

# Cognitive Biases in Engineering Organizations



**Jonathan Klein**  
@jonathanklein

**Talk Resources (Slides/Links)**

**<http://jkle.in/biases>**



# Who Am I?

# Who Am I?

- Senior performance engineer at Etsy

# Who Am I?

- Senior performance engineer at Etsy
- I write the Etsy Site Performance Reports

# Who Am I?

- Senior performance engineer at Etsy
- I write the Etsy Site Performance Reports
- I like figuring out why we believe what we believe

THINKING,  
FAST AND SLOW



DANIEL  
KAHNEMAN

WINNER OF THE NOBEL PRIZE IN ECONOMICS



# Cognitive Bias:

A deviation in judgement  
where inferences may be illogical

# System 1

Operates automatically and quickly,  
with little or no effort and no sense of  
voluntary control

# System 2

Allocates attention to the effortful mental activities that demand it, including complex computations

# System 1

Operates automatically and quickly,  
with little or no effort and no sense of  
voluntary control







5-10% of videos were upside-down

“It was designed for right-handed users,  
but phones are usually rotated 180 degrees  
when held in left hands.”



- Projection Bias
- Planning Fallacy
- Bandwagon Effect
- Sunk Cost Fallacy
- Hyperbolic Discounting
- Fundamental Attribution Error

# Part 1: A Fictional Story



**Sales Guy**



# Engineering Manager



# Software Engineer



**CEO**









## Sales Guy

Sells a feature that doesn't exist yet



## Engineering Manager

ROI is positive at < 6 weeks, thinks we can do it in 4



# Software Engineer

“Yeah, we can do that”

Two weeks of development...



# Software Engineer

“Oh sh\*t, we need 8 more weeks”



## Engineering Manager

“Let’s push forward, and hope we beat expectations”

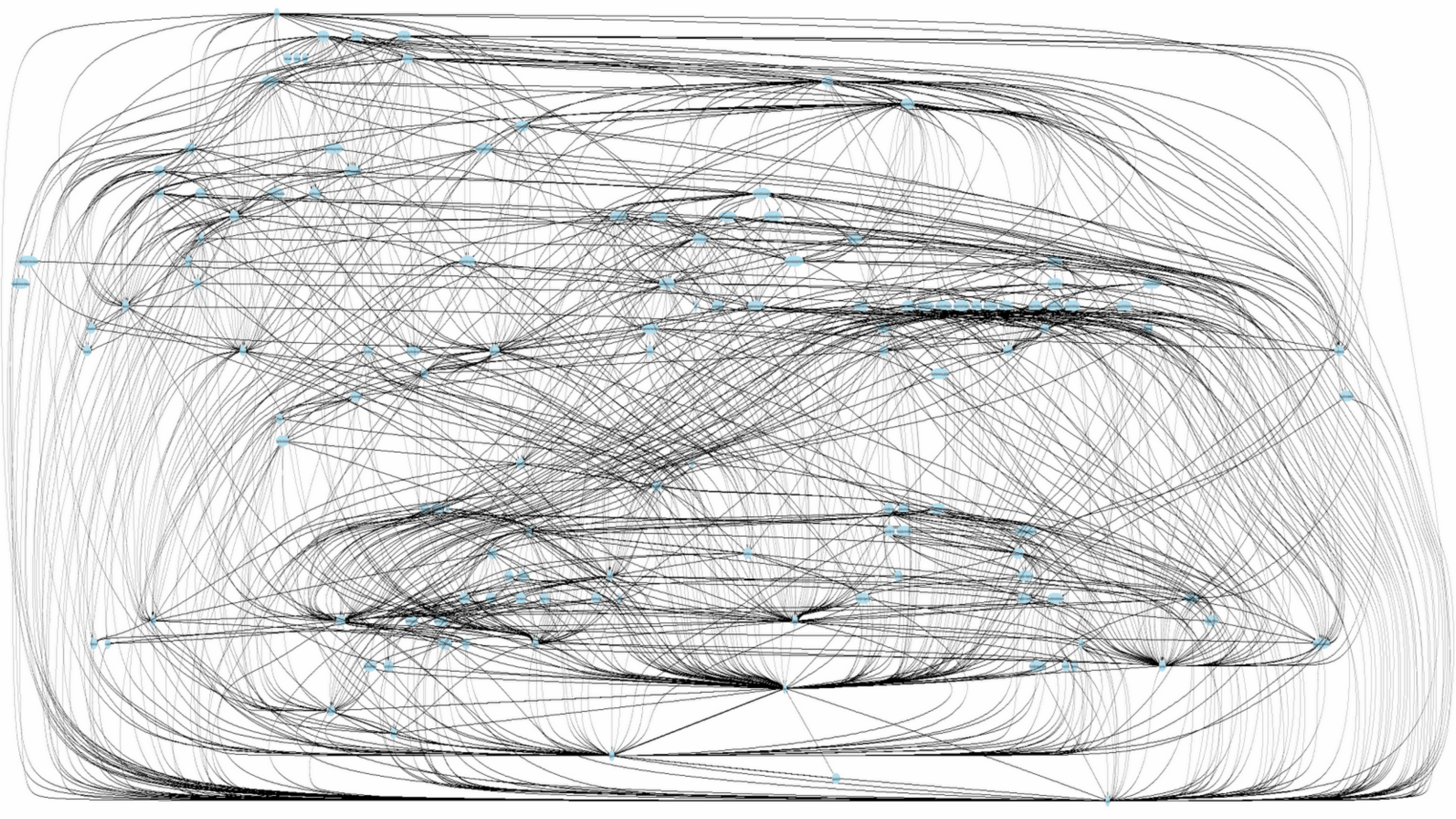


# Software Engineer

“Okay, we’ll cut some corners”

Six more weeks go by...







**CEO**

“Who do we need to fire?”

This could have been avoided

# Deconstructing the Story



## Sales Guy

Sells a feature that doesn't exist yet

# Projection Bias

One thinks that others have the same priority, attitude or belief that one harbors oneself, even if this is unlikely to be the case.

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☑ Empathy



# Projection Bias

One thinks that others have the same priority, attitude or belief that one harbors oneself, even if this is unlikely to be the case.

