having unsafe sex, reckless driving and gambling.

Using a personality questionnaire (the Zuckerman-Kuhlman Personality Questionnaire – ZKPQ) Zuckerman assessed whether the six areas of risk were closely interrelated – indicating a concept of generalized risk taking. It turned out that it was not completely clear cut but that there was quite a high degree of concordance. Smoking, drinking, sex and drugs (and rock and roll) do tend to go together for both males and females. So saying that you are into "sex drugs and rock and roll" is reasonable. However, reckless driving is only related to drinking – a somewhat deadly combination.

An interesting observation was that while gambling was related to drinking and sex in males, in women it was not related to any other form of risk taking.

Computing a general risk score for both males and females Zuckerman concluded that people who take risks score high on impulsive sensation-seeking, aggression hostility and sociability personality traits. There was no relationship to the degree of neuroticism/anxiety suggesting that risk taking is not a means of compensating for anxiety.

While men turned out to be higher risk takers than women this was entirely due to men scoring higher on impulsive sensation-seeking.

It turns out that this sensation-seeking trait described by Zuckerman has a very high genetic contribution at 60% (based on twin studies). Other work has shown that the 40% experiential influence is not so much to do with a shared family environment but to factors outside of the home such as friends and accidental life experiences.

Differences between male and female gamblers

Zuckerman's work suggests that men and women may gamble for rather different reasons. This is revealed by the different general gambling choices by men and women. Men tend to prefer fast action and competitive games based on some degree of strategic skill. Beating other players and being top dog in the hierarchy seems to be very important and even in individual gambling pursuits such as fruit machines young males in particular are more concerned about the self-esteem and recognition achieved through winning than the money. Women on the other hand seem to prioritise gambling in situations that promote connection and intimacy with others and/or where winning is not at their expense (i.e. bingo, slot machines and scratch cards). In contrast to men, women don't tend to boast about their winnings to their fellow gamblers.

How do we assess risk? The somatic marker hypothesis.

One of the most prevalent theories of how we learn to judge the level of risk has been proposed by a US scientist at the University of Iowa, Antonio Damasio. This has been called the somatic marker hypothesis (see Bechara et al. 2005). It quite simply suggests that the body's response to the stress, anxiety of risk provides an automatic feedback which we can either gauge unconsciously or consciously. By this I mean the changes that were described earlier on in terms of sweating, increased heart rate, blood pressure, butterflies in stomach etc. Experimental support for this has been provided using a gambling task called the Iowa gambling task where subjects chose between four packs of cards. Two of these only give occasional $50 rewards whereas the other two can give $100 rewards but can also make you lose money. Damasio's group found that risk performance was strongly associated with level of these somatic changes. However,

recently it has been suggested that additionally, or possibly alternatively, the brain's cognitive centres have also learned to compute risk accurately on the basis of previous experience (Maia & McClelland, 2005).

An "Oops" centre in the brain?

In support of the idea that the brain can accurately compute the risk are experiments on monkeys suggest the presence of neural networks in the cingulate cortex which learn to accurately predict mistakes (Brown & Braver, 2005). This has led to this region being described as the "Oops" centre. This region also appears to be involved in computing the level of risk in gambling tasks (McCoy & Platt, 2005).

Emotional control and computing reward consequences of risk-taking. Why can this go wrong?

A number of brain imaging studies have been carried out in the last 10 years investigating what happens when we take risks, particularly in gambling tasks which can be carried out inside the confines of a scanner – extreme sports may have to await considerable technical advances before we can do the same for this kind of sensation seeking!

Broadly speaking these studies have revealed that when we gamble with the anticipation of a positive outcome, and therefore experience positive emotions, one of the important areas of the brain for mediating pleasure and reward, the nucleus accumbens, becomes very active. This is actually the same part of the brain that lights up when a cocaine addict sees their next fix, and therein lies the problem – gambling can become addictive in the same way that anything can which activates this region (i.e. food, drink, sex, drugs etc). The important point here is that this brain reward centre becomes active in anticipation of reward in a gambling situation so it is not dependent upon whether the reward is actually obtained. Another key observation is that the higher the anticipated monetary reward, even if also associated with potential big losses, the more strongly activated is this region (Kuhnen & Knutson, 2005).

The key neurotransmitter associated with reward is dop ami ne and studies have also shown that this is released within the nucleus accumbens in proportion to the uncertainty of an anticipated reward (Zald et al. 2004). As with other addictions it has been shown that pathological gamblers display a progressive reduction in the ability of anticipated rewards to activate the accumbens and presumably dop ami ne release (i.e. they need to go for larger and larger rewards and uncertainty of winning them in order to obtain the same amount of pleasure).

If the link between dopamine and gambling is truly causative, then one would predict that dopamine agonist drugs might elicit pathological gambling behaviour in individuals that had shown no such problems before. Recent reports on patients with Parkinson's disease, which is treated with dopamine agonist drugs, have shown that some individuals in the latter stages of the disease, where very high levels of these drugs need to be administered to control symptoms, have developed pathological gambling tendencies. However, it should be emphasised that this has only been reported in a small number of patients (see Driver-Dunkley et al. 2003).

