

# **Agents Behaviour**

## **Part iii**

### **Bias and learning**



**Couldn't find a decent meme about learning, here's a puppy instead**

# Learning outcomes

Learn findings from **behavioural economics**

See **cognitive bias** examples

Compare different **learning mechanisms**



# “Thinking, fast and slow”

**Cognitive psychology** says we have two ways of thinking:

**Reasoning:** slow, voluntary, controlled, effortful, serial

**Intuition:** fast, spontaneous, associative, effortless





**What is this?**



**What's the most common pet after dogs?**

# **“Irrational” individual behaviour**

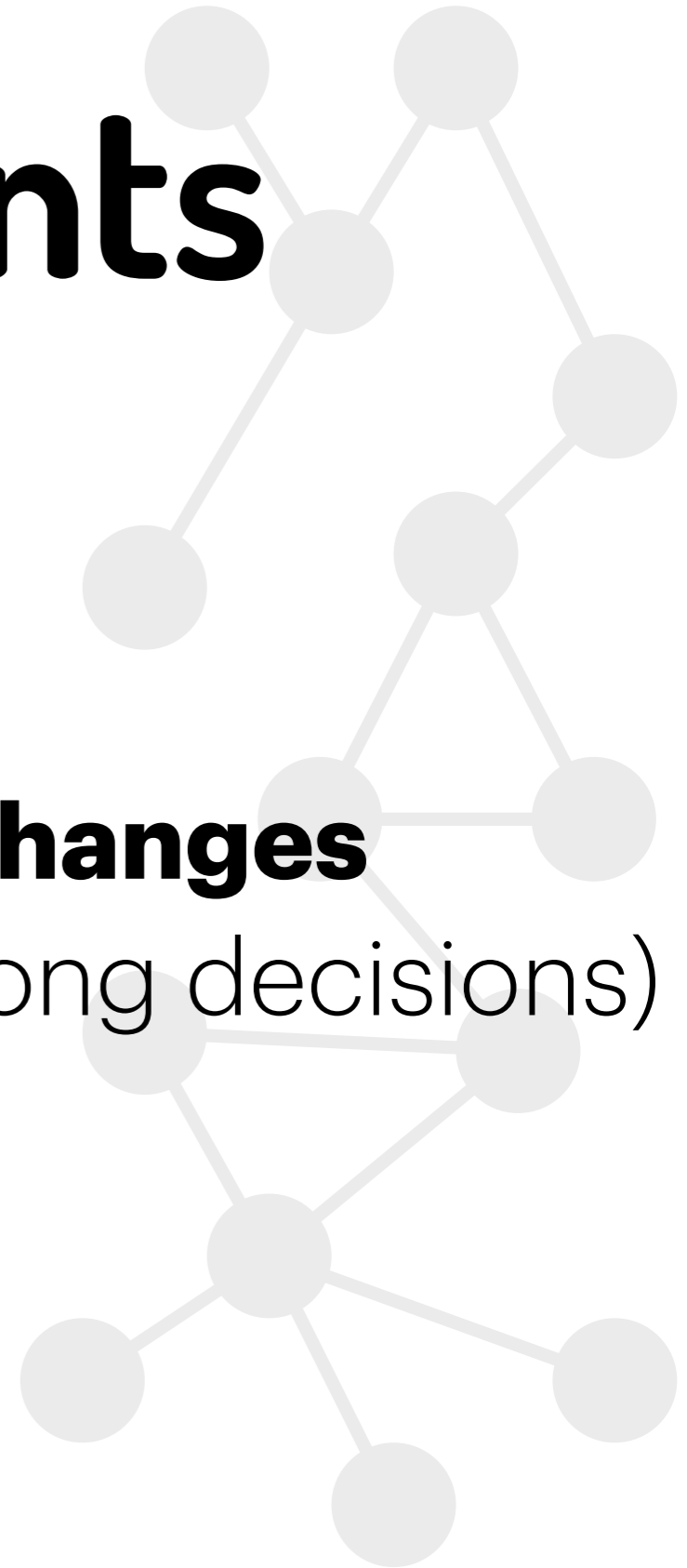
**Framing effect and risk preferences**



# Reference points

**We are more susceptible to changes**

(And because of this we make the wrong decisions)