# Solution

- ☑ Empathy
- ☑ Have people switch roles



## Engineering Manager

ROI is positive at < 6 weeks, thinks we can do it in 4

# Planning Fallacy

The tendency for people to underestimate how long they will need to complete a task, even when they have experience of similar tasks over-running

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The tendency for people to underestimate how long they will need to complete a task, even when they have experience of similar tasks over-running

# Solution

- ☑ Prototyping
- ☑ Use information from similar ventures
- ☑ “Planning poker” exercise

# Planning Poker Cards









# Software Engineer

“Yeah, we can do that”

# Bandwagon Effect

The rate of uptake of beliefs, ideas, fads and trends increases the more that they have already been adopted by others

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- ☑ Ask for confidential feedback
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# Software Engineer

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## Engineering Manager

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# Solution

- ☑ Do some math

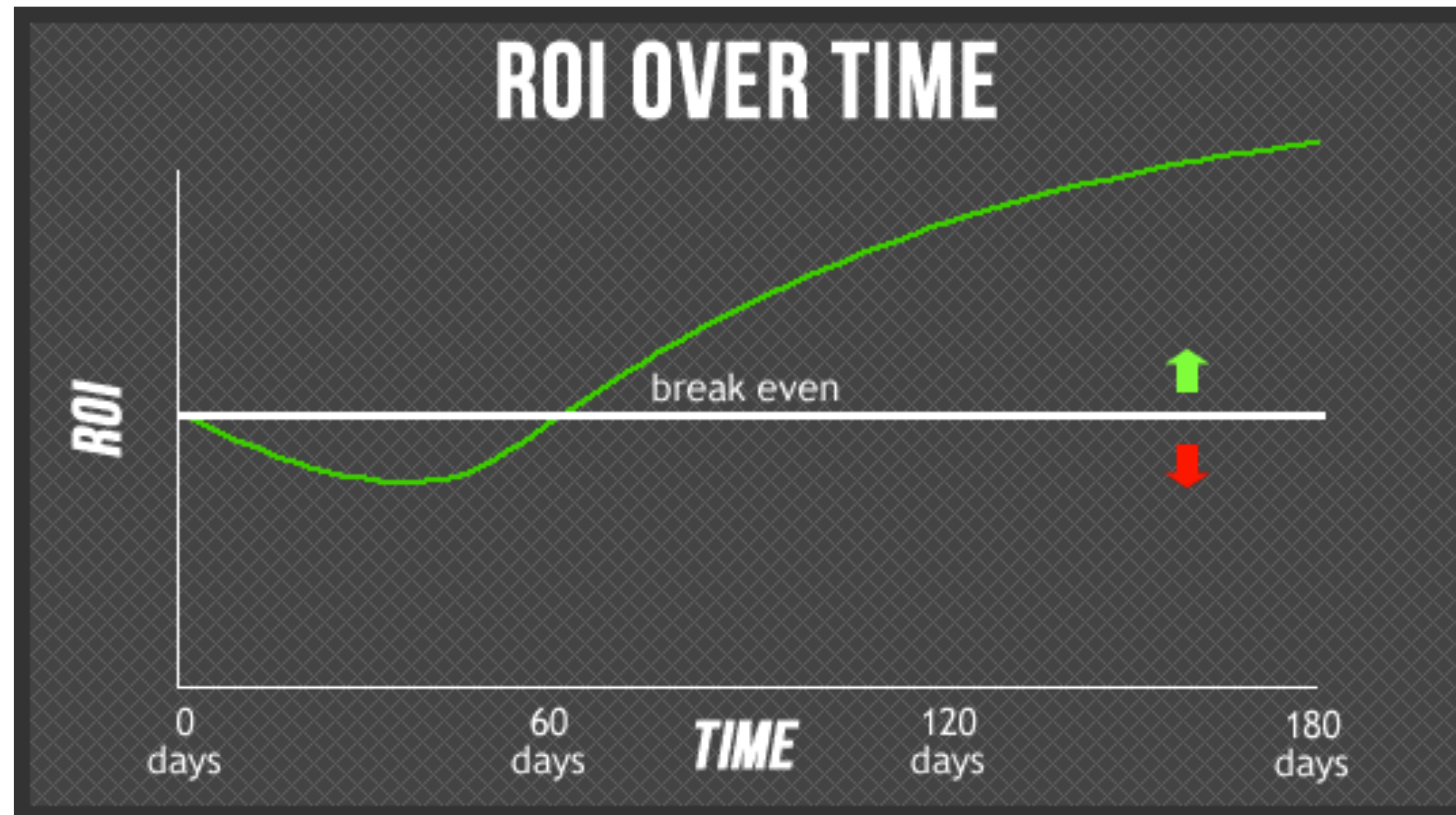
# Sunk Cost Fallacy

A sunk cost is a retrospective (past) cost that has already been incurred and cannot be recovered

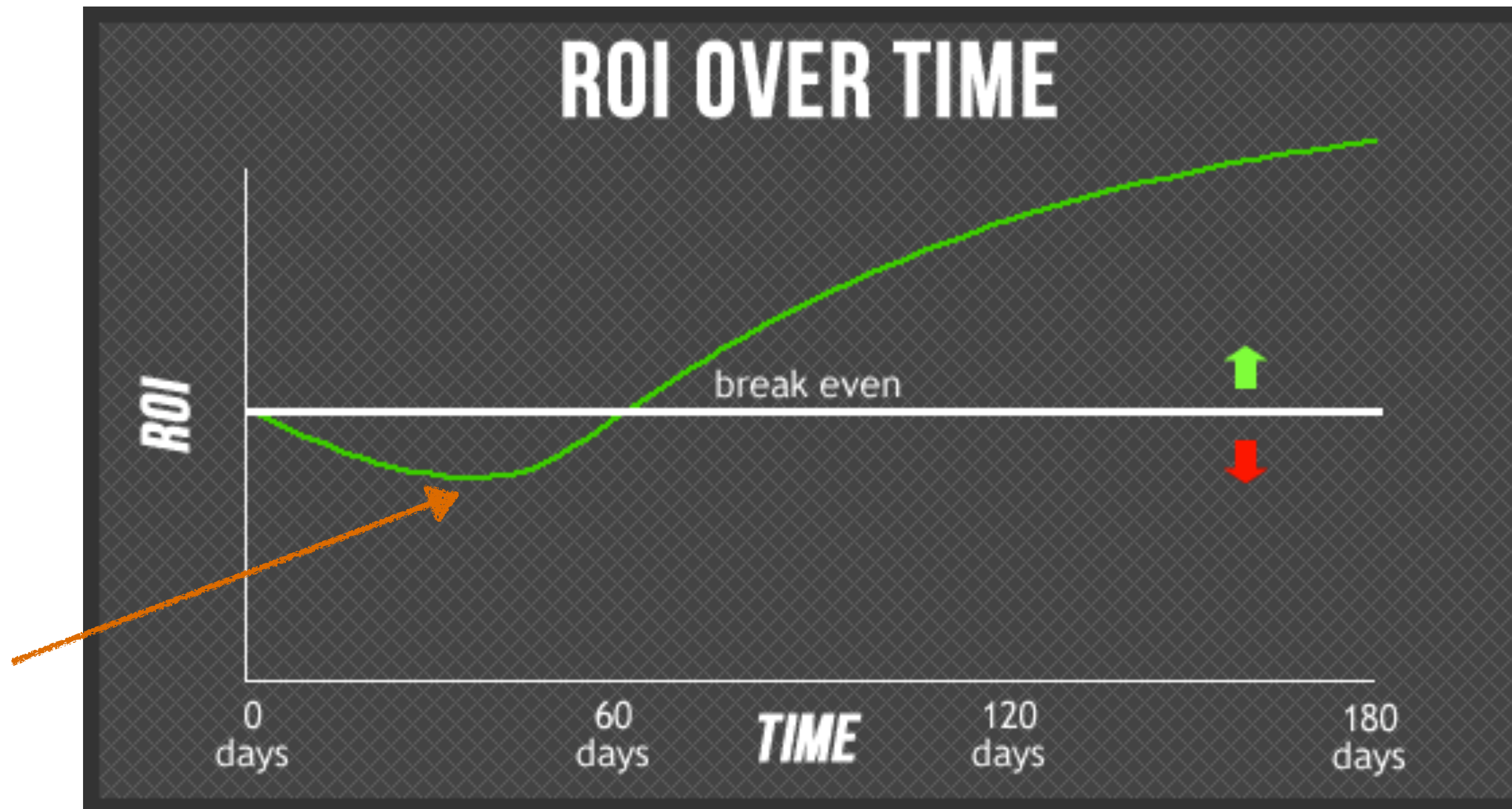
# Solution

- ☑ Do some math
- ☑ At every point in the project, the ROI should still be positive

