1

Pascal and gambling logic

Early decision theory & utility maximization

Understanding the logic of gambling decisions

Blaise Pascal, Mathematician

https://en.wikipedia.org/

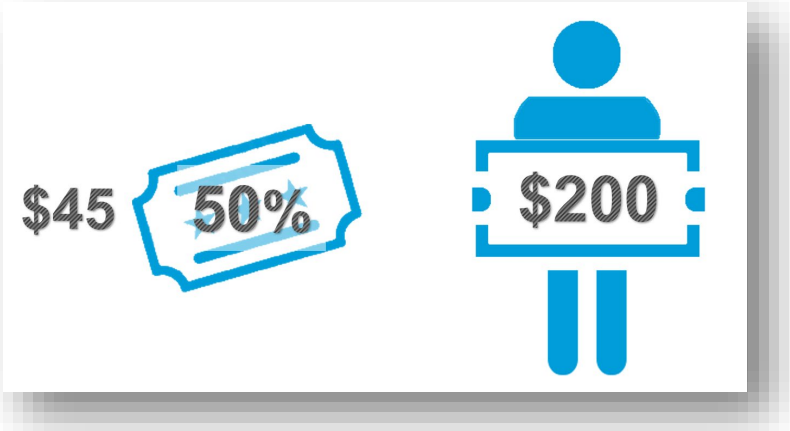
decisions, decisions...

Lottery ticket costs $45.
It has a 50% chance of winning $200

Caplin, Andrew and Paul W. Glimcher (2014) in “Basic Methods from Neoclassical Economics” in Neuroeconomics: Decision Making and The Brain.

buy ticket

Blaise Pascal, Mathematician



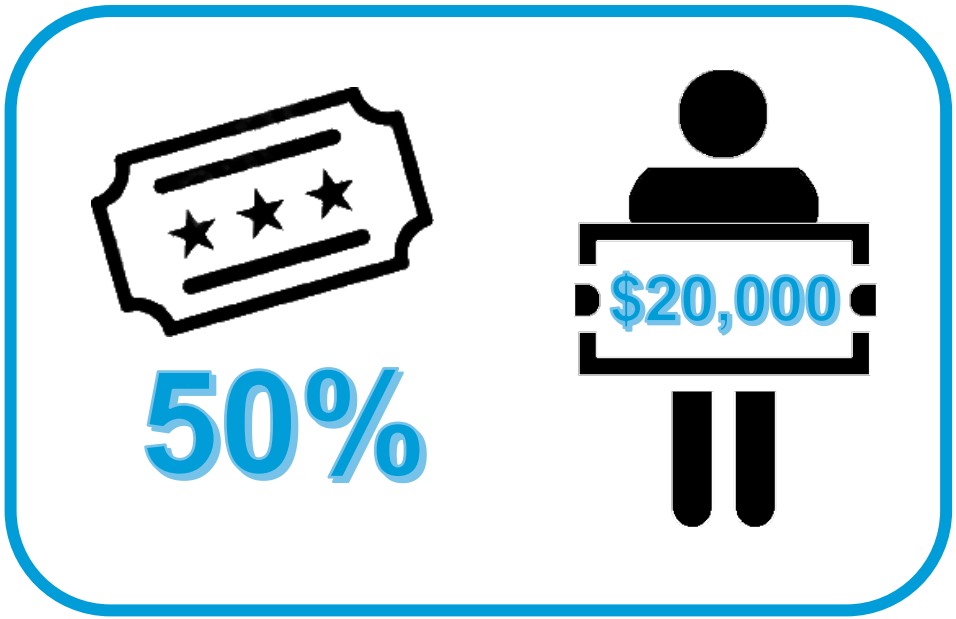
Expected value = the probability of winning X the amount to be won