Small

\$3



Large

\$7





Small

\$3



Medium

\$6.5



Large

\$7



**HGTV**

# **PROPERTY BROTHERS**

**SEASON 7**

# Examples



£200k

# Examples

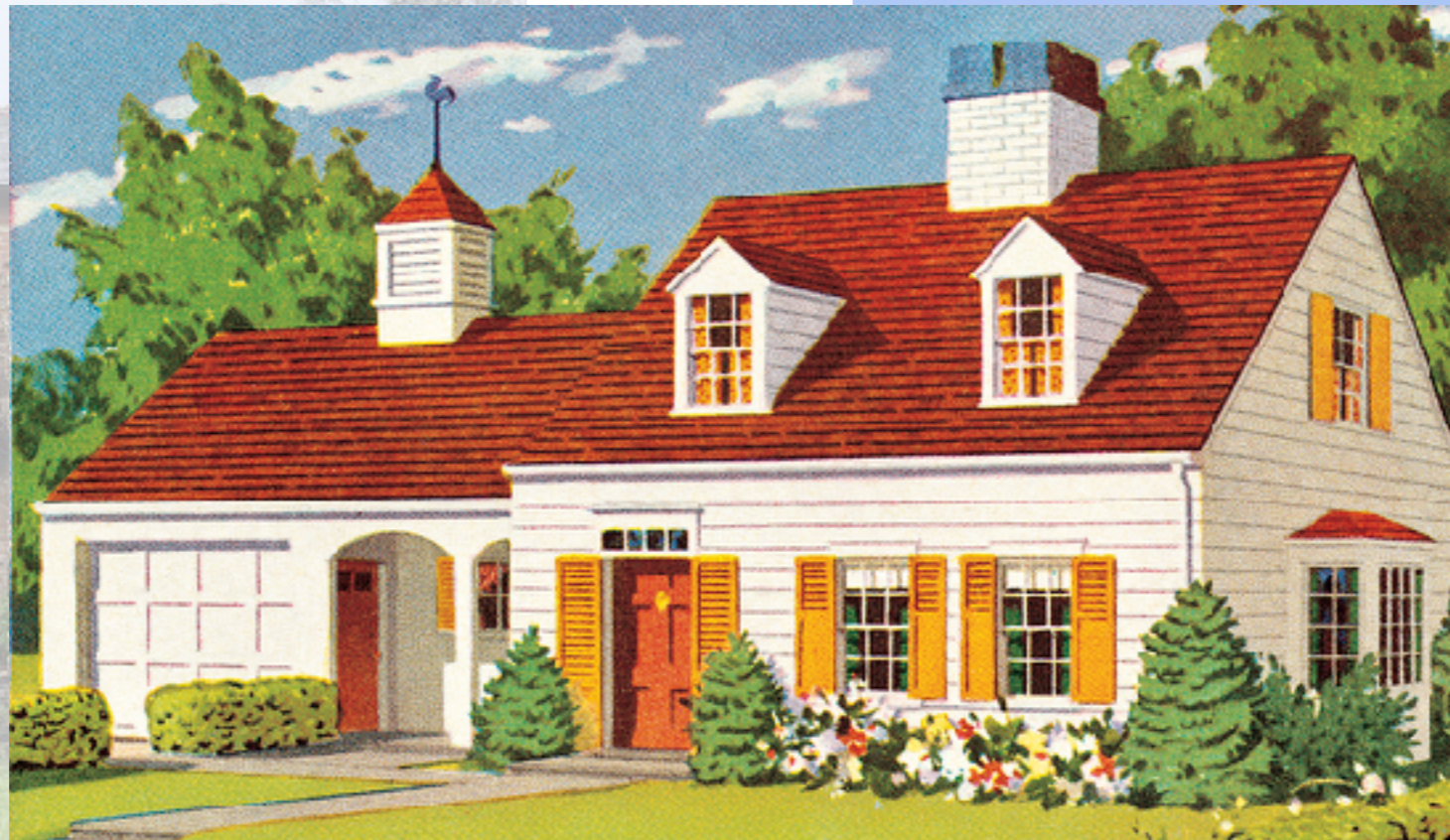


£200k



£600k

# Examples



£200k

£300k

£600k

# The economist experiment



# The economist experiment



Digital only subscription \$59

The Economist  
Russian meddling, British complacency  
Tik Tok's time runs short



