Why do we gamble and take needless risks?

Professor Keith Kendrick
All species need to take risks in order to survive.
Why take risks?

All species need to take risks in order to survive

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

Seneca
Why take risks?

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"Only those who risk going too far can possibly find out how far they can go"

T.S. Elliot
Why take risks?

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Seneca

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T.S. Elliot

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

James Bryant Conant
Why take risks?

80% of us gamble for financial gain
Why take risks?

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In the US 1.6% of population are pathological gamblers
Why take risks?

80% of us gamble for financial gain

In the US 1.6% of population are pathological gamblers

3 of every 30 children will be harmed by gambling addiction
Why take risks?

80% of us gamble for financial gain

In the US 1.6% of population are pathological gamblers

Gamblers contribute to nearly 20% of suicides
What is risk?

Conscious perception of the chance that something could happen to us which is both unwanted and represents a potential loss.
What is risk?

Conscious perception of the chance that something could happen to us which is both unwanted and represents a potential loss.

Some would add it also involves the perception that there is a possible gain.
What does taking a risk feel like?

Fear regions of the brain are activated
What does taking a risk feel like?

Heart begins to beat wildly (up to 3 times faster)
What does taking a risk feel like?

Blood pressure increases
What does taking a risk feel like?

Mouth becomes uncomfortably dry
What does taking a risk feel like?

Feel irresistible urge to avoid what is about to happen
What does taking a risk feel like?

Feel fear and possibly elation
What does taking a risk feel like?

Your body pumps out adrenalin, noradrenalin and growth hormone
What does taking a risk feel like?

Brain releases corticotrophin-releasing hormone
What does taking a risk feel like?

Pituitary releases adrenocorticotropin
What does taking a risk feel like?

Adrenal glands produce cortisol
What does taking a risk feel like?

Your blood is diverted to your muscles
What does taking a risk feel like?

You feel butterflies in your stomach and perhaps nausea
What does taking a risk feel like?

Your pupils dilate allowing you to detect movement better
What does taking a risk feel like?

Your immune system fires up in preparation for injury.
What does taking a risk feel like?

...and you jump shouting with elation...
What does taking a risk feel like?

...and you jump shouting with elation...

...or you don’t, and feel anxious and sick
What does taking a risk feel like?

So why do we put ourselves through this at all?

The biology of risk is similar to that for stress, anxiety and fear

The difference is that we choose to do it
What does taking a risk feel like?

We can find it both novel and enjoyable...

...or at least many of us do!
Our ancestors were big risk takers
The evolution of risk taking

Our ancestors were big risk takers

Hunting had to become a thrill
The evolution of risk taking

Our ancestors were big risk takers

Hunting had to become a thrill

Exploration essential
The evolution of risk taking

Our ancestors were big risk takers

Hunting had to become a thrill

Exploration essential

Ability to dominate by waging war
The evolution of risk taking

Humans are greatest risk takers on the planet
The evolution of risk taking

There has to be a strong genetic basis
The evolution of risk taking

There has to be a strong genetic basis

When life has no risks we create them
The evolution of risk taking

There has to be a strong genetic basis

When life has no risks we create them
The evolution of risk taking

We are experts are cost-benefit analysis
The evolution of risk taking

We are experts are cost-benefit analysis

We are motivated to seek novelty and take risks
The evolution of risk taking

We are experts are cost-benefit analysis

We are motivated to seek novelty and take risks

But this can lead to addiction
The evolution of risk taking

Risk taking is to help obtain knowledge
The evolution of risk taking

Risk taking is to help obtain knowledge

Our brains respond best to novelty
The evolution of risk taking

Risk taking is to help obtain knowledge

Our brains respond best to novelty

It motivates us by giving pleasure
The evolution of risk taking

The Coolidge effect
Revealing the controlling brain:

The case of Phineas Gage:
Revealing the controlling brain:

The case of Phineas Gage:

On 13th September 1848 an accident advanced Neuroscience

John Martyn Harlow, MD
1819-1907
Revealing the controlling brain:

The case of Phineas Gage:

On 13th September 1848 an accident advanced Neuroscience

Phineas was 'no longer' Gage!
Revealing the controlling brain:

The frontal cortex controls impulsive behaviour and aids decision making.
Playing for high stakes

How does an occasional flutter turn into pathological gambling?
Playing for high stakes

How does an occasional flutter turn into pathological gambling?