EV = 0.5 X 200 = 100

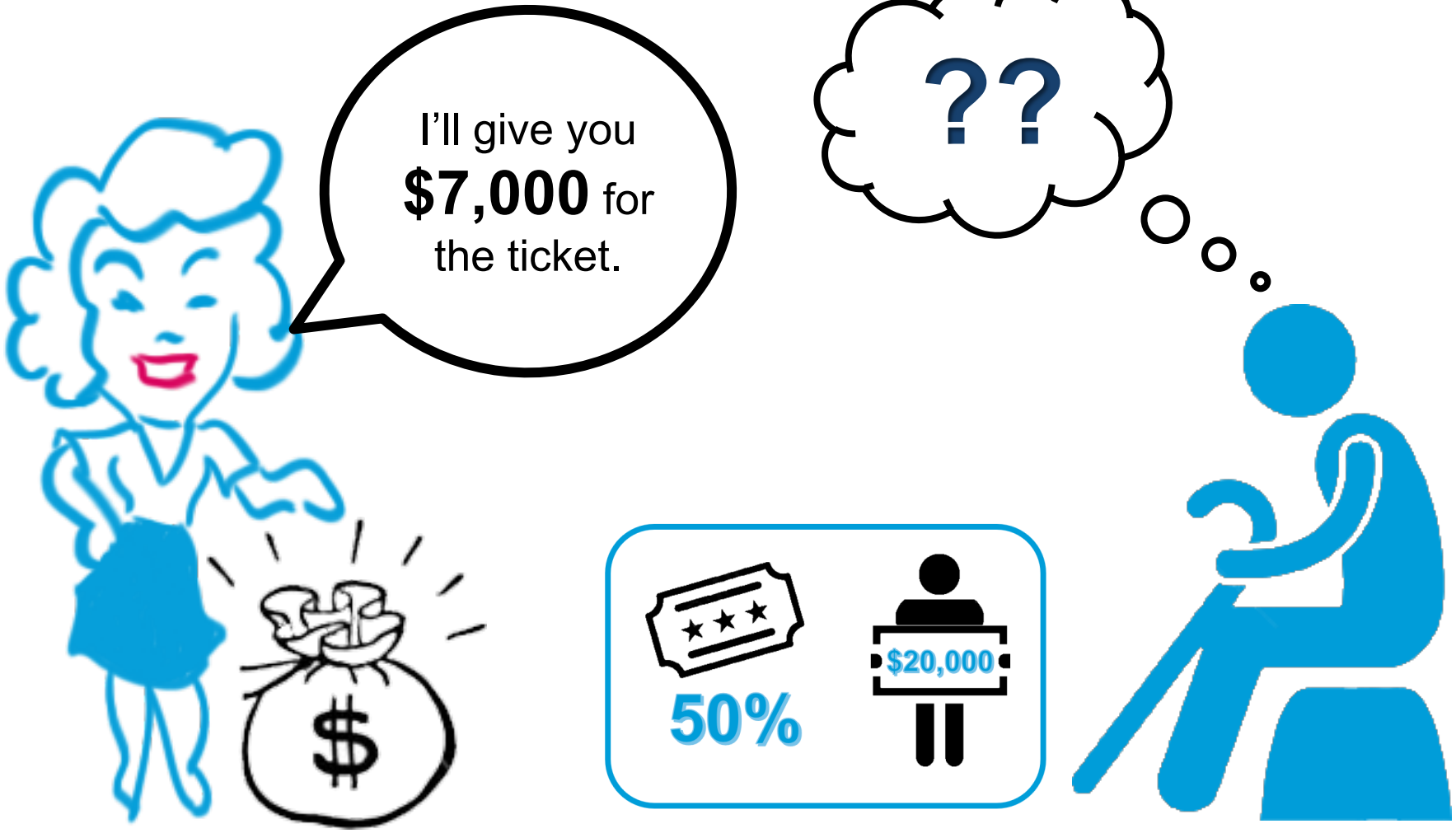
ticket price → **$45 < $100**

Caplin, Andrew and Paul W. Glimcher (2014)

Consider a poor person...