Print only subscription \$129

Free money  
When government spending knows no limits



Print+digital subscription \$129

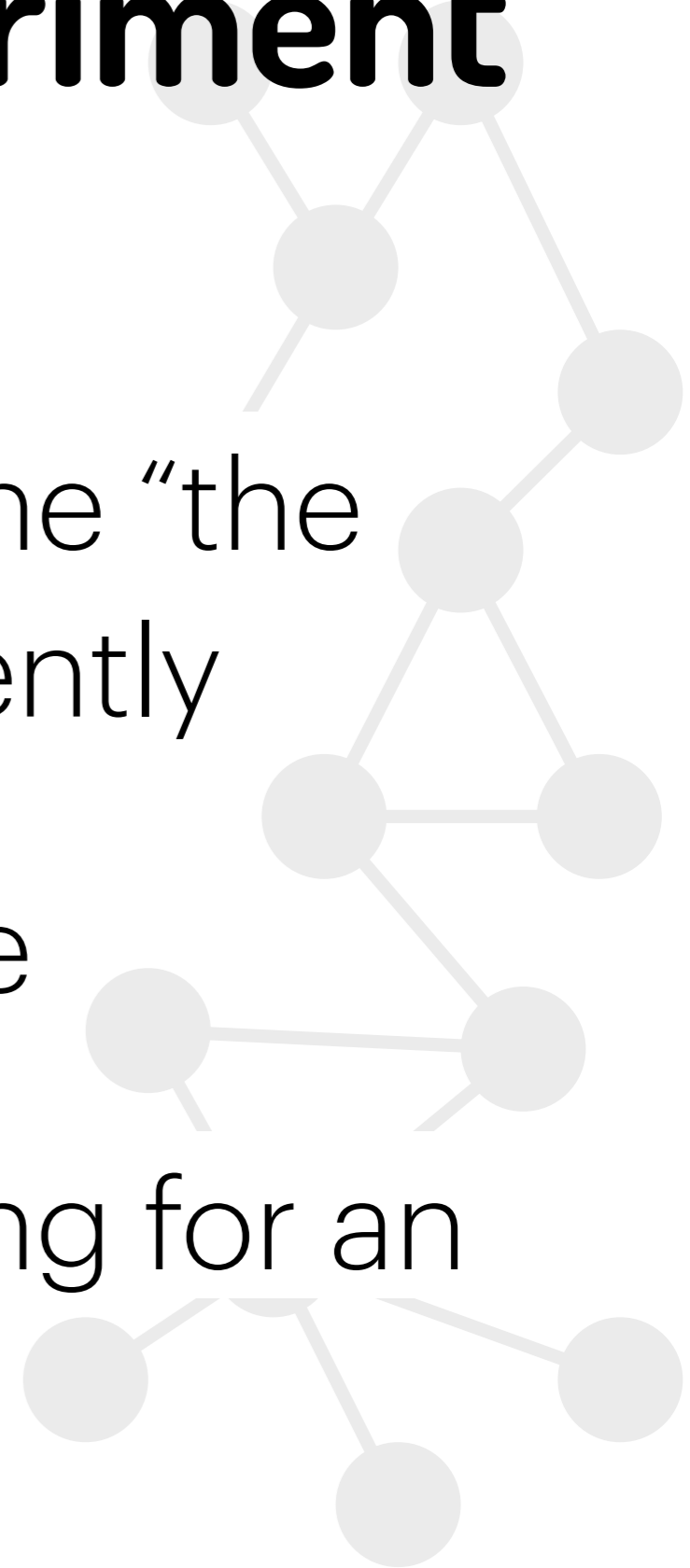


# The economist experiment

Pricing of the famous magazine “the economist” is changed frequently

Some prices are unreasonable

Prof. Dan Ariely used this setting for an experiment with his students





# The economist experiment

Digital only subscription \$59

Print+digital subscription \$129

The e...ment

68% chose

digital only

32% chose

print+digital

Digi

59

Print+digital subscription \$129

The e... ment

68% chose  
digital only  
32% chose  
print+digital

Digi

59

Print

Total revenue =  
\$8,012

129

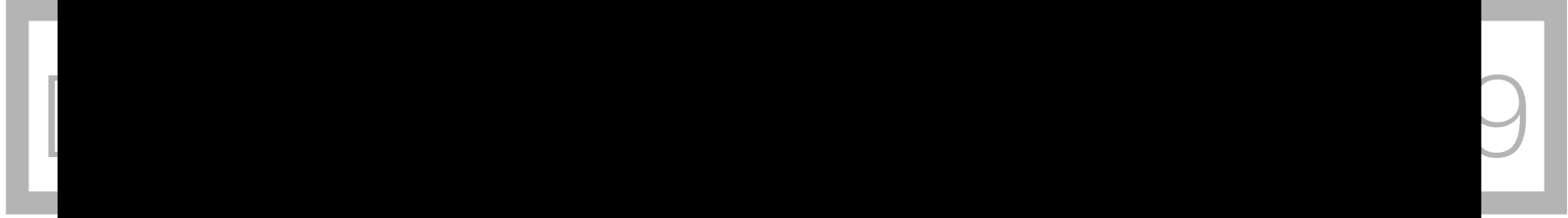
