“You’ll learn so much, and laugh along the way”
Review by Tibi Puiu, from ZME Science, November 25, 2015

Psychology Book of The Month
website All About Psychology, January 2016

E-Book of The Month
Stanford University Falconer Biology Library, April 2016
The Biased Mind

Michel De Lara
Cermics, École des Ponts ParisTech, France
(with Jérôme Boutang, CITEPA director, France)

Séminaire économie et environnement du CGDD, Paris, 25 janvier 2018
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection

How to frame messages for better communication

More on the biased mind
Why is the point-down red triangle the most powerful warning sign?
Why is the point-down red triangle the most powerful warning sign?

- **Point down** evokes unstability due to gravity
- **Cutting edges** embody the etymology of the word **risk**
- **Red color** triggers attention and **alert**
Shapes can convey instability and risk

The point-down triangle is the most preferred warning shape, followed by the diamond and then the octogon.

Shapes that appear unstable are preferred as warnings, striking our bodily sensitivity to Earth’s gravity.

[Lesch, Rau, Zhao, and Liu, 2009]
The etymology of risk provides enlightening insight

Likely etymology: Greek navigation term *rhizikon, rhiza*

Latin *resicum, risicum, riscus*: cliff, récif

“What cuts”, reef, danger for sailors

Risk is related to the uncertainty attached to the first sea travels carrying merchandise and to insurance (average comes from *avaria*)
Colors propel risk perception to various degrees

- **Red** is perceived to be more hazardous or urgent than other colors.

- Black, red and orange are the “top three” colors associated with hazards both in China and in the USA.
Red lies at the end of the visible spectrum

In *The Adapted Mind*, [Barkow, Cosmides, and Tooby, 1992] Roger N. Shepard recalls that

the overall (400 to 700 nm) range of spectral sensitivity of the human eye has long been regarded as an evolutionary accommodation to the range of solar wavelengths that reach us through the earth’s atmosphere

(...) most languages have terms that native speakers apply to colors in the very same regions of color space for which we use the words red and green
Red sunset triggered vigilance at the coming of darkness

As red marks the sunset and the coming of darkness, the color red certainly triggered attentiveness.

With poor nocturnal vision, humans had to look for a safe place for the night to shelter from predators.

This might be one of the reasons for which red is the color that most evokes risk.
Where do we stand? And what comes next?

- The warning sign example illustrates how our perceptions of risk are largely shaped by how we had to assess potential dangers in the wild:
  - setting sun reddening alert
  - cutting fang of dangerous animals (snakes)

- We display innate dispositions and biases, and the better we know them, the better we can design efficient warning signs and, more generally, the better we can communicate
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection

How to frame messages for better communication

More on the biased mind
As appetizers, here is handful of human biases

- Children fear more snakes, lions, and tigers than electric socket or cars, and have innate preferences for savanna-type landscape.
- Sounds with increasing intensity seem closer.
- Sex differences in mating attitudes:
  - Men overperceive women neutral signals as sexual advances.
  - Women are choosy.
- We crave for sugar (and their derivatives, like alcohol). Why? . . . Because vegetals manipulated animals to eat their (colored, sweet, savory) fruits and to disperse their seeds by defecation.
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection

How to frame messages for better communication

More on the biased mind
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
    Are we prisoners in time? The adapted mind
    Our mind holds a myriad of problem-solving modules
    Our mind holds old age departments
    Our mind devices are tuned like a fire-detector
    We look after clues in our environment

How to frame messages for better communication
    It pays to frame problems as social contracts issues
    Use our aversion to losses to frame messages
    Communicating proportions and probabilities
    Metaphorical framing. Visual framing

More on the biased mind
    Tips to make sound decisions. Experts
    Immoral risks outrage individuals
    Miscellaneous
At fifteen, I became an evolutionist, and it all became clear

We came from mud
And after 3.8 billion years of evolution,
at our core is still mud
Nobody can be a divorce lawyer and doubt that

Gavin (Danny DeVito)
in The War of the Roses
(movie, 1989)
A little story illuminating how evolution proceeds by natural selection

Two little dinosaurs are running as fast as they can, chased by a large T. Rex

They are both exhausted and one says to the other: “Why bother running fast? We are stupid, it’s hopeless, there’s no way we can outrun a T. Rex”

The other answers: “I’m not trying to run faster than the T. Rex, I’m trying to run faster than you!”
We share the same brain as our close ancestor who painted in the caves.

Pech Merle cave paintings

200,000 years of Superior Paleolithic have shaped our brain.

Hence, as the biologist George C. Williams said:

"Is it not reasonable to anticipate that our understanding of the human mind would be aided greatly by knowing the purpose for which it was designed?"

For instance, our ancestors had to avoid predators.
Psychologist Adah Maurer’s study of Chicago children fears
almost all the 5- and 6-year-olds schoolchildren mentioned wild animals (most frequently snakes, lions, and tigers) in response to the question “What are the things to be afraid of?”
“they do not ( . . . ) fear the things they have been taught to be careful about”, say electric socket or cars.
Evolutionary psychologists Cosmides and Tooby put forward the “multimodular mind” hypothesis

Avoiding predators was one among many problems that our ancestors had to solve, like searching for a mate, looking for food, etc.

There can be no general problem-solving device, because there is no such thing as a general problem

Hence, as our body is made of different functional parts, our mind hosts a bunch of problem-solving devices

[Barkow, Cosmides, and Tooby, 1992]
Outline of the presentation

Warming up with warning signs

**Our mind is the product of natural selection**
- Are we prisoners in time? The adapted mind
- **Our mind holds a myriad of problem-solving modules**
- Our mind holds old age departments
- Our mind devices are tuned like a fire-detector
- We look after clues in our environment

**How to frame messages for better communication**
- It pays to frame problems as social contracts issues
- Use our aversion to losses to frame messages
- Communicating proportions and probabilities
- Metaphorical framing. Visual framing

**More on the biased mind**
- Tips to make sound decisions. Experts
- Immoral risks outrage individuals
- Miscellaneous
The mind as a Swiss army knife

Gerd Gigerenzer compares the mind to
- an adaptive toolbox of heuristics
- a Swiss army knife
We often observe clashes between our mental devices

*When People Behave Against Their Better Judgment*
Veronika Denes-Raj and Seymour Epstein (1994)
Which of both “urns” would you choose if I offer you 1$ if you draw a red “bean”? 

1 out of 10  

8 out of 100
The larger bowl “looked more inviting”

When offered a chance to win $1 by drawing a red jelly bean from a transparent plastic bowl

- 54% of the subjects preferred 9 red beans among 100 than 1 red bean among 10
- 34% of the subjects preferred 5 red beans among 100 than 1 red bean among 10

"they felt they had a better chance when there were more red beans"

[Denes-Raj and Epstein, 1994]
Subjects reported that...

Subjects commonly commented that in spite of the stated odds, they felt that they had a better chance of winning by picking from the bowl with the more winning (red) beans. "I picked the ones with the more red jelly beans because it looked like there were more ways to get a winner, even though I knew there were also more whites, and that the percents were against me."

A few acknowledged that, despite knowing this, the large bowl looked more inviting, and they had to fight the temptation to make nonoptimal choices.

People commonly report a conflict between two beliefs, one that they identify as rational or objective, and that reflects their understanding of objective probabilities, and another that they identify as irrational (about which they are often apologetic), but which most find more compelling.
Do we have multiple selves?
A Ulysses pact is a pact between two selves

- Dumbeldore begging Harry Potter to have him drink a malefic liquid
- In 2011, the US Congress trying to find means to force itself to commit to reducing State spendings
- Who is sovereign, the self who sets the alarm clock to rise early, or the self who shuts it to the next morning and goes back to sleep? [Loewenstein and Thaler, 1989]
Here are examples of our mental devices
What do you see?
We have mental organs as we have body organs

body
- lungs
- heart
- immune system
- members
- eyes

mind
- face recognition
- mate searching
- food searching
- predator avoidance
- cheater detection

Modules: specialized circuits, dedicated mini-computers, Darwinian algorithms, mind gadgets, apps
Our mind holds hundreds or thousands of specialized cognitive adaptations.

*Evolutionary Psychology: The New Science of the Mind*

David Buss [Buss, 2014]

How have our mental organs been shaped by natural selection?
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
  Are we prisoners in time? The adapted mind
  Our mind holds a myriad of problem-solving modules
  Our mind holds old age departments
  Our mind devices are tuned like a fire-detector
  We look after clues in our environment

How to frame messages for better communication
  It pays to frame problems as social contracts issues
  Use our aversion to losses to frame messages
  Communicating proportions and probabilities
  Metaphorical framing. Visual framing

More on the biased mind
  Tips to make sound decisions. Experts
  Immoral risks outrage individuals
  Miscellaneous
Our mind houses natural mental categories

“Three phases for the evolution of the mind” [Mithen, 1998, p.69]

1. general intelligence
2. specialized isolated modules regrouped in departments
   ▶ general intelligence
   ▶ technical intelligence
   ▶ natural history intelligence
   ▶ social intelligence
   ▶ language
3. cognitive fluidity, team of modules
Our mind holds hard-wired categories
Here are natural ontological categories

ontological categories [Boyer, 2001, p.115]

animal
artefact
person
plant
natural object
number
### Categories trigger hard wired inference engines

<table>
<thead>
<tr>
<th>Category</th>
<th>Inference engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>inert object (artefact, natural object)</td>
<td>intuitive physics</td>
</tr>
<tr>
<td>mobile living object (animal, person)</td>
<td>intuitive psychology, intentional stance (agent)</td>
</tr>
<tr>
<td></td>
<td>goal detection</td>
</tr>
<tr>
<td>artefact</td>
<td>function detection, use mode</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mixed category</th>
<th>Inference engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>body parts</td>
<td>structure-function system</td>
</tr>
<tr>
<td>corpses, rotten</td>
<td>contagion</td>
</tr>
</tbody>
</table>
Hard wired social inference engines make cooperation and social life possible

<table>
<thead>
<tr>
<th>Inference engine</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>cheater detection</td>
<td>makes cooperation possible without free-riders</td>
</tr>
<tr>
<td>emotional system</td>
<td>prioritizing decisions, strategies in the reciprocity game</td>
</tr>
<tr>
<td>moral system</td>
<td></td>
</tr>
<tr>
<td>trading accounting system</td>
<td>keeps track of costs and benefits</td>
</tr>
<tr>
<td>“essence” system</td>
<td>coalition, “groupism”</td>
</tr>
<tr>
<td>intentional agent behind events</td>
<td>from predator avoidance to seeing plots everywhere</td>
</tr>
</tbody>
</table>
Crossing intuitive ontological boundaries

[Boyd, Carroll, and Gottschall, 2010, p.441]

⇒ Supernatural concepts refer to an ontological category, but display features that limitedly violate intuitive expectations
[Boyer, 2001, p.94-95]

⇒ This makes their features more memorable
[Boyer, 2001, p.118]

⇒ Especially when only one violation
[Boyer, 2001, p.127]

Marketing application:
create product names that cross the intuitive boundaries of natural ontological categories, but with only one violation of expectations
Book titles that cross intuitive ontological boundaries

- *The Selfish Gene / Le Gène Egoïste*, Richard Dawkins
- *La Montagne Magique*, Thomas Mann
- *Le Bateau Ivre*, Arthur Rimbaud
Outline of the presentation

Warming up with warning signs

**Our mind is the product of natural selection**
- Are we prisoners in time? The adapted mind
- Our mind holds a myriad of problem-solving modules
- Our mind holds old age departments
  - **Our mind devices are tuned like a fire-detector**
- We look after clues in our environment

How to frame messages for better communication
- It pays to frame problems as social contracts issues
- Use our aversion to losses to frame messages
- Communicating proportions and probabilities
- Metaphorical framing. Visual framing

More on the biased mind
- Tips to make sound decisions. Experts
- Immoral risks outrage individuals
- Miscellaneous
Sounds with increasing intensity seem closer

Auditory looming: sounds with increasing intensity seem closer

Converging evidence suggests that perceivers underestimate the time-to-impact of approaching sounds

Theoretical explanation: anticipating predator approaching

[Neuhoff, 1998]
Fire detectors are biased toward false alarms

<table>
<thead>
<tr>
<th></th>
<th>fire</th>
<th>no fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>alarm (positive P)</td>
<td>true positive (TP)</td>
<td>“false alarm”</td>
</tr>
<tr>
<td>no alarm (negative N)</td>
<td>“miss” false negative (FN)</td>
<td>true negative (TN)</td>
</tr>
</tbody>
</table>

> In hazard detection,
  > true negatives (misses)
  > are often much more costly than
  > false positives (false alarms)

> Hence, hazard detectors are often biased toward false alarms
Errors asymmetrical in costs induce biases

The life-dinner principle
(Richard Dawkins [Dawkins and Krebs, 1979])

“The rabbit runs faster than the fox, because the rabbit is running for his life while the fox is only running for his dinner”
“A healthy dose of paranoia can keep you alive in this business”

Henrietta "Hetty" Lange (portrayed by Linda Hunt)
Operations Manager at NCIS in Los Angeles
(Season 3, Cyber Threat)
The paranoid optimist is tuned like a fire detector

*The paranoid optimist* [Haselton and Nettle, 2006]

- You walk back to your tribe camp after hunting
- You see the grass moving ahead of you
- What to believe?
  - snake?
  - no snake?
- Natural selection favored those *Homo Sapiens* with a bias towards false alarm
Better treat a stick as a snake than the reverse!
The illusion of animacy

Better believe there’s an agent behind an event because missing an agent may be lethal
“Grissom, do you believe in a separate, living evil?”

Crime scene investigator Gil Grissom answers:

“You’re primitive man on the savannah. You see something move out of the corner of your eye. You assume it’s a hyena. You run, you live. If you assume it’s the wind and you’re wrong, you die. We have the genes of the ones who ran. We’re genetically hardwired to believe living forces that we cannot see.”
Religion Explained
The Evolutionary Origins of Religious Thought

"Et l'homme créa les dieux"

Pascal Boyer [Boyer, 2001]
Many differences in relations between men and women also result from reproductive cost asymmetries.
President Coolidge and his wife were touring a farm

While the President was elsewhere, the farmer proudly showed Mrs. Coolidge a rooster that "could copulate with hens all day long, day after day"

Mrs. Coolidge coyly suggested that the farmer tell that to Mr. Coolidge, which he did

The President thought for a moment and then inquired, "With the same hen?"

"No, sir," replied the farmer

"Tell that to Mrs. Coolidge," retorted the President
Men overperceive women neutral signals as sexual advances

[Haselton and Buss, 2000] claim that the documented tendency for men to overestimate women’s sexual intent could be an adaptive bias designed by natural selection.

Men produce millions of sperm, replenished at a rate of roughly 12 million per hour: there is no end to men reproductive success.

Because men’s reproduction is limited primarily by the number of sexual partners to whom they gain sexual access,

A bias that caused men to err on the side of assuming sexual interest would have resulted in fewer missed sexual opportunities, and hence greater offspring number, than unbiased sexual inferences.

Therefore, natural selection should favor sexual overperception in men.
Women are choosy (*comen a la carta*)

- Women’s gestation and breastfeeding is the bottleneck to reproductive success:
  about 400 ovulations, 9 months gestation + breastfeeding (up to 4 years); about 12 children at the maximum, whatever the number of sexual partners

- Imagine a female trying to detect whether a male is willing to make a significant postreproductive investment if she mates with him

- A “false negative” (not mating, though man willing) involves missing out on it, so the opportunity cost is significant

- However, the value of the “false positive” is potentially higher (very costly), because if she mates and then is deserted, she faces the possibility of raising an offspring alone and may have trouble finding another partner in the future

- Hence, women are choosy
Natural selection shaped female and male psychologies in various fields.
Hypothesis: evolutionary origins for a football bias?

football

- male teams
- locate partners and opponents on large distances
- run and move quickly
- collaborate and coordinate by movements
- not much talking

hunting and fighting enemy groups

- male teams
- locate friends and foes on large distances
- run and move quickly
- collaborate and coordinate by movements
- not much talking
  (not to alert prey or enemy)

Empirical facts: males surpass females in throwing abilities, and use directional cues (routes, roads) for orientation

[Baron-Cohen, 2004, p.78-79]
Hypothesis: evolutionary origins for a shopping bias?

shopping
- women go shopping together
- clothes touching
- sensitivity to colors
- talking and information exchange

gathering
- women go gathering together
- fruit and berries touching
- sensitivity to colors (fruit maturity)
- relative location of fruit and berries

Empirical facts: females surpass males in remembering the relative location of objects, and use specific landmark cues (signposts) for orientation
[Baron-Cohen, 2004, p.78-79]
Sex differences

ike Sex differences in mating attitudes
  ▶ Men overperceive women neutral signals as sexual advances
  ▶ Women are choosy

ike Sex differences in spatial abilities
  ▶ Females surpass males in recollection of objects
  ▶ Males are better at wayfinding

ike Sex differences in colours perception
  ▶ Men see the world in the standard three basic colours: red, blue, green
  ▶ About one third of women see the world in four basic colours: red, blue, green + extra shade of green or red
    correlated to the amount of bare facial skin in primates? [Dunbar, 2010, p.17-18]
Outline of the presentation

Warming up with warning signs

**Our mind is the product of natural selection**
- Are we prisoners in time? The adapted mind
- Our mind holds a myriad of problem-solving modules
- Our mind holds old age departments
- Our mind devices are tuned like a fire-detector
- **We look after clues in our environment**

How to frame messages for better communication
- It pays to frame problems as social contracts issues
- Use our aversion to losses to frame messages
- Communicating proportions and probabilities
- Metaphorical framing. Visual framing

More on the biased mind
- Tips to make sound decisions. Experts
- Immoral risks outrage individuals
- Miscellaneous
Optical illusion
The half-spheres are protuberant or in hollow?
Gerd Gigerenzer claims that we can learn from that perceptual illusion how our mind functions.

Our mind recalls that natural light comes from above (in relation to retinal coordinates), and that there is only one source of light, the sun.

If the shade is in the upper part, then the dots are concave; if the shade is in the lower part, then the dots are convex.

Seeing is more scanning than contemplating.
My mind restores missing speech sound


- “It was found that the wheel was on the axle”
- “It was found that the (···)eel was on the axle” → wheel
- “It was found that the (···)eel was on the orange” → peel
Language is an instinct (Steven Pinker) and a collaborative tool

Steven Pinker [Pinker, 1994]

- “John tried to clean his room”
- “I went to the cinema yesterday”
Watch the borders!

Edgar J. Hoover was the Director of the Federal Bureau of Investigation (FBI) of the United States.


On the FBI website, you find the following anecdote about the “blue gems”

Hoover liked to write on the margins of memos.

One day, his staff received an annotated memo with the warning “watch the borders!”

Inquiries were sent to the Border Patrol about any strange activities on the Canadian and Mexican frontiers.

It took a week before someone understood the message related to the borders of the memo paper: the text had simply overflowed in the margin!
Where do we stand? And what comes next?

- Our mental biases drive us in awkward directions, quite unconsciously
- Evolutionary rationality transpires behind our mental biases
- Our mind is modular
- Knowing our biases can help us better communicate and interact
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection

How to frame messages for better communication

More on the biased mind
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
   Are we prisoners in time? The adapted mind
   Our mind holds a myriad of problem-solving modules
   Our mind holds old age departments
   Our mind devices are tuned like a fire-detector
   We look after clues in our environment

How to frame messages for better communication
   It pays to frame problems as social contracts issues
   Use our aversion to losses to frame messages
   Communicating proportions and probabilities
   Metaphorical framing. Visual framing

More on the biased mind
   Tips to make sound decisions. Experts
   Immoral risks outrage individuals
   Miscellaneous
Our mind hosts a cheater-detection module
[Cosmides and Tooby, 1992]
The Wason cards are a famous brainteaser

You are shown a set of four cards each of which has

- a number on one side
- a color on the other side

The visible faces of the cards show 3, 8, red and brown

Which card(s) must you turn over in order to test the truth of the proposition that

if a card shows an even number on one face, then its opposite face is red?
The Wason cards are a famous brainteaser

You are shown a set of four cards each of which has
- a number on one side
- a color on the other side

The visible faces of the cards show 3, 8, red and brown

Which card(s) must you turn over in order to test the truth of the proposition that
- if a card shows an even number on one face, then its opposite face is red?
- 8 and brown
Now, consider the reformulation of the Wason cards as a cheater detection task

[Cosmides and Tooby, 1992], [Pinker, 1997]

- You are a bouncer in a bar, and are enforcing the rule
- “If a person is drinking beer, he must be eighteen or older”
- You may check what people are drinking or how old they are
- Which do you have to check:
  - a beer drinker
  - a Coke drinker
  - a twenty-five-year-old
  - a sixteen-year-old?
Now, consider the reformulation of the Wason cards as a cheater detection task

[Cosmides and Tooby, 1992], [Pinker, 1997]

اتهم You are a bouncer in a bar, and are enforcing the rule

 пом “If a person is drinking beer, he must be eighteen or older”

اتهم You may check what people are drinking or how old they are

اتهم Which do you have to check:

• a beer drinker
• a Coke drinker
• a twenty-five-year-old
• a sixteen-year-old?

اتهم Most people correctly select

• the beer drinker
• and the sixteen-year-old
To help convey the notion of Pareto optimum, frame it as a “social contract”

At a Pareto optimum, no agent has interest in changing his basket of goods

↩️ An allocation is a collection of baskets of goods, one by agent

↩️ An allocation $A^b$ is dominated by an allocation $A^\#$ if

▷ all agents either strictly prefer $A^\#$ to $A^b$, or are indifferent between $A^\#$ and $A^b$

▷ at least one agent strictly prefers $A^\#$ to $A^b$

↩️ An allocation is feasible if the sum of all goods is less than or equal to the total of goods in the economy

↩️ An allocation is a Pareto optimum if it is not dominated by a feasible allocation
To help convey the notion of Pareto optimum, frame it as a “social contract”

At a Pareto optimum, no agent has interest in changing his basket of goods

- An allocation is a collection of baskets of goods, one by agent
- An allocation $A^b$ is dominated by an allocation $A^\#:\text{ if}$
  - all agents either strictly prefer $A^\#$ to $A^b$, or are indifferent between $A^\#$ and $A^b$
  - at least one agent strictly prefers $A^\#$ to $A^b$
- An allocation is feasible if the sum of all goods is less than or equal to the total of goods in the economy
- An allocation is a Pareto optimum if it is not dominated by a feasible allocation

You cannot rob Peter to pay Paul
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
  Are we prisoners in time? The adapted mind
  Our mind holds a myriad of problem-solving modules
  Our mind holds old age departments
  Our mind devices are tuned like a fire-detector
  We look after clues in our environment

How to frame messages for better communication
  It pays to frame problems as social contracts issues
  Use our aversion to losses to frame messages
  Communicating proportions and probabilities
  Metaphorical framing. Visual framing

More on the biased mind
  Tips to make sound decisions. Experts
  Immoral risks outrage individuals
  Miscellaneous
Loss aversion and Samuelson’s colleague

Economist Paul Samuelson once offered a colleague the following bet:
*flip a coin, heads you win $200 and tails you lose $100*

Samuelson reports that his colleague turned this bet down on the rationale that

"I won’t bet because I would feel the $100 loss more than the $200 gain"

This sentiment is the intuition behind the concept of loss aversion [Kahneman and Tversky, 1974],

“There are twice as many negative emotions (fear, grief, anxiety, and so on) as positive ones” [Pinker, 1997]
A proper framing can improve the impact of communication

☞ You can **gain** several potential health benefits by **spending** only five minutes each month doing breast self-examination

∧

☞ You can **lose** several potential health benefits by **failing to spend** only five minutes each month doing breast self-examination

[Meyrowitz and Chaiken, 1987]
A proper framing can improve the impact of communication

- You can gain several potential health benefits by spending only five minutes each month doing breast self-examination

- You can lose several potential health benefits by failing to spend only five minutes each month doing breast self-examination

Subjects who read a pamphlet with arguments framed in loss language manifested more positive breast self-examination attitudes, intentions, and behaviors (57% > 38% at the 4-month follow-up)

[Meyerowitz and Chaiken, 1987]
Kahneman and Tversky value function
Concavity for gains / Convexity for losses

[Thaler, 1985]

Concavity for gains

- We prefer multiple small gains to one larger gain
- Moral: do not wrap all the Christmas presents in one box!
- Adding options to an automobile or house purchase are classic, well-known examples in sale techniques
Concavity for gains / Convexity for losses

[Thaler, 1985]

.githubusercontent.com

Concavity for gains

- We prefer multiple small gains to one larger gain
- Moral: do not wrap all the Christmas presents in one box!
- Adding options to an automobile or house purchase are classic, well-known examples in sale techniques

Convexity for losses

- We prefer to pay once in for all than many small debts/losses
- Moral: do not present the bills one after the other!
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
  Are we prisoners in time? The adapted mind
  Our mind holds a myriad of problem-solving modules
  Our mind holds old age departments
  Our mind devices are tuned like a fire-detector
  We look after clues in our environment

How to frame messages for better communication
  It pays to frame problems as social contracts issues
  Use our aversion to losses to frame messages
  Communicating proportions and probabilities
  Metaphorical framing. Visual framing

More on the biased mind
  Tips to make sound decisions. Experts
  Immoral risks outrage individuals
  Miscellaneous
$0.1 \neq 10\% \neq \frac{1}{10} \neq \frac{10}{100} \neq \frac{1}{10}$

Priya Raghubir,
*The effect of denominator salience on perceptions of base rates of health risk*, Int. J. of Research in Marketing, 2008 [Raghubir, 2008]

Isaac Lipkus,
Three formats for the same problem
Some speak more to the (biased) mind than others
The medical diagnosis problem is a famous example where mathematical reasoning can be deficient.

[Casscells, Schoenberger, and Graboys, 1978]

“If a test to detect a disease whose prevalence is 1/1000 has a false positive rate of 5%, what is the chance that a person found to have a positive result actually has the disease, assuming that you know nothing about the person’s symptoms or signs?"

Only 18% of Harvard medical school students and staff answered the correct Bayesian answer: "2%"

45% of them answered “95%”
Here is a frequentist formulation of the medical diagnosis problem

*Are humans good statisticians after all?* [Cosmides and Tooby, 1996]

- 1 out of every 1000 Americans has disease X
- A test has been developed to detect when a person has disease X
- Every time the test is given to a person who has the disease, the test comes out positive (i.e., the "true positive" rate is 100%)
- But sometimes the test also comes out positive when it is given to a person who is completely healthy
- Specifically, out of every 1000 people who are perfectly healthy, 50 of them test positive for the disease (i.e., the "false positive" rate is 5%)

56% gave the correct answer
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[
\mathbb{P}(\mathcal{D}) = \frac{1}{1000} \quad \mathbb{P}(\mathcal{T}|\mathcal{D}) = 1 \quad \mathbb{P}(\mathcal{T}|\bar{\mathcal{D}}) = \frac{50}{1000}
\]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[
P(D) = \frac{1}{1000} \quad P(T|D) = 1 \quad P(T|\bar{D}) = \frac{50}{1000}
\]

\[
P(D|T) = \frac{P(D|T)}{P(T)} = \frac{P(T) - P(T|\bar{D}) \times P(\bar{D})}{P(T)}
\]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[
\begin{align*}
P(D) &= \frac{1}{1000} \quad P(T|D) = 1 \quad P(T|\bar{D}) = \frac{50}{1000} \\

P(D|T) &= \frac{P(D|T)}{P(T)} = \frac{P(T) - P(T|\bar{D}) \times P(\bar{D})}{P(T)} \\

P(T) &= P(T \cap D) + P(T \cap \bar{D})
\end{align*}
\]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[ P(D) = \frac{1}{1000} \quad P(T|D) = 1 \quad P(T|\bar{D}) = \frac{50}{1000} \]

\[ P(D|T) = \frac{P(D|T)}{P(T)} = \frac{P(T) - P(T|\bar{D}) \times P(\bar{D})}{P(T)} \]

\[ P(T) = P(T \cap D) + P(T \cap \bar{D}) \]

\[ P(T \cap D) = P(T|D) \times P(D) \]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[ P(D) = \frac{1}{1000} \quad P(T|D) = 1 \quad P(T|\bar{D}) = \frac{50}{1000} \]

\[ P(D|T) = \frac{P(D|T)}{P(T)} = \frac{P(T) - P(T|\bar{D}) \times P(\bar{D})}{P(T)} \]

\[ P(T) = P(T \cap D) + P(T \cap \bar{D}) \]

\[ P(T \cap D) = P(T|D) \times P(D) \]

\[ P(T \cap \bar{D}) = P(T|\bar{D}) \times (1 - P(\bar{D})) \]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[ P(D) = \frac{1}{1000} \quad P(T|D) = 1 \quad P(T|\bar{D}) = \frac{50}{1000} \]

\[ P(D|T) = \frac{P(D|T)}{P(T)} = \frac{P(T) - P(T|\bar{D}) \times P(\bar{D})}{P(T)} \]

\[ P(T) = P(T \cap D) + P(T \cap \bar{D}) \]

\[ P(T \cap D) = P(T|D) \times P(D) \]

\[ P(T \cap \bar{D}) = P(T|\bar{D}) \times (1 - P(\bar{D})) \]

\[ P(D|T) = 1 - \frac{P(T|\bar{D}) \times (1 - P(D))}{P(D) + P(T|\bar{D}) \times (1 - P(D))} = \frac{1}{21} \]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[ P(D) = \frac{1}{1000} \]  \[ P(T|\bar{D}) = \frac{50}{1000} \]  \[ P(T|D) = 1 \]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[ P(D) = \frac{1}{1000} \quad P(T|\bar{D}) = \frac{50}{1000} \quad P(T|D) = 1 \]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[
\begin{align*}
\mathbb{P}(\mathcal{D}) &= \frac{1}{1000} \\
\mathbb{P}(\mathcal{T}|\bar{\mathcal{D}}) &= \frac{50}{1000} \\
\mathbb{P}(\mathcal{T}|\mathcal{D}) &= 1
\end{align*}
\]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[ P(D) = \frac{1}{1000} \quad P(T|\bar{D}) = \frac{50}{1000} \quad P(T|D) = 1 \]
And now, here is the Bayesian approach followed by a visual-frequentist approach

\[
P(D) = \frac{1}{1000} \quad P(T|\bar{D}) = \frac{50}{1000} \quad P(T|D) = 1
\]

\[
P(D|T) = \frac{1}{51}
\]
Presenting information in frequency formats helps improve Bayesian reasoning

By analyzing several thousand solutions to Bayesian problems, Gigerenzer and Hoffrage found that

- when information was presented in frequency formats
- statistically naive participants derived up to 50% of all inferences

[Gigerenzer and Hoffrage, 1995]
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
   Are we prisoners in time? The adapted mind
Our mind holds a myriad of problem-solving modules
Our mind holds old age departments
Our mind devices are tuned like a fire-detector
We look after clues in our environment

How to frame messages for better communication
   It pays to frame problems as social contracts issues
   Use our aversion to losses to frame messages
   Communicating proportions and probabilities
   Metaphorical framing. Visual framing

More on the biased mind
   Tips to make sound decisions. Experts
   Immoral risks outrage individuals
Miscellaneous
Metaphors we live by

Ideas are
- cutting instruments: *incisive, cutting, sharp*
- light-sources: *insightful, illuminating*
- food: *digest, swallow, devoured, warmed over, food for thought, meaty part*

Knowledge: *unknown is up, known is down*
- that question is still up in the air
- that settles the question
- it’s still up for grabs
- let’s bring it up for discussion

[Lakoff and Johnson, 1981]
The embodied mind
Or how we grasp abstract concepts in bodily terms

When someone reads
grasping the idea,
zones corresponding to the physical action of grasping
are activated in the premotor cortex of the left hemisphere,
grabbing more attention than
understanding the idea
We think with images

- Thought is made largely from images, which include symbolic representations like somatic markers
- Marked by positive or negative feeling, through lifetime experience
- Negative marker of an image of a future outcome: alarm

[Damasio, 1995]
“I know a Brazilian man who...”

- Emotion arises as a reaction of mental images
- Warnings more efficient when based upon people and anecdotes than statistics:
  “I know a Brazilian man who...”
Sinuous snakes haunt our minds

[Mundkur, 1983]
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection

How to frame messages for better communication

More on the biased mind
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
  Are we prisoners in time? The adapted mind
Our mind holds a myriad of problem-solving modules
Our mind holds old age departments
Our mind devices are tuned like a fire-detector
We look after clues in our environment

How to frame messages for better communication
  It pays to frame problems as social contracts issues
  Use our aversion to losses to frame messages
  Communicating proportions and probabilities
  Metaphorical framing. Visual framing

More on the biased mind
  Tips to make sound decisions. Experts
  Immoral risks outrage individuals
Miscellaneous
Use experts for what they are good at: quickly extracting the right features in a messy situation
Knowing exactly where to tap

In his book *59 Seconds: Change Your Life in Under a Minute*, Richard Wiseman tells a very old story, often used to kill time during training courses:

- A man is trying to fix his broken boiler, but fails despite his best efforts.
- He decides to call in an engineer, who simply gives one gentle tap on the side of the boiler and instantly brings it back to life.
- The engineer presents the man with a bill, and the man argues that he should pay only a small fee as the job took the engineer only a few moments.
- The engineer quietly explains that the man is not paying for the time he took to tap the boiler but rather the years of experience involved in knowing exactly where to tap.
An anecdote with painter Pablo Picasso
“\textit{It took me forty years to get there}”

\begin{itemize}
\item A woman approached Picasso in a restaurant and asked him to scribble something on a towel.
\item She claimed she was ready to pay whatever he asked.
\item Picasso complied and said: “\textit{It will be ten thousand dollars}”
\item “\textit{But you did it in thirty seconds}!” answered the amazed woman.
\item “\textit{No},” said Picasso, “\textit{It took me forty years to get there}”
\end{itemize}
Do *not* use experts to integrate information they have extracted. Prefer a linear model.