Caplin, Andrew and Paul W. Glimcher (2014)



Caplin, Andrew and Paul W. Glimcher (2014)

Daniel Bernoulli:

one should maximize expected utility

He makes a distinction between:
expected value and expected utility.

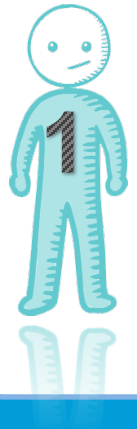
Caplin, Andrew and Paul W. Glimcher (2014)

2

Prospect Theory

people *evaluate potential changes*
in
relative wealth,
not absolute wealth

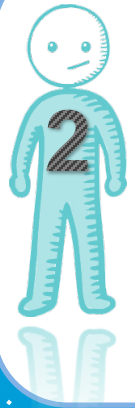
Famous Kahneman and Tversky experiment:



Start with $1000

Choose between:

- 50/50 chance of wining $1000 or $0
- Get $500



Start with $2000

Choose between:

- 50/50 chance of losing 1000 or 0
- Lose $500

Framing matters.

A reverse sunk cost effect in risky decision making: Sometimes we have too much invested to gamble [1]

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Abstract

The sunk cost effect refers to the empirical finding that people tend to let their decisions be influenced by costs made at an earlier time in such a way that they are more risk seeking than they would be had they not made these costs. This finding seems to be in conflict with economic theory which implies that only incremental costs and benefits should affect decisions. The effect is often explained in terms of prospect theory of (Kahneman, D., Tversky, A., 1979. Prospect theory: An analysis of decision under risk. Econometrica 47, 263–291), suggesting that sunk costs may induce a 'loss frame,' consequently causing risk seeking behavior. We argue that sunk costs may also result in risk aversion. In the present study we investigated the effect of time and effort investments (Behavioral Sunk Costs) on risky decision making in gain and loss situations. The results show that, in agreement with prospect theory, participants were more risk averse in gain situations than in loss situations. Moreover, incurring Behavioral Sunk Costs appeared to increase risk aversive choices, i.e., a reverse sunk cost effect.

Costs made earlier in time

↑ risk seeking

loss frame

⇒ risk behavior

Zeelenberg, M and van Dijk, E. (1997) Journal of Economic Psychology 18

Fear of losing>

20% OFF sitewide.
Use code: BLKFRIDAY

- Prospect Theory says that people evaluate potential changes in RELATIVE wealth, not in absolute wealth states.

- This is the most central idea in behavioral economics
- It will exert its influence in many key decisions.

reference dependence

When faced with a risky decision we think less about out bank account and more about weather we will be better or worse off afterward.