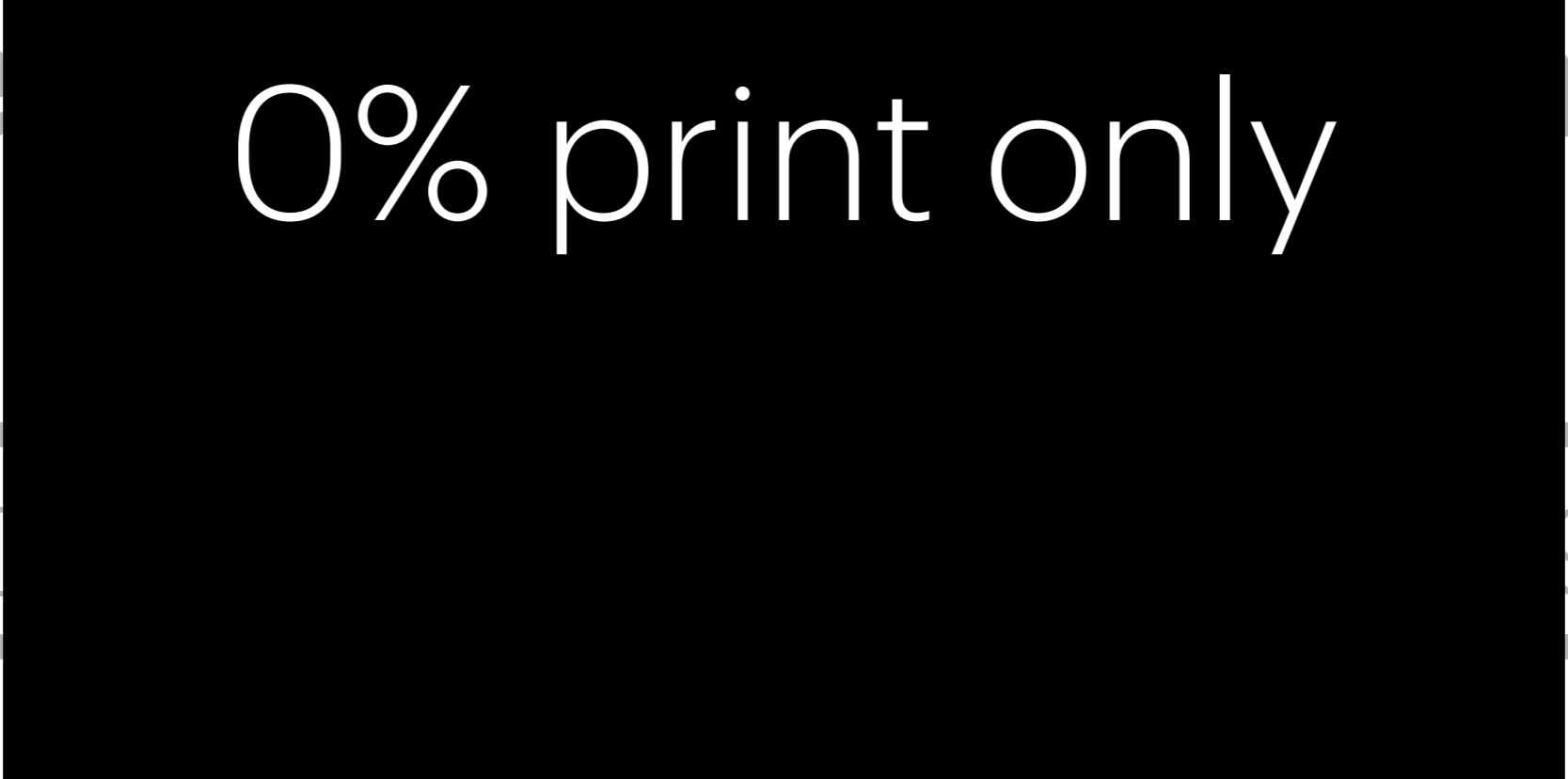
# The economist experiment

Digital only subscription \$59

Print only subscription \$129

Print+digital subscription \$129

The **0% print only** ment



Print only subscription \$129

Print+digital subscription \$129

The ent

0% print only  
16% digital only  
84% print+digital

P 29

Total revenue =  
\$11,444

Print+digital subscription \$129

# The economist experiment

43% revenue  
boost!!!

Print+digital subscription \$129

The

ment

If I prefer

**a over b,**

and

**b over c,**

I will prefer


**a over c**



# Beware... the decoy effect



consumers will tend to have a **specific change in preference** between two options when also presented with a third option that is **asymmetrically dominated**.