“Well someone’s got to win so why not me?”
Playing for high stakes

How does an occasional flutter turn into pathological gambling?

“Well someone’s got to win so why not me?”

We are willing to accept incredible odds...
Playing for high stakes

How does an occasional flutter turn into pathological gambling?

“Well someone’s got to win so why not me?”

We are willing to accept incredible odds...

...but not when losing is punitive
Playing for high stakes

Pathological gamblers see only winning
Playing for high stakes

We and monkeys prefer to risk for big gains
(McCoy and Platt, 2005)
Playing for high stakes

We and monkeys prefer to risk for big gains
(McCoy and Platt, 2005)

Greater anticipation and excitement
Playing for high stakes

We and monkeys prefer to risk for big gains
(McCoy and Platt, 2005)

Greater anticipation and excitement

More, smaller prizes in the lottery would not work
The concept of personality traits dates back to the Greeks

Galen
The concept of personality traits dates back to the Greeks

Hans Eysenck

Extraversion vs. introversion

Emotional stability vs. neuroticism

Psychoticism vs. humaneness
Risk taking as a personality trait

Costa and McCrae

Openness to experience

Agreeableness

Conscientiousness
Risk taking as a personality trait

These traits are 30-50% genetically determined
Risk taking as a personality trait

Risk-taking (or sensation-seeking) personality

Pursuit of novel, intense and complex sensations and experiences and the willingness to take risks for the sake of such experience

“Risk taking is not the main point of sensation seeking behaviour but the price you pay for engaging in activities that satisfy the need for novelty, change and excitement”

Zuckerman
Risk taking as a personality trait

Not everything sensation-seekers do is risky
Risk taking as a personality trait

There are four sub-divisions:

Sensation-seeking in extreme physical sports (thrill and adventure)
Risk taking as a personality trait

There are four sub-divisions:

Sensation-seeking in extreme physical sports (thrill and adventure)

Casting off inhibitions in a social setting (disinhibition)
Risk taking as a personality trait

There are four sub-divisions:

Sensation-seeking in extreme physical sports (thrill and adventure)

Casting off inhibitions in a social setting (disinhibition)

Deviant lifestyles (experience-seeking)
Risk taking as a personality trait

There are four sub-divisions:

Sensation-seeking in extreme physical sports (thrill and adventure)

Casting off inhibitions in a social setting (disinhibition)

Deviant lifestyles (experience-seeking)

Pursuit of change for change’s sake (boredom susceptibility)
Risk taking as a personality trait

How are these related to six high-risk activities?

Smoking
Risk taking as a personality trait

How are these related to six high-risk activities?

Smoking

Drinking alcohol
Risk taking as a personality trait

How are these related to six high-risk activities?

Smoking

Drinking alcohol

Taking drugs of abuse
Risk taking as a personality trait

How are these related to six high-risk activities?

Smoking

Drinking alcohol

Taking drugs of abuse

Having unsafe sex
Risk taking as a personality trait

How are these related to six high-risk activities?

Smoking

Drinking alcohol

Taking drugs of abuse

Having unsafe sex

Reckless driving
Risk taking as a personality trait

How are these related to six high-risk activities?

Smoking
Drinking alcohol
Taking drugs of abuse
Having unsafe sex
Reckless driving
Gambling
Risk taking as a personality trait

Zuckerman-Kuhlman Personality Questionnaire (ZKPQ)

High degree of concordance - smoking, drinking, sex and drugs (and rock and roll!)

Reckless driving is only related to drinking!

For men gambling is related to drinking and sex

In women gambling is not related to any other form of risk-taking
Risk taking as a personality trait

People who take risks score high on impulsive sensation-seeking, aggression hostility and sociability personality traits
Risk taking as a personality trait

People who take risks score high on impulsive sensation-seeking, aggression hostility and sociability personality traits.

There is no relationship to neuroticism/anxiety.
Risk taking as a personality trait

Men are higher risk takers than women due to impulsive sensation-seeking
Risk taking as a personality trait

Men are higher risk takers than women due to impulsive sensation-seeking

Risk taking personality has a 60% genetic contribution
Risk taking as a personality trait

Men are higher risk takers than women due to impulsive sensation-seeking.

Risk taking personality has a 60% genetic contribution.