# Return on Investment

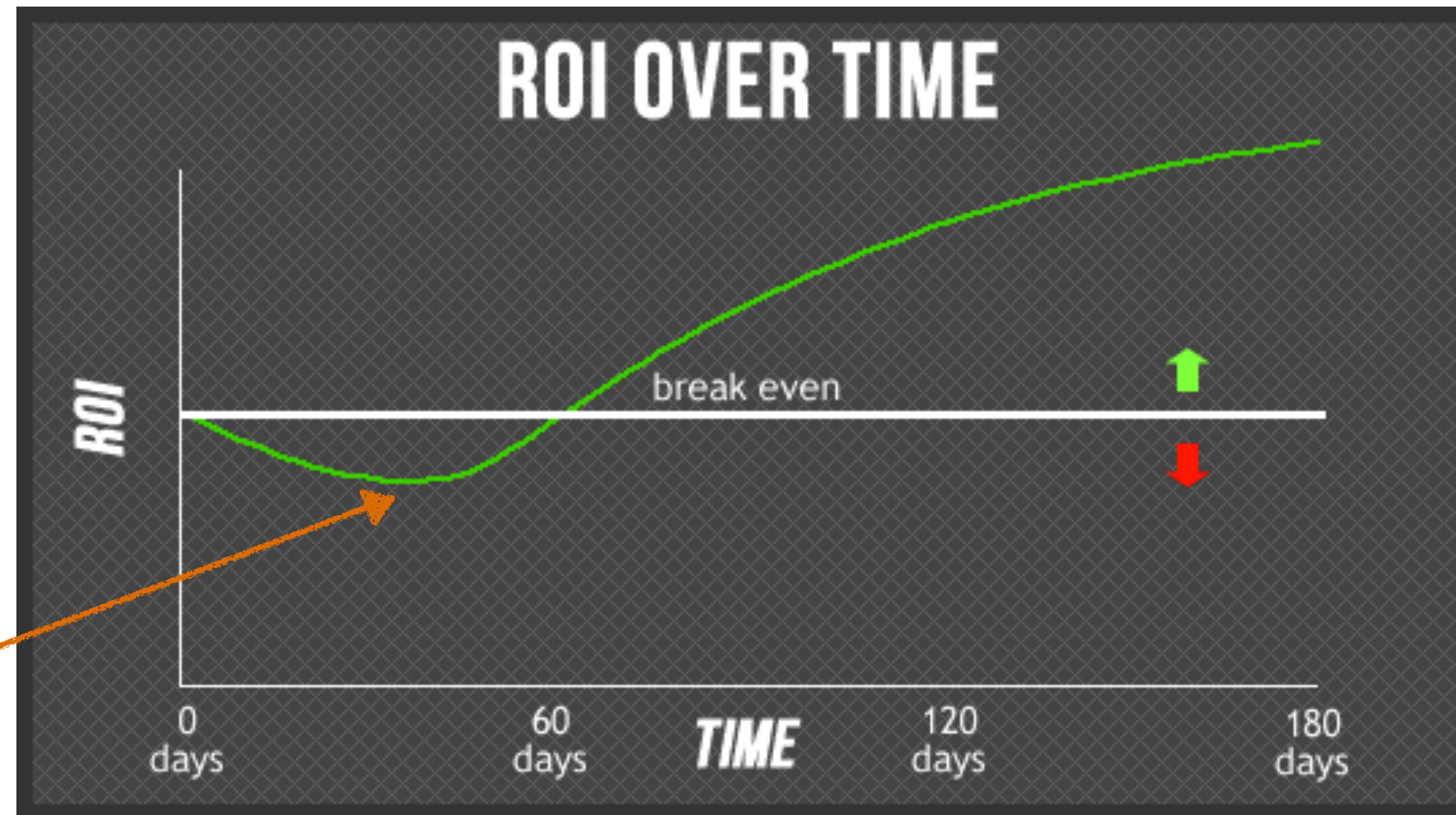


# Return on Investment





# Return on Investment



Project Completed

# Our Example

Estimated Development Time: **4 Weeks**

Estimated Development Cost: **\$8000**

Client Is Paying: \$12,000

# Our Example

Estimated Development Time: **8 Weeks**

Estimated Development Cost: **\$16,000**

Client Is Paying: \$12,000





Software Engineer  
“Okay, we’ll cut some corners”

# Hyperbolic Discounting

Given two similar rewards, humans show a preference for one that arrives sooner rather than later.

Humans are said to discount the value of the later reward, by a factor that increases with the length of the delay.

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- ☑ Deliberately stop and do an estimation exercise



# Hyperbolic Discounting

Given two similar rewards, humans show a preference for one that arrives sooner rather than later.

Humans are said to discount the value of the later reward, by a factor that increases with the length of the delay.

# Solution

- ☑ Deliberately stop and do an estimation exercise
- ☑ Consider implications for future developers