Another class of rewarding substances released within the brain, and which is associated with gambling, are the endogenous opiates (the brain's natural morphine). While it is difficult to target dop ami nergic systems in the brain for therapeutic purposes because of its key importance in locomotor control, this is less of a problem with the opioids. For this reason one of the most commonly used drugs to treat pathological gambling is the opioid antagonist, naltrexone. Treatment with this reduces the anticipatory buzz that gamblers experience and in combination with counselling can produce positive outcomes. However, it does have peripheral side effects and it is therefore of great interest that another drug "Nalmefene" may soon be on the market which has the same action on opioid receptors but without these side effects.

In contrast to reward centres, the inhibitory control centre in the medial prefrontal cortex which is important for regulating impulsive behaviour, and which is closely linked with the nucleus accumbens, only alters its activity in response to reward outcome. So if the reward achieved matches expectation then the medial prefrontal cortex is activated, however if the gamble fails then it shows reduced activity (Knutson et al. 2003). One might argue that the consequence of losing a gamble when you were positively motivated to take the risk in the first place may make it more likely that you will take the gamble again. This is because there is less control over the centres evoking the pleasure you get in anticipation of being successful in achieving a positive outcome with your next gamble.

It turns out that pathological gamblers along with alcoholics, highly aggressive individuals and people experiencing clinical anxiety, obsessive compulsive disorder and depression all tend to have reduced activity in parts of the frontal cortex and this is generally associated with decreased levels of a key neurotransmitter in this region, serotonin. This is why the ubiquitous serotonin selective re-uptake inhibitors (SSRIs) which act to boost levels of available serotonin in this region are often used as part of the treatment for some of these conditions, including pathological gambling. Indeed, pathological gambling often has comorbidity with bipolar disorder, obsessive compulsive disorder and attention deficit disorder.

It is important to emphasise though that the prefrontal cortex is also critical for decision making along with the cingulate cortex. Indeed, it appears to be able to compute good and bad outcomes within around 250ms (Knutson et al, 2003). So impairment in its functioning doe not only reduce control over impulsive behaviour but also can reduce your capacity for accurately assessing reward outcomes – for the pathological gambler this is a double whammy, you are more likely to gamble and your judgement of the odds is also impaired. In this respect it is interesting that a recent study has shown that this brain region is particularly susceptible to ageing and that older (56-85 years) individuals were significantly impaired in making judgements on gambling tasks compared with younger ones (26-55 years) (Denberg, Tranel & Bechara, 2005). Luckily the motivation to gamble reduces with age but the authors of the study point out that their findings might have societal implications with older individuals being easier to con by fraudulent salesmen or advertising.

What makes people risk averse?

It seems that when people who do not show negative emotion in anticipation of risk taking behaviour show increased activation in the insular cortex which is also associated with pain and anxiety (Kuhnen & Knutson, 2005). They also show a correspondingly smaller activation of the dopamine reward centres. So presumably anxiety induced changes in inhibitory control centres had completely wiped out any positive feeling of excitement that is associated with the risk taking behaviour.

The risky teenager

It is increasingly recognised that people in their teens are greater risk takers than older adults and as such are highly vulnerable to potentially dangerous pursuits such as drug taking, criminal activities, unprotected sex and high risk sporting or other activities. Research has provided good evidence that teenagers both have less developed control and risk assessment decision making because their frontal cortex is still undergoing development. They also have a low boredom threshold since it appears that potentially rewarding activities, including gambling, do not cause as great an activation of the dopaminergic pleasure centres of their brain as in older adults.

The risks of the most magnificent obsession

While one might not immediately consider the search for love a prime example of risk taking it is actually the highest risk social activity we and other species engage in. For those of you who may remember back to my lectures on different aspects of the mating game I have tried to make this point before. The highest risk is of course for females who, if they get pregnant by a less than perfect male, are saddled with the consequences for some considerable time whereas their male partner has much more opportunity to correct a similar error. For this reason females tend to carry out a much more extensive risk evaluation of a prospective mate in that they take into account far more attributes when assessing attraction than do males (see my lecture “Addicted to love, beauty or sex?” 14/2/05). Females actually find risk-taking males more sexually attractive than risk-averse ones, and it is not surprising therefore that males will often adopt “look at me” strategies to attract women when performing dangerous activities. Mutual risk taking (roller-coaster rides etc) is one of the biggest turn ons for prospective couples as well. So the mating game is actually helping to promote risk-taking genes!

An interesting recent observation associated with the large increase in the use of the internet for dating is that the perceived risk that meeting your prospective partner “offline” will not be the same as “online” is very high. Of course we are all well aware of how well people can misrepresent their attributes when contact is indirect, but we also know that there needs to be a kind of physical chemistry and that usually requires individuals to meet up. Indeed, that is very much one of the key principles in the “speed dating”

approach – 3 minutes may be all it takes to decide!

Even having sex is a risky business because while partners are engaged in this they are highly vulnerable to attack by predators. This may explain why animal species that live in the trees, and therefore have a relatively low risk of attack, generally take much longer over having sex than those on the ground which are exposed to a much higher risk.