40% experience is due mainly to factors outside the family environment.
Male and female gamblers - the differences

Men prefer fast action and competitive games with strategic skill
Male and female gamblers - the differences

Men prefer fast action and competitive games with strategic skill

Beating other players is very important
Male and female gamblers - the differences

Men prefer fast action and competitive games with strategic skill

Beating other players is very important

With young men it is more about self-esteem and recognition than money
Male and female gamblers - the differences

Women prioritise gambling in social situations...
Male and female gamblers - the differences

Women prioritise gambling in social situations...

...and don’t tend to boast about their winnings to their fellow gamblers
How do we assess risk?

The somatic marker hypothesis

The Iowa Gambling Task and the somatic marker hypothesis: some questions and answers

A. Bechara, H. Damasio, D. Tranel and A.R. Damasio

Department of Neurology (Division of Cognitive Neuroscience), University of Iowa College of Medicine, Iowa, USA
How do we assess risk?

The somatic marker hypothesis

The body’s response to the stress, anxiety of risk provides an automatic feedback

Antonio Damasio, University of Iowa

The Iowa Gambling Task

<table>
<thead>
<tr>
<th></th>
<th>“Bad” decks</th>
<th>“Good” decks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$100</td>
<td>$50</td>
</tr>
<tr>
<td>B</td>
<td>$100</td>
<td>$50</td>
</tr>
<tr>
<td>C</td>
<td>$1250</td>
<td>$250</td>
</tr>
<tr>
<td>D</td>
<td>$1250</td>
<td>$250</td>
</tr>
</tbody>
</table>

Gain per card: $100, $100, $50, $50
Loss per 10 cards: $1250, $1250, $250, $250
Net per 10 cards: $-250, $-250, $+250, $+250

TRENDS in Cognitive Sciences
How do we assess risk?

The somatic marker hypothesis

The brain’s cognitive centres may compute risk independently
Maia & McClelland, 2005

The somatic marker hypothesis: still many questions but no answers
Response to Bechara et al.

Tiago V. Maia¹ and James L. McClelland¹,²

¹Department of Psychology, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, Pennsylvania 15213, USA
²Center for the Neural Basis of Cognition, Carnegie Mellon University, 115 Mellon Institute, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213, USA
An 'Oops' centre in the brain?

Cingulate cortex networks learn to predict mistakes accurately
Brown & Braver, 2005
An 'Oops' centre in the brain?

Cingulate cortex networks learn to predict mistakes accurately
Brown & Braver, 2005

Also compute the level of risk in gambling tasks
McCoy & Platt, 2005
Why can this go wrong?
Emotional control and computing reward

Why can this go wrong?

Gambling with positive anticipation activates brain reward centres

Kuhnen et al 2005
Emotional control and computing reward

The higher the anticipated reward the greater the activation

Knutson et al 2003
Emotional control and computing reward

The higher the anticipated reward the greater the activation

Dopamine is released at this time

Zald et al 2004
Emotional control and computing reward

The higher the anticipated reward the greater the activation

Dopamine is released at this time

Same region as for a cocaine addict!
Emotional control and computing reward

Gambling can become an addiction

A CHART OF COMPULSIVE GAMBLING AND RECOVERY
Emotional control and computing reward

Risk aversion activates anxiety brain regions
Emotional control and computing reward

Treatment with dopamine agonists can cause pathological gambling
Emotional control and computing reward

Treatment with dopamine agonists can cause pathological gambling

Brain opiates also involved in reward:

Naltrexone

Nalmefene
The frontal cortex

The medial prefrontal cortex is activated when reward outcome matches expectation

If the gamble fails there is reduced activation

So failure helps promote another attempt

Knutson et al 2003
The frontal cortex

There is reduced frontal cortex activity in...
The frontal cortex

There is reduced frontal cortex activity in...

Pathological gamblers
The frontal cortex

There is reduced frontal cortex activity in...

Pathological gamblers

Alcoholics
The frontal cortex

There is reduced frontal cortex activity in...

Pathological gamblers

Alcoholics

People with:

High aggression
Clinical anxiety
ADD
OCD
Depression
The frontal cortex

Decreased levels of serotonin
The frontal cortex

Frontal cortex also computes good and bad outcomes in 250ms

Gehring et al 2002
The frontal cortex

Frontal cortex also computes good and bad outcomes in 250ms

So reduced activity means high impulsivity and poor judgement
The frontal cortex

Frontal cortex also computes good and bad outcomes in 250ms

So reduced activity means high impulsivity and poor judgement

Frontal cortex function is impaired during normal ageing

Denberg, Tranel & Bechara 2005
The frontal cortex

Frontal cortex also computes good and bad outcomes in 250ms

So reduced activity means high impulsivity and poor judgement

Frontal cortex function is impaired during normal ageing

Denberg, Tranel & Bechara 2005

Although motivation to gamble declines with age
The risky teenager

Teenagers are greater risk takers than older adults

Have less developed control and risk assessment in frontal cortex
The risky teenager

Smaller response in brain dopaminergic pleasure centres
The risks of the most magnificent obsession

The mating game is highest risk social activity we engage in
The risks of the most magnificent obsession

The mating game is highest risk social activity we engage in

Females have to chose the right male...
The risks of the most magnificent obsession

The mating game is highest risk social activity we engage in

Females have to chose the right male...

...and find risk-taking in males sexually attractive
The risks of the most magnificent obsession

Taking risks together is a big turn-on
Internet dating – meeting 'offline' is a higher risk than 'online'

**gimli55:** there's this girl in trig that I really like...

**hesdeadjim42:** so r u going to ask her out?

**gimli55:** no. but i made a Sim that looks EXACTLY like her...
The risks of the most magnificent obsession

So the mating game actually helps promote risk-taking genes!
Having sex is a big risk...

RISKY SEX

- fun sex?
- great sex?
- lots of sex?

DANGEROUS SEX!
The risks of the most magnificent obsession

Having sex is a big risk...

...which may be why men are so quick!

41 Mistakes Men Make in Bed

"New Resource Reveals The Common Mistakes Men Make in Bed"

Frustrated Men Only-Potent information for your sexual life with your mate. This e-book reveals some of the secrets in meeting, dating and becoming intimate with gorgeous women.
The risks of the most magnificent obsession

But species that live in trees take their time!
The risks of the most magnificent obsession

But species that live in trees take their time!

![Image](image_url)

**Intromission time**

- Arboreal
- Terrestrial

![Bar chart](chart_url)
The risks of the most magnificent obsession

Being rejected in love is like gambling for big gains or losses

Helen Fisher
The risks of the most magnificent obsession

Being rejected in love is like gambling for big gains or losses

So losing in love is like taking a hit on the stock market!
The importance of trust

You will risk more if you trust someone
The importance of trust

You will risk more if you trust someone

So spray oxytocin up a potential investor’s nose!
Kosfeld et al
Genes and risk

Dopamine D4 and D3 receptor

[Diagram of dopamine receptor with labels: dopamine receptor, amino (N) terminal, synaptic cleft, post-synaptic membrane, carboxyl (C) terminal, cytoplasm, G-protein, β, α]
Genes and risk

Serotonin transporter and monoamine oxidase A
Genes and risk

Not enough genes identified yet for DNA profiling!
Genes and risk

Not enough genes identified yet for DNA profiling!

However if the trait is 60% genetic...
Genes and risk

Not enough genes identified yet for DNA profiling!

However if the trait is 60% genetic...

...it's only a matter of time
Insurance risks and bringing down the bank

Nick Leeson ran up a debt of £827 million over around 3 years
Insurance risks and bringing down the bank

'Speculate to accumulate' system rewards risk-takers
Insurance risks and bringing down the bank

'Speculate to accumulate' system rewards risk-takers

Most organisations have senior risk managers
'Speculate to accumulate' system rewards risk-takers

Most organisations have senior risk managers

Insurance companies conclude that high risk in one area means high risk in all

"We've considered every potential risk except the risks of avoiding all risks."
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
Conclusions

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
Conclusions

Teenagers take more risks

Old age impairs judgement of risk

The mating game also involves high risks

Don’t trust a salesman with an oxytocin spray...

...or an employee with a long D4 receptor gene...

...unless in the business of speculation
Conclusions

Keep taking risks if you want to make something of your life

But...
Conclusions

...remember that some risks may not be worth it!

BBC Sport

England's odds lengthen

Beckham's injury is a major blow for England
British bookmakers William Hill have lengthened the odds on England winning the World Cup in the wake of David Beckham's injury.