# The Stanford Marshmallow Experiment



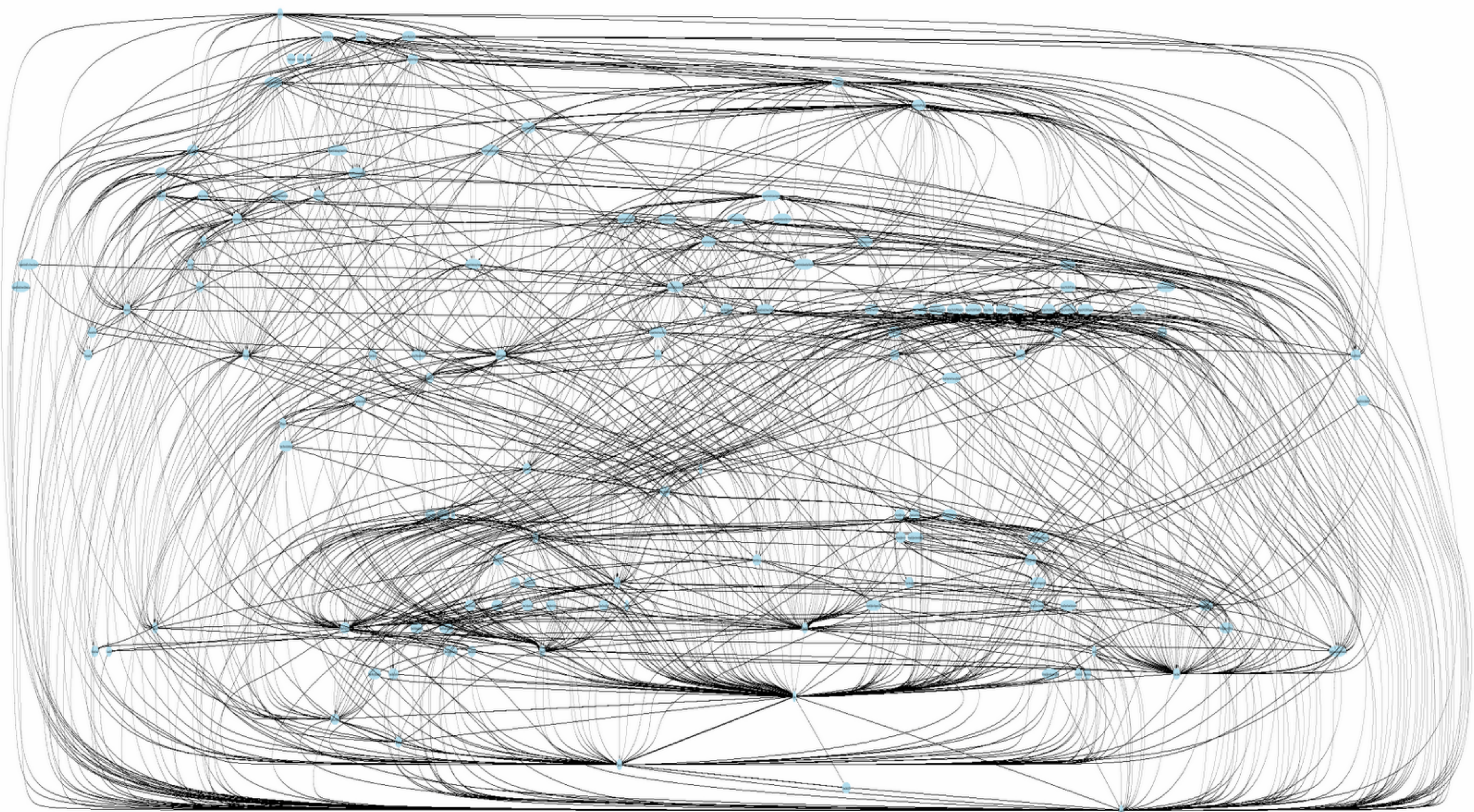




# Experimental Outcomes

Researchers found that children who were able to wait longer for the preferred rewards tended to have better life outcomes:

- SAT Scores
- Educational attainment
- Body Mass Index (BMI)





**CEO**

“Who do we need to fire?”



# Fundamental Attribution Error

People's tendency to place an undue emphasis on internal characteristics to explain someone else's behavior in a given situation, rather than considering external factors.

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People's tendency to place an undue emphasis on internal characteristics to explain someone else's behavior in a given situation, rather than considering external factors.

# Solution

- ☑ Blameless postmortems

Everyone had good intentions

# Our intuition is imperfect



# Our intuition is imperfect





# Part 2: Real Studies





# Which is More Dangerous?

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A disease that kills 1,286 people out of every 10,000

# Which is More Dangerous?

A disease that kills 1,286 people out of every 10,000

A disease that kills 24.4 out of 100

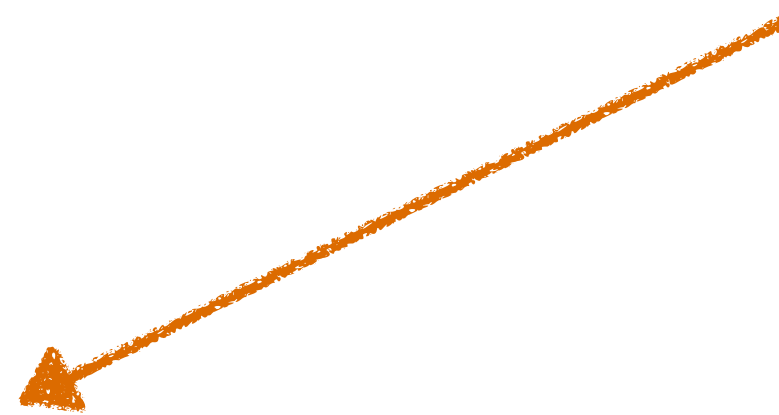
# Which is More Dangerous?

A disease that kills 1,286 people out of every 10,000

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# Which is More Dangerous?

Most people say this



A disease that kills 1,286 people out of every 10,000

A disease that kills 24.4 out of 100

# Which is More Dangerous?

Most people say this



A disease that kills 1,286 people out of every 10,000

A disease that kills 24.4 out of 100

This is twice as bad



# Denominator Neglect

# We Can't Always Trust Our Intuition



Set A: 40 Pieces

Set B: 24 Pieces

Dinner Plates

8, all good condition

8, all good condition

Soup/Salad bowls

8, all good condition

8, all good condition

Dessert plates

8, all good condition

8, all good condition

Cups

8, 2 broken

None

Saucers

8, 7 broken

None

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None

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None

# Three Groups in the Experiment

1. Shown both sets together
2. Shown only set A
3. Shown only set B

## Group 1 - Joint Evaluation:

Set A: \$32

Set B: \$30



# Groups 2 and 3 - Single Evaluation:

## Groups 2 and 3 - Single Evaluation:

Set A: \$23

Set B: \$33

Set A: 40 Pieces

Set B: 24 Pieces

Dinner Plates

8, all good condition

8, all good condition

Soup/Salad bowls

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Dessert plates

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8, 2 broken

None

Saucers

8, 7 broken

None



**Manipulation**



# Subscriptions to The Economist

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1. A web-only subscription for \$59

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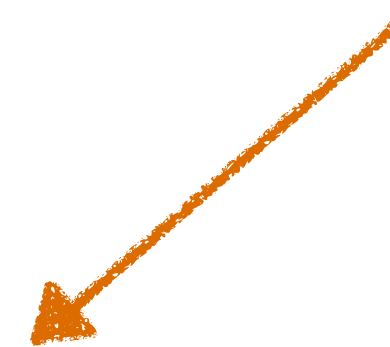
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Useless



# Subscriptions to The Economist

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Removing the middle option costs

\$3400+ per 100 subscribers

Based on 2013 circulation, this could  
cost The Economist \$53M



What's the best way to sell a \$3,000 suit?

What's the best way to sell a \$3,000 suit?

Put it next to a \$10,000 suit

# Simple Pricing

All plans are standard with **solid state drives** (SSD).

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Multiple Page Deployment

SAML & LDAP Support

# Pricing Guide

Slack is free to use for as long as you want and with an unlimited number of people.