Helen Fisher's group in New York has recently reported a brain imaging study where individuals looked at pictures of individuals who had rejected their romantic interest. The results showed changes in activity in the nucleus accumbens/ventral putamen/pallidum, lateral orbitofrontal cortex, and anterior insular/operculum cortex (Fisher et al 2005). They had much stronger activation in the ventral striatum/putamen/pallidum than did individuals who were happily-in-love (Aron et al 2005). As I have already discussed, other studies have shown that the nucleus accumbens/ventral pallidum/putamen region becomes more active as an individual chooses a high-risk investment associated with big gains or big losses, making it an uncertain gain (Kuhnen & Knutson 2005), or anticipates a money reward (Knutson et al 2001; Zald et al 2004). Even studies on rats suggest that the nucleus accumbens is important for choices of uncertain rewards and delayed reinforcement. Activity in this region is also associated with pairbond formation in animals. The region of the anterior insula/operculum cortex has been associated with skin and muscle pain and with anxiety. The lateral orbitofrontal cortex has been associated evaluating punishment and obsessive/compulsive behaviors. So overall, failure to attract a romantic partner is very similar to risk-taking for big monetary gains or losses and an individual showing obsessive/compulsive behaviors as well as causing pain and anxiety. So perhaps losing in love has more in common with losing on the stock exchange than you might perhaps have thought.

The importance of trust

Something that is often overlooked in terms of the propensity to take risks is "trust". In financial terms of course it is important to have trust in the organisations in which you invest. However, often financial risks are based on a more personal recommendation that is influenced by the degree of social trust. A recent paper has reported that the same peptide that promotes bonds between sexual partners and mothers and their offspring, "oxytocin" may also be involved in promoting trust between individuals. Administering this peptide to humans via a nasal spray so that it could influence the brain increased the proportion of individuals in the study willing to invest maximally in a personally recommended scheme from 21 to 45% (Kosfeld et al. 2005). So in future when being interviewed by someone trying to convince you to invest in some enterprise beware of nasal sprays and consider using nose plugs!

Genes and risk

Despite the fact that there are claims of a high genetic contribution to novelty seeking, impulsivity and risk taking, there are still relatively few gene candidates identified which show a strong association (see Kreek et al, 2005). For risk taking the strongest candidate has been one of the dopamine receptors, the D4 receptor, where high risk takers tend to have a longer version of this gene than low ones, although not all studies have confirmed this. There have been similar associations claimed for another dopamine receptor, the D3 receptor. Indeed, this is the receptor targeted by the drugs used to treat Parkinson's disease patients who developed pathological gambling problems. Impulsive behaviour has been linked with more genes including the serotonin transporter and a gene important for metabolizing all monoamines (monoamine oxidase A) which could be contributing to reduced concentrations of serotonin, noradrenaline and dopamine in the frontal cortex and elsewhere. Both these genes, as well as many others, are also linked to addiction. The D4 receptor is also associated with impulsivity and addiction.

Thankfully perhaps, there are so far insufficient gene markers to accurately predict the likelihood of potential pathological gambling, compulsive and high risk taking behaviours so at present potential employers and insurance companies are unlikely to benefit from asking you to take a DNA test. However, it is probably only a matter of time if the genetic contributions to these behaviour traits are indeed as much as 60%.

Insurance risks and bringing down the bank

When Nick Leeson's speculative trading activities brought down Baring's Bank after he had systematically run up a debt of £827 million over around 3 years, it sent shock waves through many financial organisations. In the same way that the armed forces tend to recruit people with high sensation-seeking, risk taking personalities so do financial organisations involved in the business of "speculate to accumulate". The rewards for such individuals financially are often substantial as is the buzz that their work activities and fast lane lifestyles usually bring. However, just as soldiers can easily overstep the mark so can financial traders. This can be because of the perception of punishment that might occur as a result of risk taking becoming progressively diminished. Alternatively it can be that the need to maintain a particular lifestyle is so important that it is worth taking even greater risks to maintain it. There simply is no way out of this for financial institutions other than to put in place appropriate safeguards and to perhaps put less pressure on their staff. It is not surprising that many large financial institutions have risk mangers to try to set formal rules as to what level of risk their organisation considers acceptable.

The Insurance industry has also taken note of research suggesting that there may be a risk-taking personality trait. Some seem to operate a principle whereby an individual is considered to be high risk on all forms of insurance after showing evidence for risk-taking in a single context. So if you prang your car it could sometimes make it more difficult to perhaps insure your house contents or for travel!

Some conclusions

Risk taking is essential for survival Our ancestors were big risk takers We like novelty Taking risks can give pleasure And activate the same brain areas as cocaine Control centres regulate impulsivity And compute risk and likely reward outcome Risk taking may be a personality trait Risk aversion activates anxiety promoting regions Pathological gambling involves reduced control .. and altered dopamine and serotonin activity. The mating game also involves high risks Teenagers take more risks Old age impairs judgement of risk Don't trust a salesman with an oxytocin spray Or an employee with a long D4 receptor gene ….unless in the business of speculation but…. Keep taking risks if you want to make something of your life

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