The “Moral Algebra” with +1 and -1
Children – (if it Please God) – Constant companion, (& friend in old age) who will feel interested in one, – object to be beloved & played with. – –better than a dog anyhow. – Home, & someone to take care of house – Charms of music & female chit-chat. – These things good for one’s health. – Forced to visit & receive relations but terrible loss of time. –
W My God, it is intolerable to think of spending ones whole life, like a neuter bee, working, working, & nothing after all. – No, no won’t do. – Imagine living all one’s day solitarily in smoky dirty London House. – Only picture to yourself a nice soft wife on a sofa with good fire, & books & music perhaps – Compare this vision with the dingy reality of Grt. Marlbro’ St.
Marry – Marry – Marry Q.E.D.
Not Marry

No children, (no second life), no one to care for one in old age.– What is the use of working 'in' without sympathy from near & dear friends–who are near & dear friends to the old, except relatives Freedom to go where one liked – choice of Society & little of it. – Conversation of clever men at clubs – Not forced to visit relatives, & to bend in every trifle. – to have the expense & anxiety of children – perhaps quarelling – Loss of time. – cannot read in the Evenings – fatness & idleness – Anxiety & responsibility – less money for books &c – if many children forced to gain one’s bread. – (But then it is very bad for ones health to work too much) Perhaps my wife wont like London; then the sentence is banishment & degradation into indolent, idle fool –
One subject decided to get a divorce after realizing that she was fighting more than loving

[Dawes, 1982]

- Researchers at the University of Oregon attempted to predict self rating of marriage happiness.
- They showed that a crude improper linear model:
  
  \[
  \text{marriage happiness} = \text{rate of lovemaking} - \text{rate of fighting}
  \]

  could judge such a complex concept as marital happiness.
- The conclusion is that
  - if we love more than we hate, we are happy
  - when we hate more than we love, we are miserable

- One subject decided to get a divorce after realizing that she was fighting more than loving.
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
  Are we prisoners in time? The adapted mind
  Our mind holds a myriad of problem-solving modules
  Our mind holds old age departments
  Our mind devices are tuned like a fire-detector
  We look after clues in our environment

How to frame messages for better communication
  It pays to frame problems as social contracts issues
  Use our aversion to losses to frame messages
  Communicating proportions and probabilities
  Metaphorical framing. Visual framing

More on the biased mind
  Tips to make sound decisions. Experts
  Immoral risks outrage individuals
  Miscellaneous
Outrage and moral factors have a substantial impact on risk perception

\[ \text{Risk} = \text{Hazard} + \text{Outrage} \quad (\text{Sandman}) \]

Reliance on outrage is the major reason that public evaluations of risk differ from expert evaluations (based on analysis of hazard, e.g., mortality statistics)
Adding a moral factor improves the explanatory value of risk perception

- With the factors novelty, dread, uncontrollable, catastrophic, etc., the psychometric model's explanatory value is only around 20% of the variance of raw data.
- Adding a moral factor doubles the explanatory value:
  - unnatural risk
  - immoral risk
  - human arrogance
  - tampering with Nature
- Nuclear energy and GMO are seen as transgressions, that evoke skin crossing by a cutting instrument

*Factors in risk perception*, Lennart Sjöberg [Söberg, 2000]
“We’re not just breaking international laws, we’re screwing with the laws of nature”

(official trailer of the 2013 Helix TV series on virus outbreak)
Outline of the presentation

Warming up with warning signs

Our mind is the product of natural selection
  Are we prisoners in time? The adapted mind
  Our mind holds a myriad of problem-solving modules
  Our mind holds old age departments
  Our mind devices are tuned like a fire-detector
  We look after clues in our environment

How to frame messages for better communication
  It pays to frame problems as social contracts issues
  Use our aversion to losses to frame messages
  Communicating proportions and probabilities
  Metaphorical framing. Visual framing

More on the biased mind
  Tips to make sound decisions. Experts
  Immoral risks outrage individuals

Miscellaneous
Our mind was shaped by natural selection to solve adaptive problems.

Our brains were built for survival and reproduction (fitness), not for truth.

Biases may appear:
- when truth and fitness are not aligned
- when adaptive problems have changed (parasites, health)

Our mental biases are mostly unconscious.
Our mental biases are mostly unconscious.

The time spent with the grandparent and the resources (gifts) they received from the grandparent depends on whether:

- the grandparent is the father’s father (less resources)
- the grandparent is the mother’s mother (more resources)

El hijo de mi hija, mi nieto ser;
el hijo de mi hijo, no saber
Inevitable luxury business

Wasting is an honest signal of richness

The peacock’s tail was a challenge to Darwin: a product of sexual selection that is a handicap for survival

Zahavi’s paradox of the handicap
Inevitable gossip business

- It is unlikely that language evolved to communicate about “the bison by the lake”
- Indeed, producing a message is costly to the emitter, hence should be to his/her benefit [Dawkins and Krebs, 1979]
- Language evolved for gossip, to obtain information about group members, hence improving fitness [Dunbar, 1997]
Self-promotion, nobody will do it for you ;-) 

- What makes the number 7 so special?
- Why is it that the French eat snails but not slugs?
- Why is it better to whisper words of love into the left ear?
- Why is the image to the left, and the text to the right?
More readings
On the Origin of Species

The evolution of species comes from natural selection

[Darwin, 1859]
We are, however, here concerned only with that kind of selection, which I have called sexual selection. This depends on the advantage which certain individuals have over other individuals of the same sex and species, in exclusive relation to reproduction.

[Darwin, 1981]
Darwin’s Dangerous Idea
Evolution and the Meanings of Life

[Dennett, 1995]
Is it not reasonable to anticipate that our understanding of the human mind would be aided greatly by knowing the purpose for which it was designed?

[Williams, 1966]
We are survival machines — robot vehicles blindly programmed to preserve the selfish molecules known as genes. This is a truth which still fills me with astonishment.

[Dawkins, 2006]
Sociobiology
The New Synthesis

fellows of the international Animal Behavior Society ranked “Sociobiology: The New Synthesis” the most important book on animal behavior of all time

[Wilson, 2000]
The greatest enterprise of the mind has always been and always will be the attempted linkage of the sciences and humanities. The ongoing fragmentation of knowledge and resulting chaos in philosophy are not reflections of the real world but artifacts of scholarship.

[Wilson, 1998]
Can there be a more important subject than human nature?

Human nature exists, composed of the complex biases of passion and learning propensities often loosely referred to as instincts. (…) scientific explanation embrace both the how (neurosciences) and why (evolutionary biology) of brain action (…)
Human Universals

(...) what we know about universals places clear limits on the cultural relativism that anthropologists have developed and disseminated widely

[Brown, 1991]
Evolutionary psychology is simply psychology that is informed by the additional knowledge that evolutionary biology has to offer, in the expectation that understanding the process that designed the human mind will advance the discovery of its architecture.

[Barkow, Cosmides, and Tooby, 1992]
In this book I intend to specify the ‘whats’, ‘whens’ and ‘whys’ for the evolution of the mind. While following its course I will be searching for — and will find — the cognitive foundations of art, religion and science.

[Mithen, 1998]
This book proposes that our minds evolved not just as survival machines, but as courtship machines. (...) I shall argue that the most distinctive aspects of our minds evolved largely through the sexual choices our ancestors made.

[Miller, 2001]
Evolutionary psychology provides the conceptual tools for emerging from the fragmented state of current psychological science and linking psychology with the rest of the life sciences in a larger scientific integration.

[Buss, 2014]
Men and women differ in their sexual natures because throughout the immensely long hunting and gathering phase of human evolutionary history the sexual desires and dispositions that were adaptive for either sex were for the other tickets to reproductive oblivion.

[Symons, 1979]
Right from the outset of evolutionary thinking, however, a tiny group of women were as Darwinian as they were feminist. George Eliot, a woman who took a man’s name because women writers at that time were not taken seriously, was one of them.

[Hrdy, 1999]
The subject of essential sex differences in the mind is clearly very delicate. I could tiptoe around it, but my guess is that you would like the theory of the book stated plainly. So here it is:

The female brain is predominantly hard-wired for empathy. The male brain is predominantly hard-wired for understanding and building systems.

[Baron-Cohen, 2004]
How the Mind Works

My goal was to weave the ideas into a cohesive picture using two even bigger ideas that are not mine: the computational theory of mind and the theory of the natural selection of replicators.

[Pinker, 1997]
Finally, the denial of human nature has not just corrupted the world of critics and intellectuals but has done harm to the lives of real people. (…) The romantic notion that all evil is a product of society has justified the release of dangerous psychopaths who promptly murdered innocent people.

[Pinker, 2002]
For although language is an instinct, written language is not.

[Pinker, 1994]
I am a psycholinguist and a cognitive scientist, and what is style, after all, but the effective use of words to engage the human mind?

[Pinker, 2014]
I shall examine not only what we do with language but also the more fundamental questions of why we have it, whence it came and how long ago it appeared.
I also did not draw explicit parallels between how rival chimpanzees curry favor with females by grooming them and tickling their young and the way human politicians hold up and kiss babies, something they rarely do outside the election season.

[de Waal, 2007]
Homicide

This book is an exercise in "evolutionary psychology": the attempt to understand normal social motives as products of the process of evolution by natural selection. There is simply no question that this is the process that created the human psyche, and yet psychologists seldom ask what implications this fact might have for their discipline. We think that the implications are many and profound

[Daly and Wilson, 1988]
Murder gives us an X-ray of the inner core of human nature. It lays bare the things that matter most to humans everywhere — the necessities of survival, the attainment of status, the defense of honor, the acquisition of desirable partners, the loyalty of our lovers, the bonding of our allies, the vanquishing of our enemies, the protection of our children, and the successes of the carriers of our genetic cargo.

[Buss, 2006]
"Much light will be thrown on the origin of man and his history"
Darwin ended his Origin of Species with that prophecy.
(…) In the first century after the Origin of Species, virtually no one tested Darwin’s theory against the evidence of human history. In the last decade, that tide has changed; this book is caught up in it.

[Betzig, 2008]
Moral problems involve the interests of people, and biology gives good reasons for expecting different individuals to behave as if their interests are unique, and thus as if interests conflict among individuals to some degree almost all of the time.

[Alexander, 1989]
L’esprit ne fonctionne donc pas comme une machine à “passer en revue tous les faits pour leur trouver une explication générale”. Il se compose d’un grand nombre de dispositifs d’explication spécialisés, plus précisément nommé systèmes d’inférence, dont chacun est adapté à certains types d’événements précis et suggère automatiquement des explications à leur propos.

[Boyer, 2001]
We are thoroughgoing liars, even to ourselves. Our most prized possession — language — not only strengthens our ability to lie but greatly extends its range. (...) But why self-deception? Why do we possess marvelous sense organs to detect information only to distort it after arrival? Evolutionary biology provides the foundation for a functional view of the subject

[Trivers, 2013]
This is the second edition of The Nurture Assumption, but its message remains the same. The “experts” are wrong: parental nurturing is not what determines how a child turns out. Children are not socialized by their parents. The nurture assumption is a myth and most of the research used to support it is worthless. Diplomacy has never been my strong suit.

[Harris, 1998]
My hope is that a greater number of consumer scholars in particular and business scholars more generally will eventually come to realize that human minds are the product of natural and sexual selection. In doing so, they will view evolutionary theory as a theoretical framework that can help them augment the explanatory power of their research (...)

[Saad, 2011]


Robin Dunbar. *How Many Friends Does One Person Need?: Dunbar’s Number and Other Evolutionary Quirks.* Faber and Faber, 2010.