[Sign up for Free](#)

Lite	Standard	Plus	Enterprise
\$0	\$6 <sup>67</sup>	\$12 <sup>50</sup>	\$49-99
no limits on users / time	per user / month when paid annually	per user / month when paid annually	per user / month when paid annually

Coming in 2015

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10,000 message searchable archive

5 external integrations

Fully searchable archive with **unlimited** messages

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Coming in 2015

Available Today

10,000 message searchable archive

5 external integrations

Fully searchable archive with **unlimited** messages

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# Revisiting the Sunk Cost Fallacy

# It Preys on Loss Aversion

# Another Experiment



\$0.01



\$0.15

# Another Experiment



\$0.01



\$0.15

Most people choose this

# Lower the Price



Free!



\$0.14



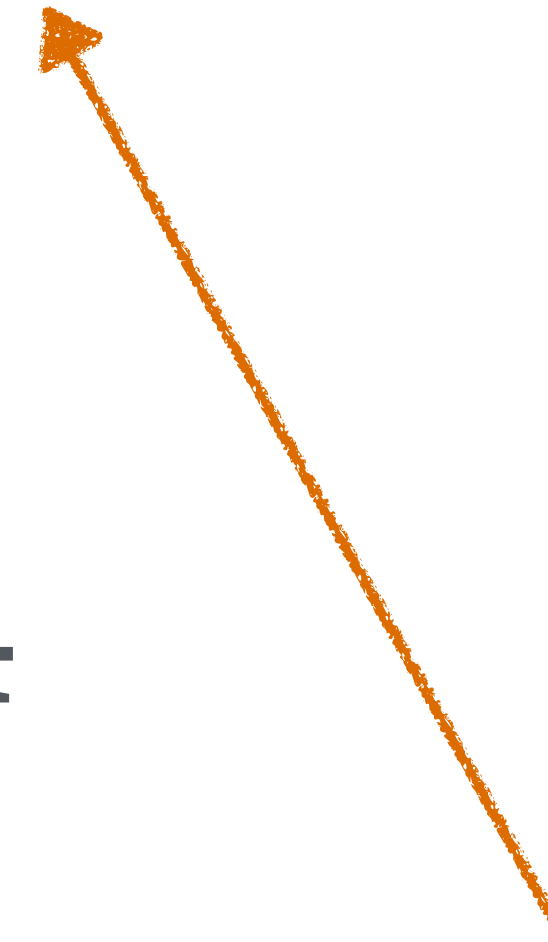
# Lower the Price



Free!



\$0.14



Most people choose this



We need a framework for decision making

# Bayesian Reasoning

# Bayes' Theorem

$$P(A | B) = \frac{P(B | A)P(A)}{P(B)}$$

1. Anchor your judgement of the probability of an outcome on a plausible base rate

2. Question the importance and relevancy of your evidence



## Engineering Manager

ROI is positive at < 6 weeks, thinks we can do it in 4



“What is the base rate for estimation accuracy?”

“Why is this situation different?”

# Will I succeed

with my startup?

by Anna Vital & Vlad Shyshov

In a startup absolutely nothing happens  
unless you make it happen.

- Marc Andreessen  
Co-Founder, Andreessen Horowitz

of all new products  
succeed.

10%



# Succeed

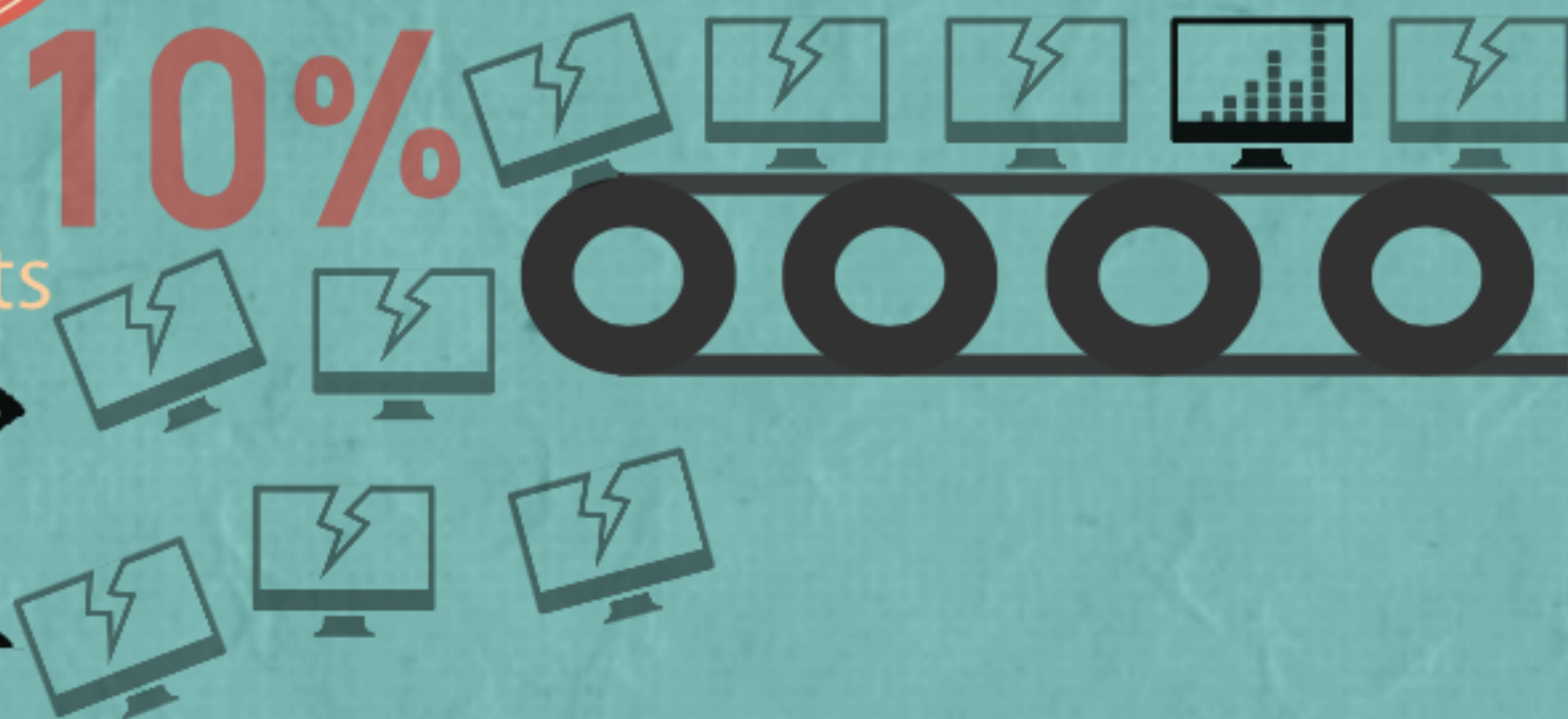
## with my startup?

by Anna Vital & Vlad Shyshov

- Marc Andreessen  
Co-Founder, Andreessen Horowitz

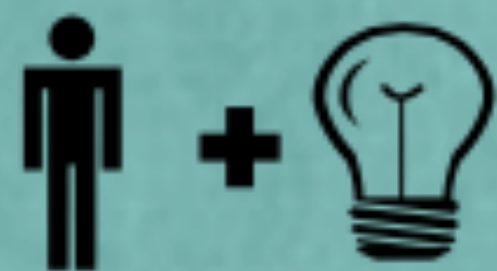
of all new products  
succeed.

# 10%



## Startup Entrepreneur Success Rate

### THE FIRST-TIMER



1st-time entrepreneur 1st startup

# 18%

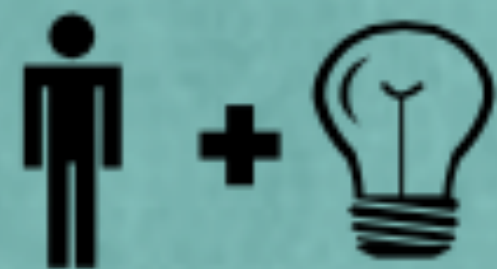
of all new products succeed.



10%

## Startup Entrepreneur Success Rate

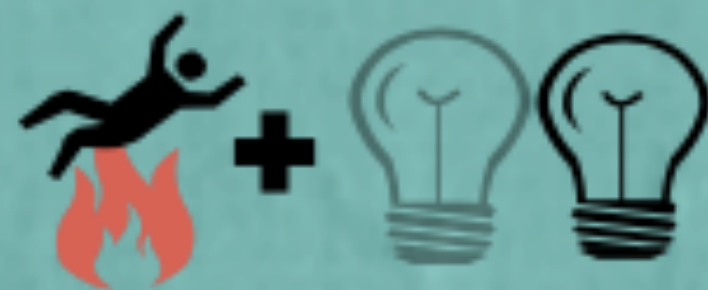
### THE FIRST-TIMER



18%


1st-time entrepreneur 1st startup

### THE REPEAT PLAYER



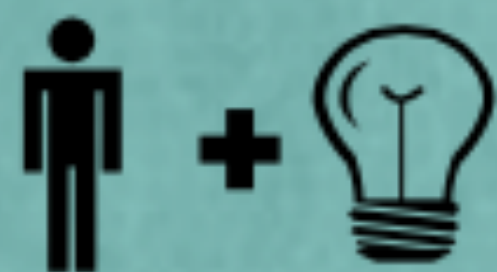
20%

Failed 1st-time entrepreneur success with next startup



# Startup Entrepreneur Success Rate

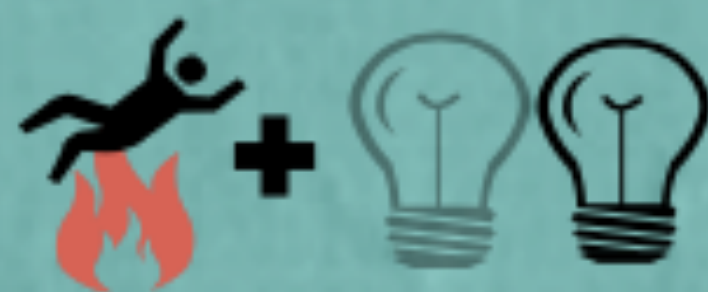
## THE FIRST-TIMER



18%

1st-time entrepreneur 1st startup

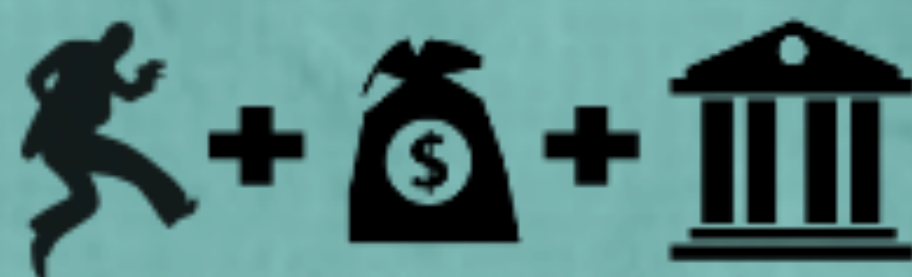
## THE REPEAT PLAYER



20%

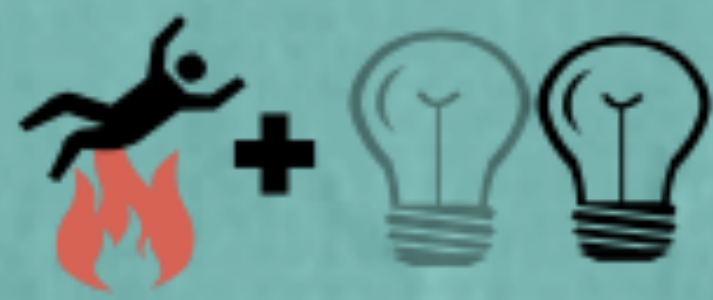
Failed 1st-time entrepreneur success with next startup

## THE VETERAN



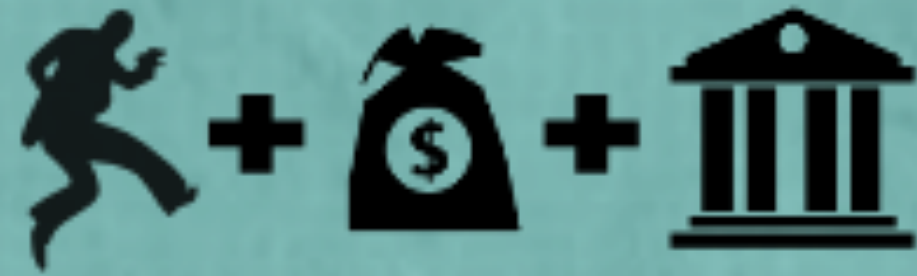
30%

VC- backed entrepreneur who IPO'd success with next startup



Failed 1st-time entrepreneur success with next startup

## THE VETERAN



VC- backed entrepreneur who IPO'd success with next startup

## THE WISDOM

Most entrepreneurs, even veterans, will fail.  
But the more you try, the more likely you are to succeed.

So keep doing your startup.

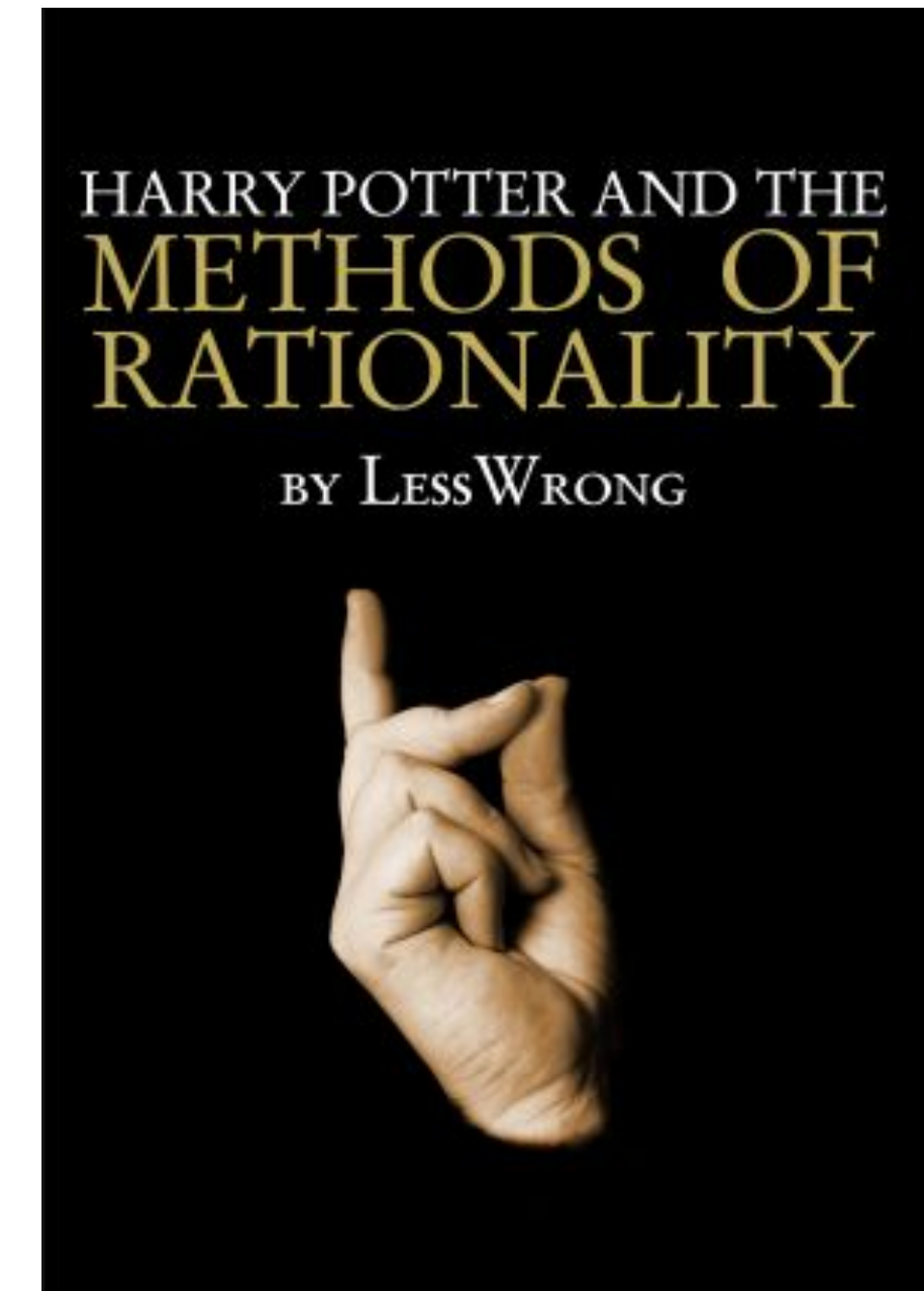
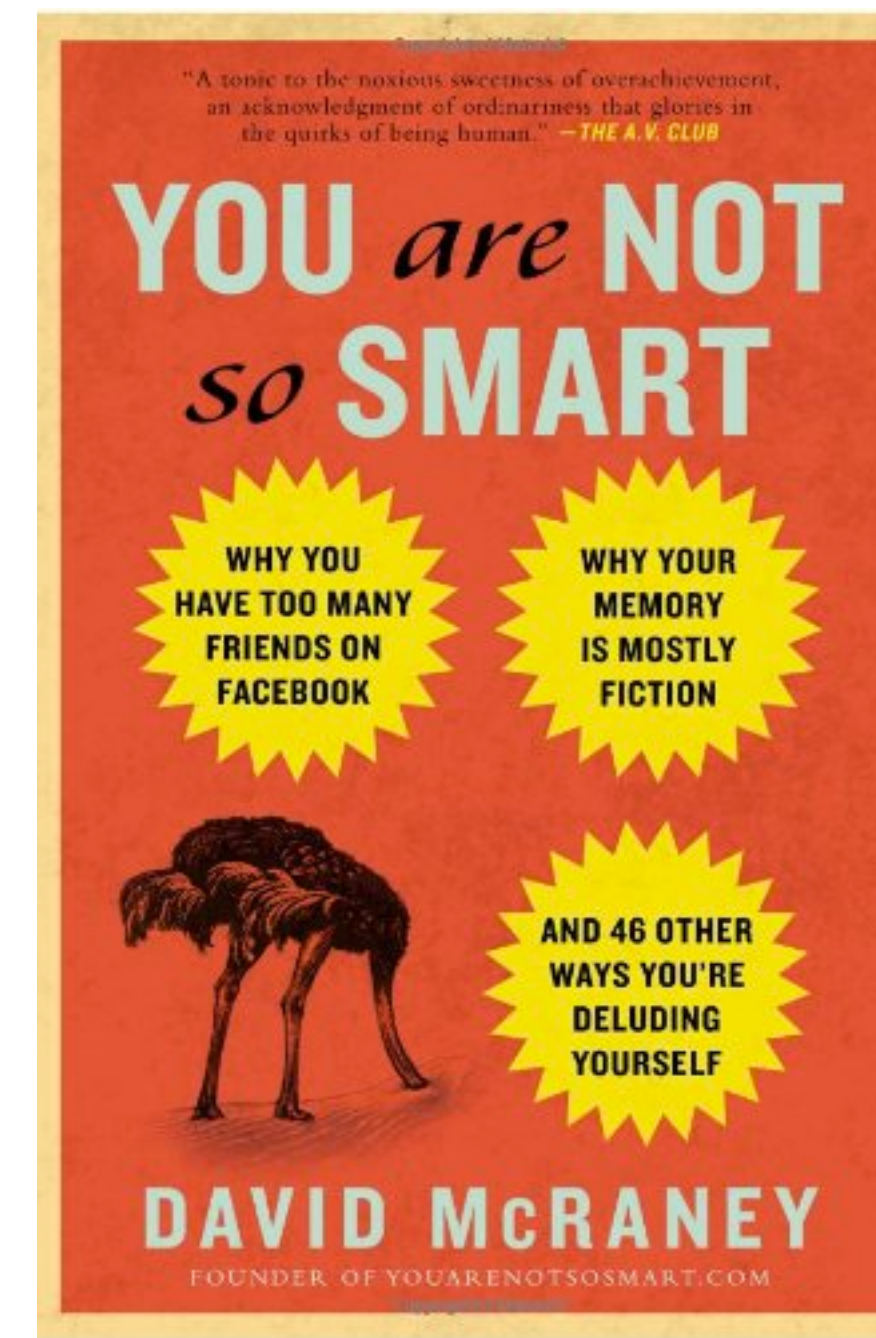
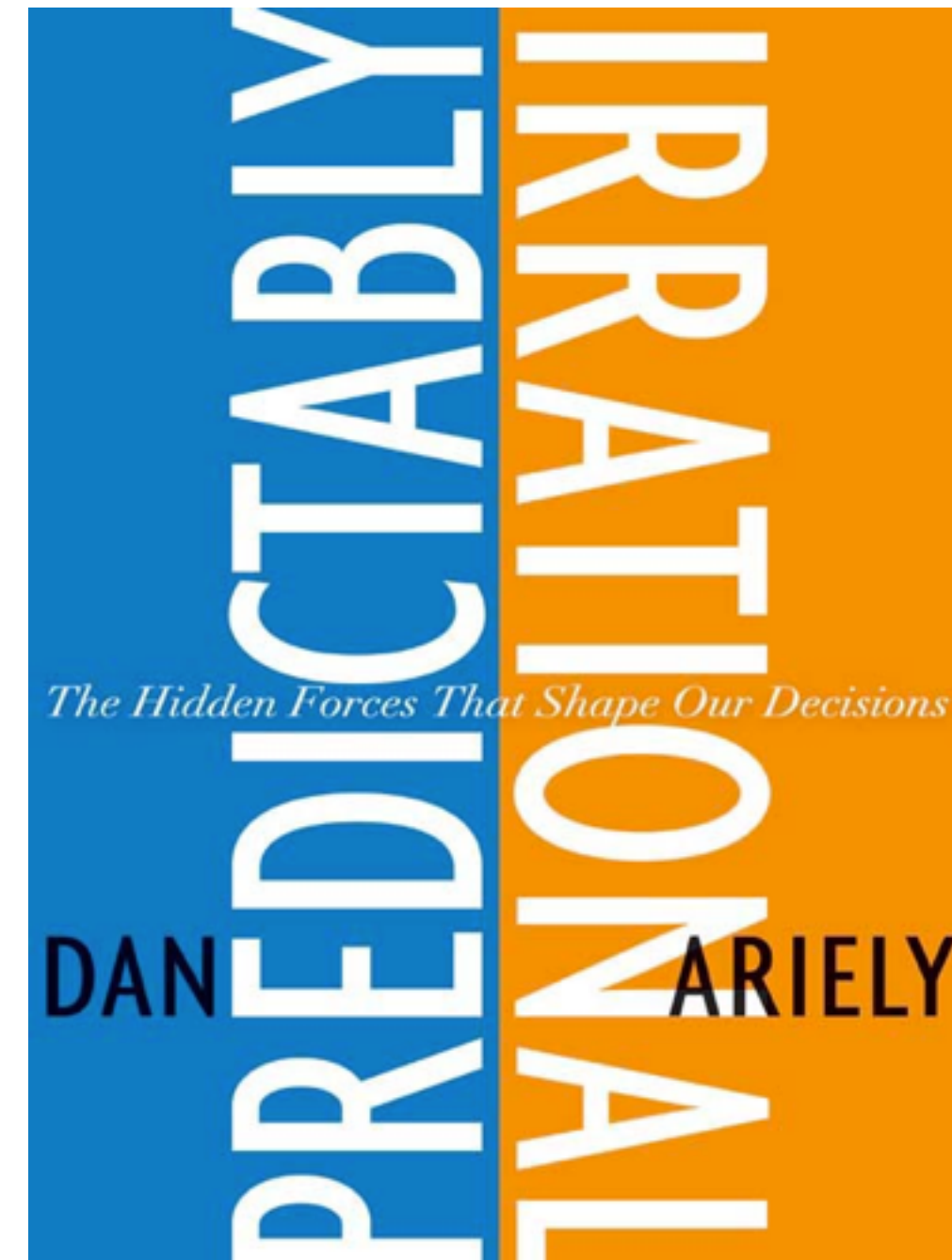
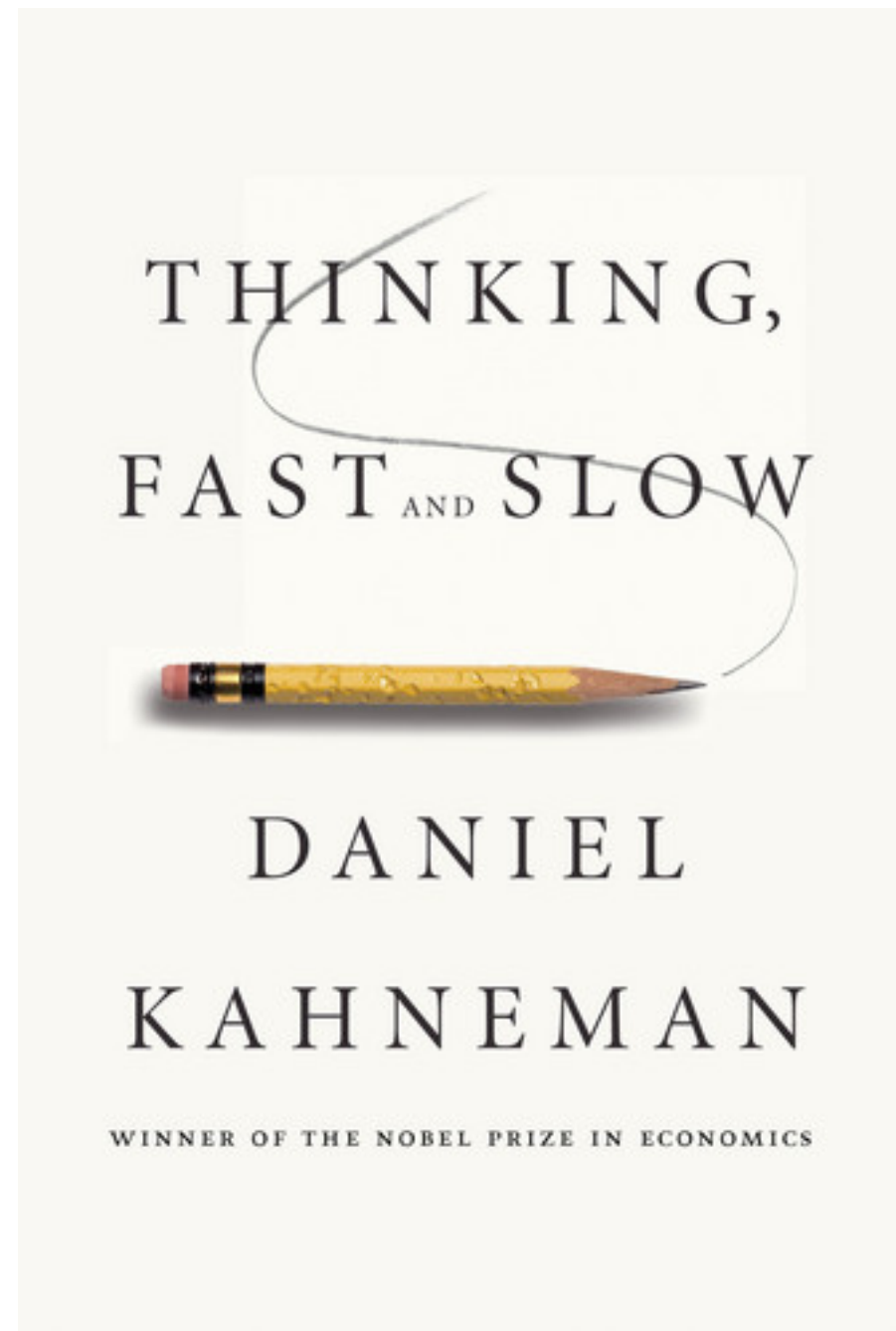
FundersandFounders.com

To make rational decisions, you must understand  
the base rate



You must also objectively evaluate the evidence  
for departing from the base rate

Two Principles: Dramatically better decisions



[jkle.in/biases](http://jkle.in/biases)

# Thanks!

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