# Examples

Candidate A

Candidate B

Candidate C



Voters' Perceptions

Strong on national security

+++

+++

++

Fresh face in Washington

+++

+

+

Chances of winning the election

+++

+++

+

# Examples

Candidate A

Candidate B

Candidate C



Voters' Perceptions

Strong on national security

+++

+++

++

Fresh face in Washington

+++

+

+

Chances of winning the election

+++

+++

+

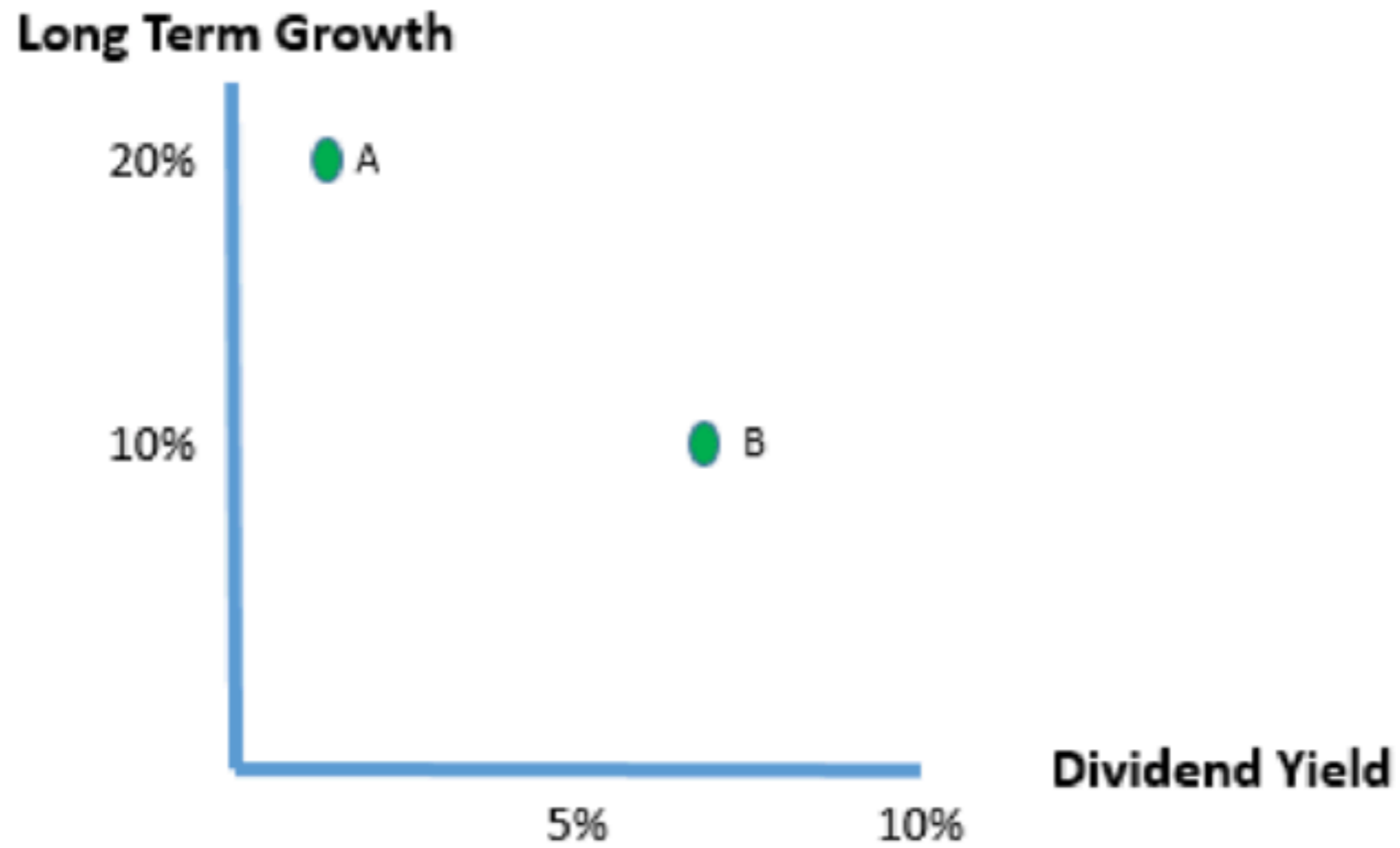
# Examples

**Stock A:** long-term growth 20% - dividend yield 2%

**Stock B:** long-term growth 10% - dividend yield 7%

# Examples

## Situation 1



# Examples

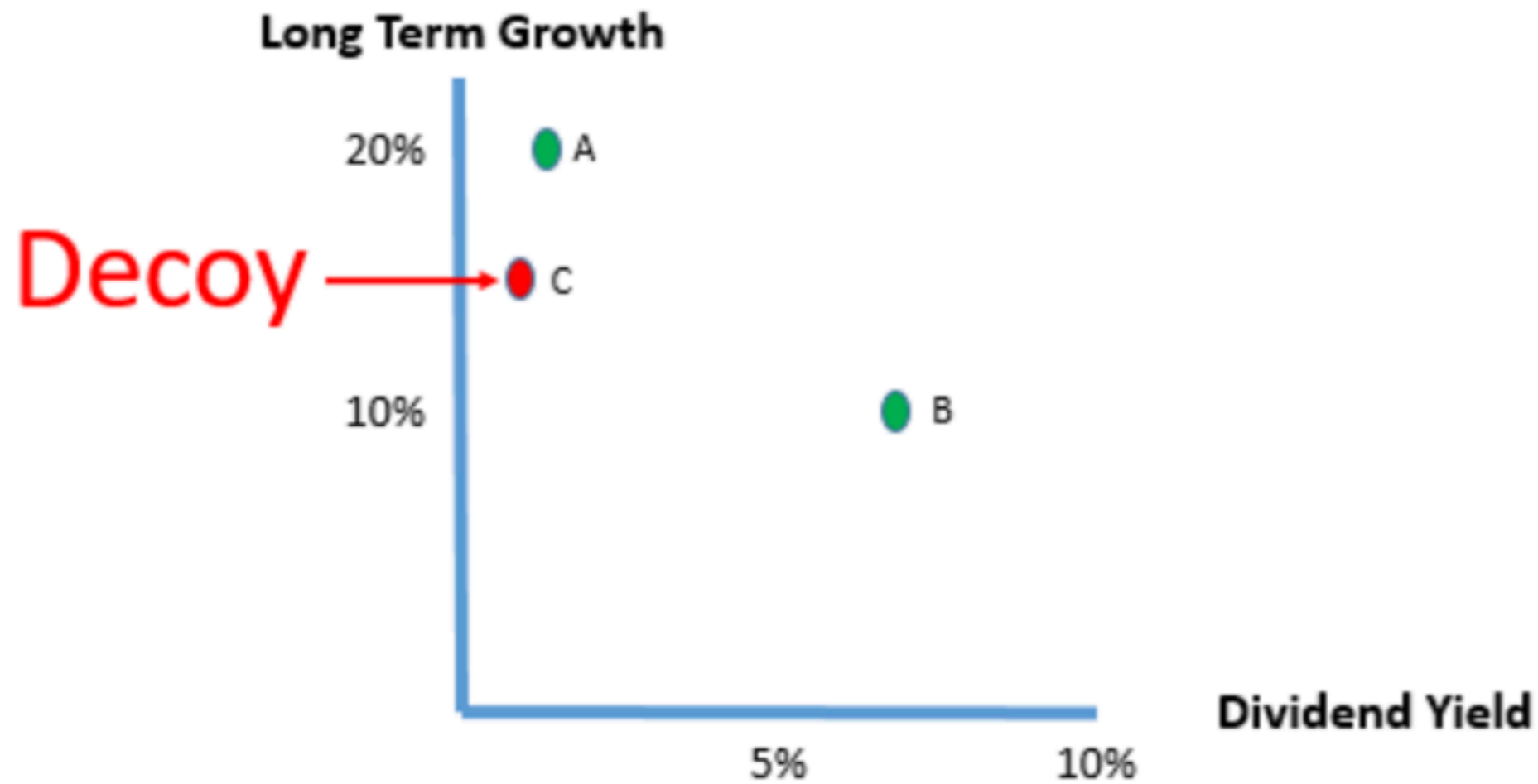
**Stock A:** long-term growth 20% - dividend yield 2%

**Stock B:** long-term growth 10% - dividend yield 7%

**Stock C:** long-term growth 15% - dividend yield 1%

# Examples

## Situation 2



# Examples

**Stock A:** long-term growth 20% - dividend yield 2%

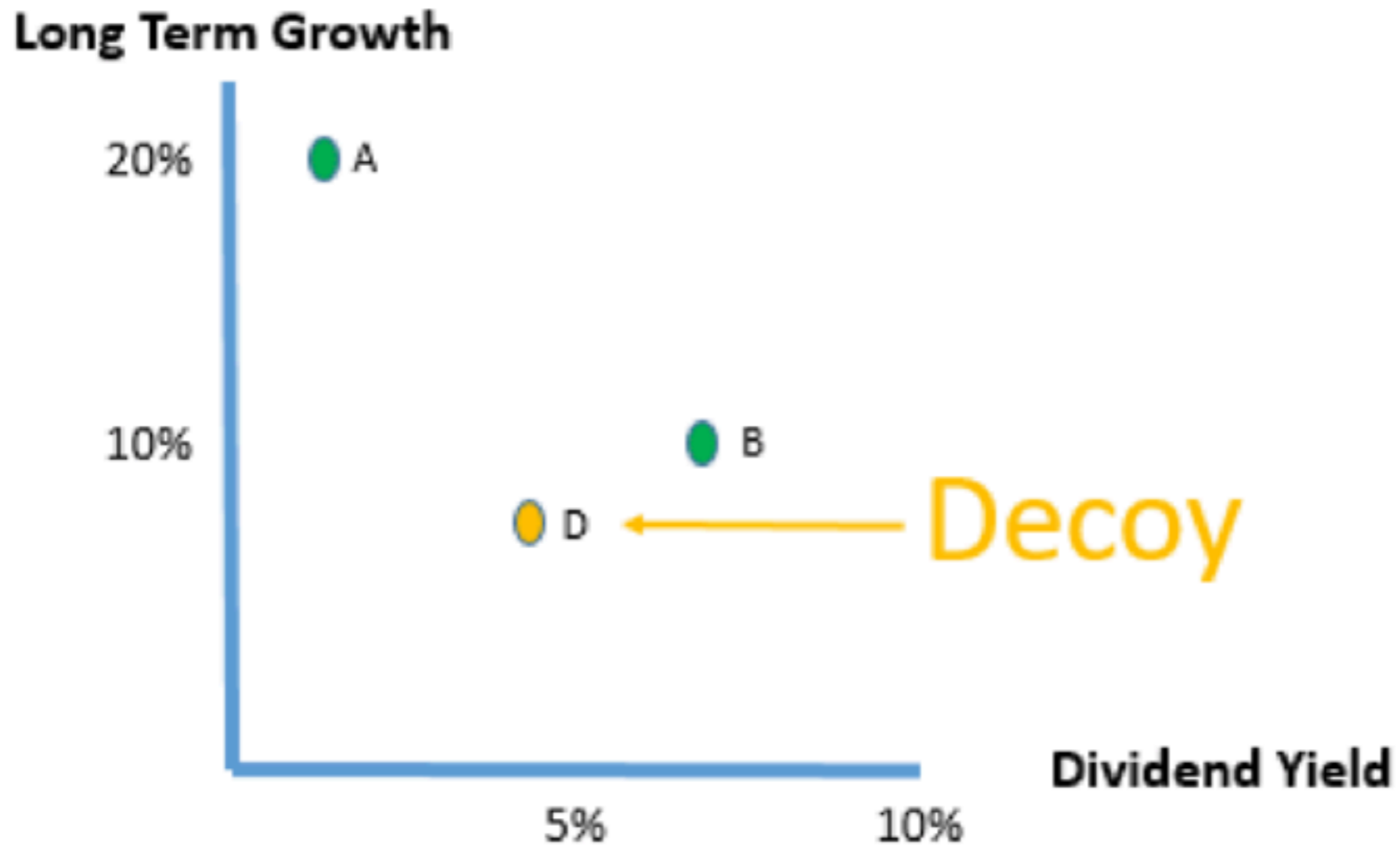
**Stock B:** long-term growth 10% - dividend yield 7%

**Stock D:** long-term growth 7% - dividend yield 4.5%



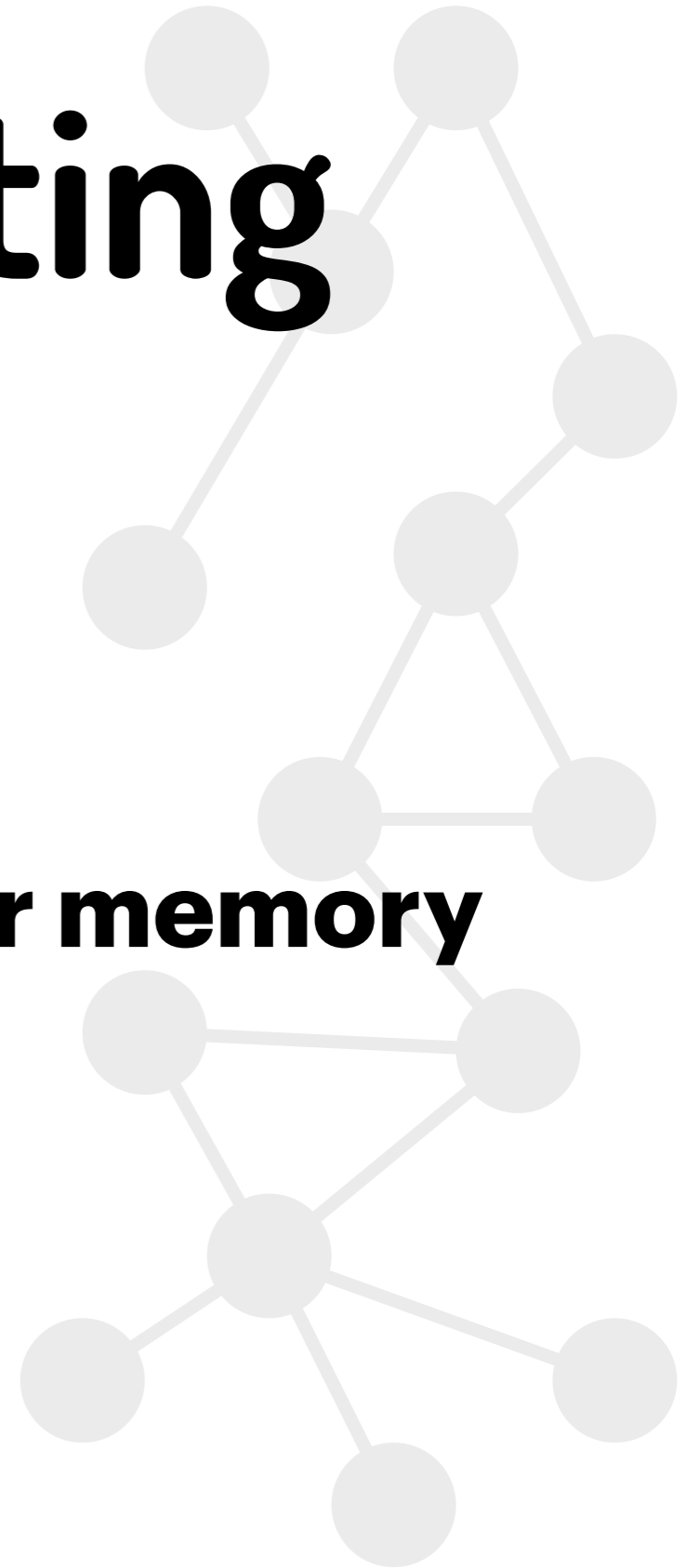
# Examples

## Situation 3



# Mental accounting

**We keep “compartments” in our memory**



# Mental accounting



Imagine that you have decided to see a show where admission is **\$10 per ticket**. As you enter the theatre you discover that you have **lost a \$10 bill**. Would you still **pay \$10 for a ticket** for the show?

Imagine that you have decided to see a show and **paid** the admission price of **\$10 per ticket**. As you enter the theatre you discover that you have **lost the ticket**. Would you pay \$10 for **another** ticket?

# Mental accounting



Imagine that you have decided to see a show where admission is **\$10 per ticket**. As you enter the theatre you discover that you have **lost a \$10 bill**. Would you still **pay \$10 for a ticket** for the show?

Imagine that you have decided to see a show and **paid** the admission price of **\$10 per ticket**. As you enter the theatre you discover that you have **lost the ticket**. Would you pay \$10 for **another** ticket?

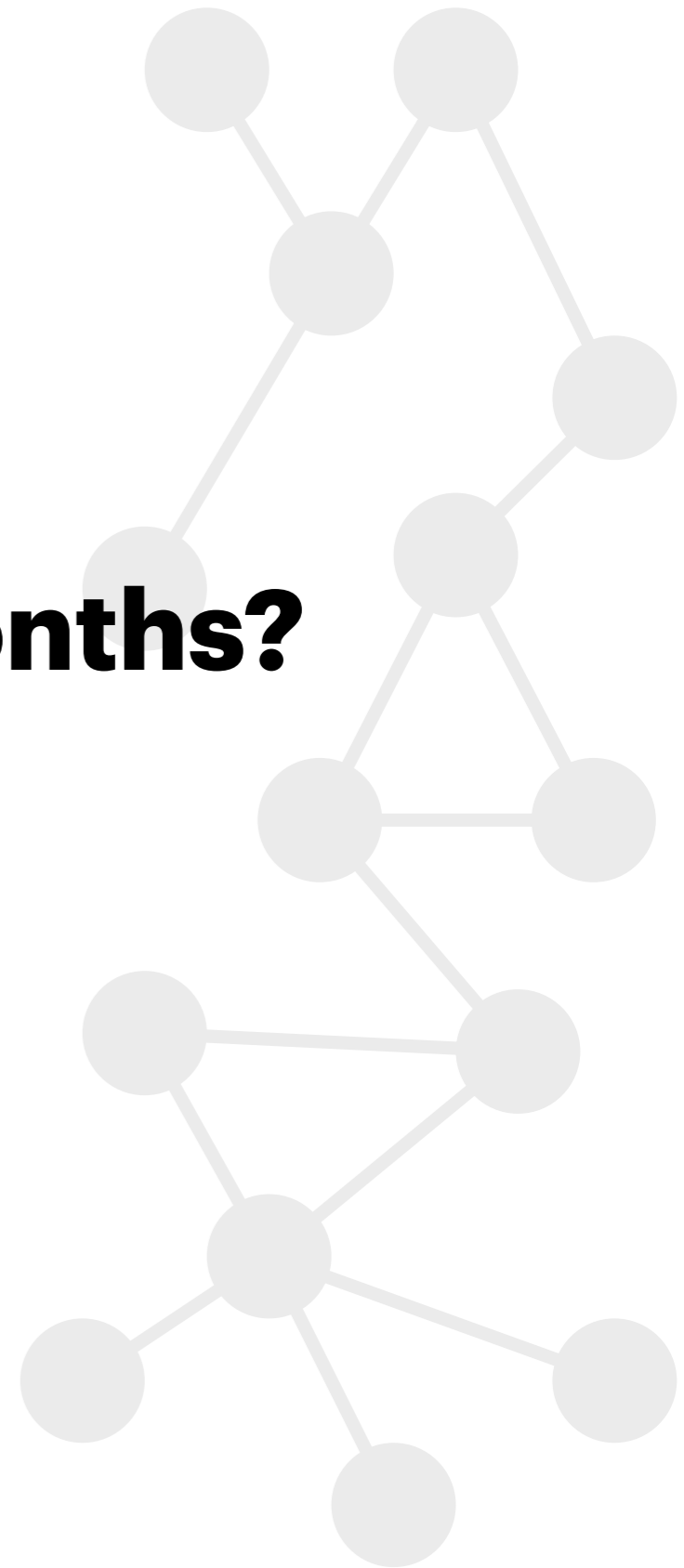
# Mental accounting

Imagine that you have decided to see a show where admission is **\$10 per ticket**. Before you enter the theatre you discover that you have **lost** a **\$10 for a ticket** for the show? **Yes: 88%** Would you still **pay**

Imagine that you have decided to see a show and **paid** the admission price of **\$10**. