Decision Making Constraints
Reference Dependence
LARGE vs SMALL DECISIONS

Is there a difference in how people make large decisions and small decisions?
same brain is used for both large & small decisions

Not different

The same biases are found in the small “day to day” decisions and in the larger more meaningful “once in a lifetime” decisions.
SAME DECISION MAKING TOOLS

Forage for food & Fight predators

Same Brain

Buy a car & Choose a college
TWO FUNDAMENTAL LIMITATIONS

1. Constraints on our cognitive abilities.
   - Basic limitations to intellectual capacity.
   - We cannot know nor remember everything.
   - We simplify decisions.

2. We do not have unconstrained time to make decisions.
   - We need to make decisions with incomplete information due to time constraints.
We don't process information in absolute terms. It is all relative.

1. Constraints on our cognitive abilities.
2. Basic limitations to intellectual capacity.
3. We cannot know nor remember everything.
4. We simplify decisions.
Olympians - 2 place disappointment relative to your expectations

- Paradox
- Silver > Bronze
- Counter intuitive

Happiness is a function of how well you perform.
Why Winning Olympic Silver Is More Disappointing Than Bronze-And The Crucial Thing That Tells Us About Performance Reviews

This article is by Victoria Husted Medvec, the Adeline Barry Davee professor of management and organizations and executive director of the Center for Executive Women at Northwestern University's Kellogg School of Management.

For Olympic athletes, nothing shines quite like gold. Silver, while still impressive, is often tarnished with thoughts of what might have been. This disappointment, rooted in what is known as counterfactual thinking, is not limited to athletes who miss winning a race by 0.01 second. The same letdown is often felt by employees whose performance evaluations are just shy of excellent, like the student whose grade falls one point shy of an A.

Curiously, the opposite is generally true for bronze medalists, for whom the “what could have been” is fourth place with no medal at all. Happy to be on the podium, third-place finishers generally feel pleased with their performance—just like the employee who squeak into the good category in an evaluation, or the student who ekes out one more point to make a B. In fact, as research I conducted with my colleagues Thomas Gilovich of Cornell University and Scott Madley of the University of Toledo has shown, bronze medalists are generally happier than those who bring home silver; counterfactual thoughts lead those who perform better to feel worse than those they outperform.
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The Truth About Relativity. Dan Ariely
relativity

The tendency to estimate the value of things according to how they compare with other items.

adaptation

The process of adjusting to new conditions.

From: The Truth About Relativity. Dan Ariely
VALUE
The essence of decision making.
What’s Important to You?
How is value calculated?

By understanding value, we gain insight into choices.
How is value calculated? By understanding value, we gain insight into choices.

Value is an abstract concept in economics.

\[
\begin{pmatrix}
\text{value} \\
\end{pmatrix} \Rightarrow \text{pleasure}
\]

\[
\begin{pmatrix}
\text{value} \\
\end{pmatrix} \Rightarrow \text{pain}
\]

How much do we benefit?
But, are all choices made solely based on benefit?

Value is then measured by both pleasure & benefit.
value? benefit?

pleasure?
Value of something can be completely separate from the benefit.

Value is MORE than pleasure and benefit.
Motivation is a reason or a set of reasons for engaging in a particular behavior.
Select between different foods, make a decision, you eat it, and based on your experience, you learn, and then modify your valuation associated with this food.
Select between different foods, make a decision, you eat it, and based on your experience you learn, and then modify your valuation associated with this food.

valuation this is key

Q can we understand & decode neural representation of valuation ??
we want to be able to predict the decisions of the decision maker.
Choice

utility is a measure of the desirability of consequences of an action.

value = \$2

utility = X

value = \$4

utility = Y
Choice

- utility is a measure of the desirability of consequences of an action

value = $3
utility = x

value = $4
utility = y

utility fcn:
IF x < y
select y

The rule of maximization: choose the option yielding the highest utility.
How to measure utility?

Preferences cannot be measured numerically.

Worse | Equal | Better

Ordinal utility

Relative utility ordering
How's your wife?

Economists convention

- Don't use absolute numbers
- Everything is relative
- Assign relative utility to different conditions.
"But enough about me... What brings you folks to Polynesia?"
Cardinal Utility

1. the utility gained from a particular good or service can be measured
2. the magnitude of the measurement is meaningful.
Utility is a measure of the desirability of consequences of an action. A value is subjective for each person.

Economics Book: $150.00
DOPAMINE
The neurotransmitter that determines value!
SOME BASIC NEUROSCIENCE...

the human brain 😊
Neuron Basics

Soma (cell body)

Terminal

Axon (output of neuron)

Dendrites (input to neuron)

Basic Neuron
Neurons communicate with each other. Information is transmitted from one neuron to another.
Neurons communicate with each other at the synapse.

Pre-synaptic side

Post-synaptic side
Neurons communicate at the synapse from the pre-synaptic side to the post-synaptic side.
neurotransmitter is stored in the pre-synaptic terminal in vesicles.
When the presynaptic neuron "fires," the neurotransmitter is released.
neurotransmitter

transmits a signal to the postsynaptic neuron

binding neurotransmitter

signal
SIGNAL FREQUENCY MATTERS

Effect on post syn. side:

- Low freq \(\Rightarrow\) Small
- Med freq \(\Rightarrow\) Medium
- High freq \(\Rightarrow\) Large
SOUNDS OF SPIKING NEURONS

- Low frequency
- Medium frequency
- High frequency

Spike frequency histogram
frontal lobe
parietal lobe
sagittal plane
occipital lobe
corpse callosum
cerebellum
brain stem
Dopaminergic system

NA: Nucleus Accumbens

VTA: Ventral Tegmental Area

SN: Substantia Nigra
THE DOPAMINERGIC SYSTEM

VTA
ventral tegmental area
notice - VTA neurons project to the frontal lobe and emotional areas.

VTA contains neurons that make dopamine.

The dopaminergic system.
VTA also projects to the Nucleus Accumbens (NA)
NA is very important for reward system.
SN neurons project to the basal ganglia. Substantia nigra (SN) also contain dopaminergic neurons.
SN neurons project to the basal ganglia.

Basal Ganglia

Important for movement

Parkinson's disease
Dopaminergic system
NA (nucleus accumbens)
VTA (ventral tegmental area)
SN (substantia nigra)
DOPAMINERGIC SYSTEM - VTA

- Prefrontal cortex
- Nucleus accumbens
- Striatum
- Ventral tegmental area

Part of the Basal Ganglia