Loss Aversion and Endowment Effect

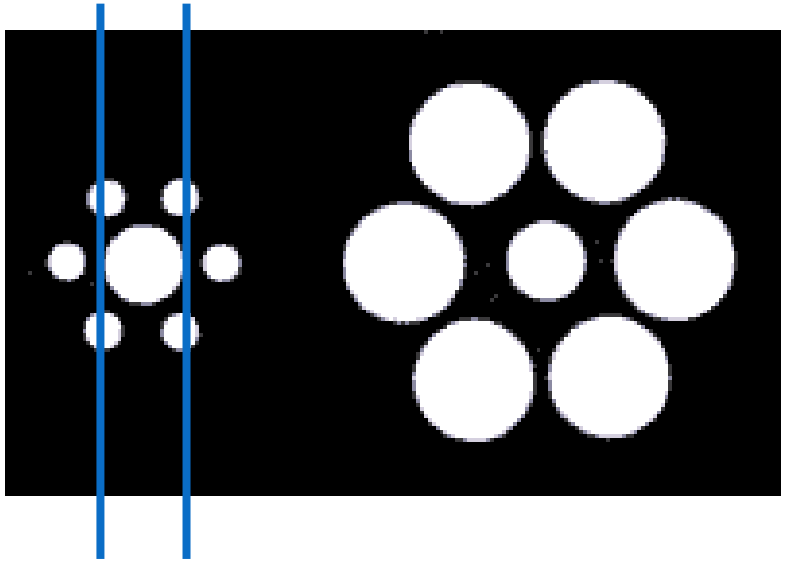
Dan Ariely

https://www.youtube.com/watch?v=YpiGVWO-C64

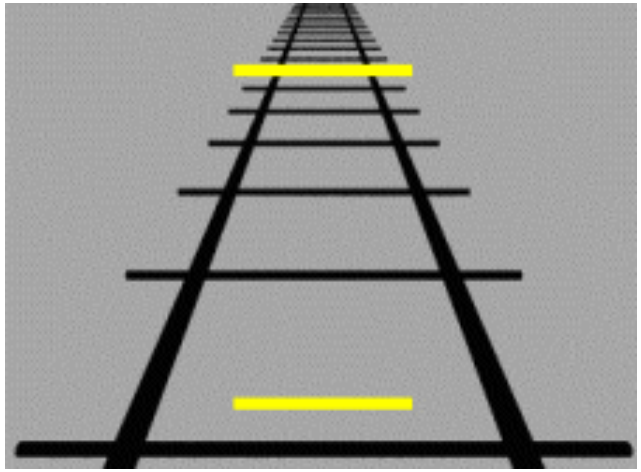
Everyday example of reference points

- Consumer's love sales!
- Marketers love sales because it is a reference point to the regular price
- *Not* saving money when buying something at 20% off.
- However, if one adopts the reference point of the merchandise as the regular price then the sale of 20% can seem psychologically like savings.

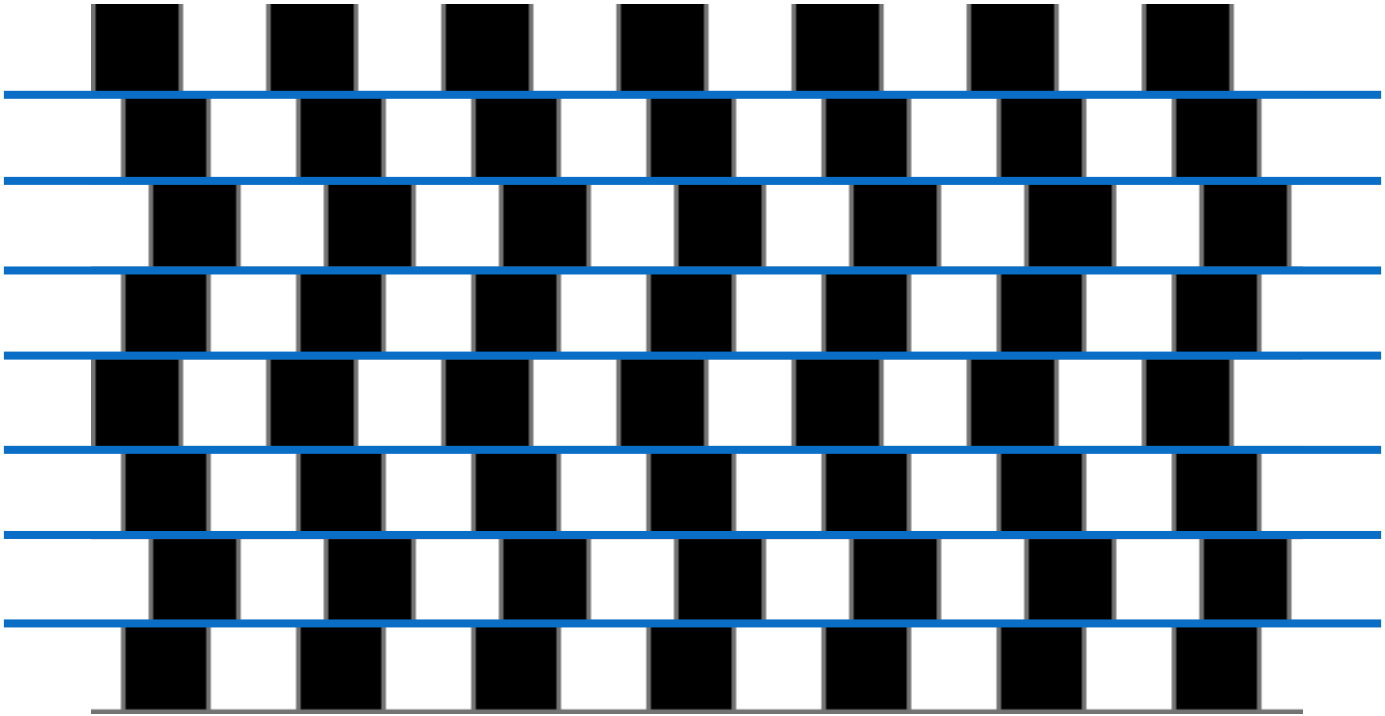
Is the left center circle larger?



Is the top yellow line longer?

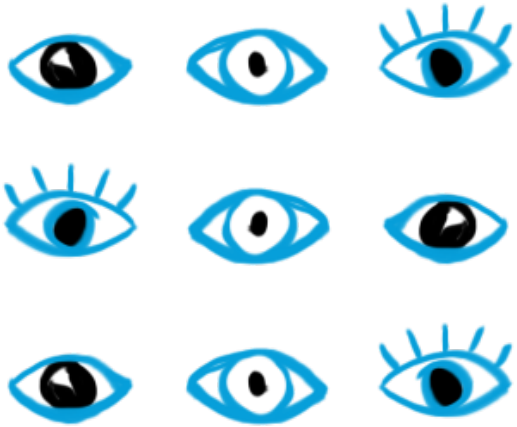


Are these lines straight or crooked?



How do you represent something with **sufficient range** to accommodate **big** numbers and **sufficient precision** to resolve differences between *small numbers*?

visual system solves this



Range representation problem

10,000,000:1

Humans can see over a light intensity range of several million to one.

Surface luminance levels

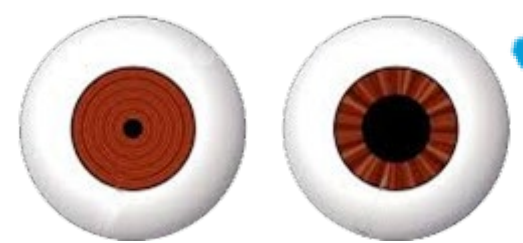
- Sunlight: 10^5 candelas/meter^2 (cd/m^2)
  - Approx. 10^{22} photons/m^2/sec
  - 3%-90% of photons are reflected as luminance
  - 3% for black surfaces, 90% for white surfaces
  - Only some of the reflected photons enter the pupil of eye
- Indoor lighting, CRTs: 10^2 cd/m^2
- Moonlight: 10^{-1} cd/m^2
- Starlight: 10^{-3} cd/m^2
- The eye can adjust to changes in light level by a factor of 100,000,000!
- Yet firing rates only typically range from 0-400Hz.

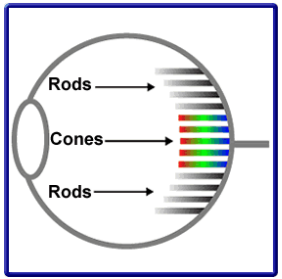
www.cns.nyu.edu/~david/courses/perception/lecturenotes/light-adapt/light-adapt.html

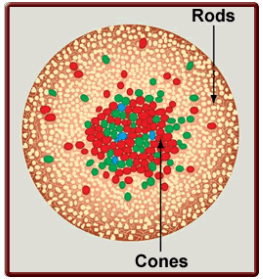
Mechanisms of light/dark adaptation

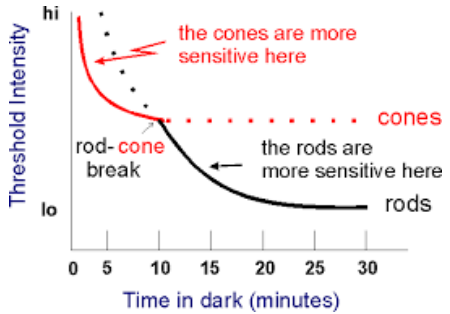
1. Pupil size
2. Switchover between rods and cones
3. Bleaching/regeneration of photopigment
4. Feedback from horizontal cells to control the responsiveness of photoreceptors

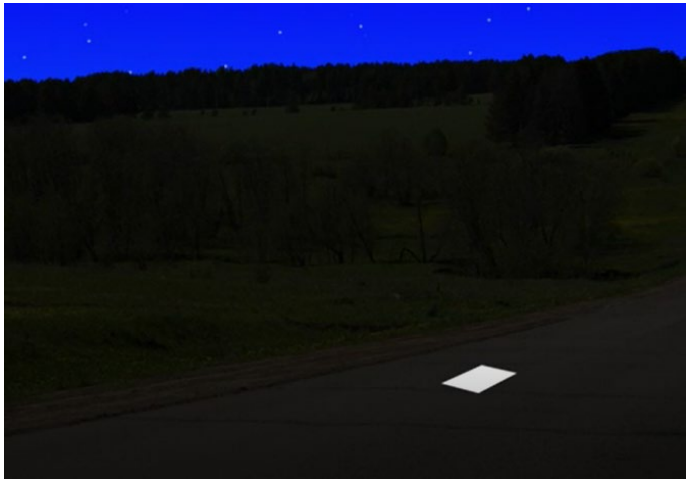
www.cns.nyu.edu/~david/courses/perception/lecturenotes/light-adapt/light-adapt.html

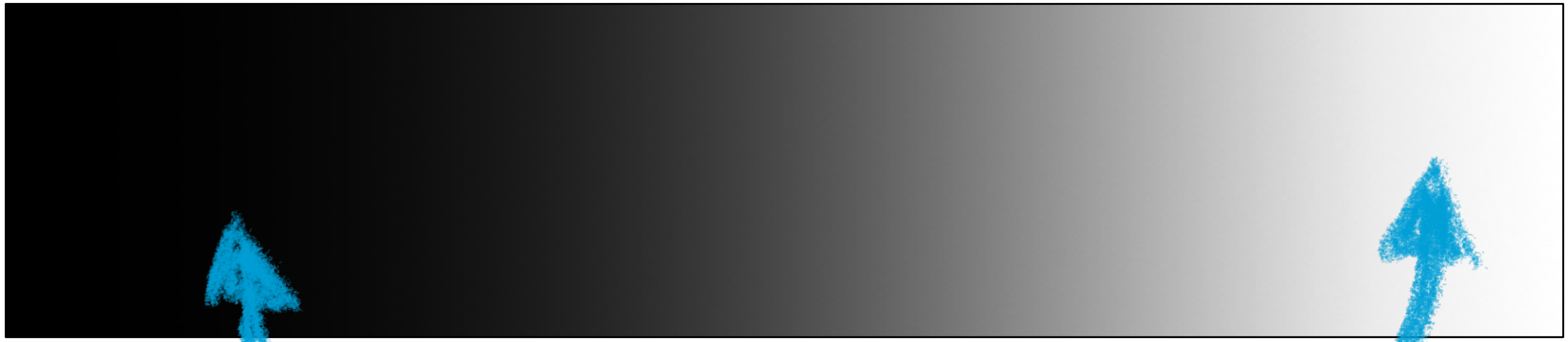












At night, tiny changes in absolute brightness change the neurons firing rate

During the day, in bright light, the reference point increases and greater changes in absolute brightness are required to alter the firing rate of a neuron.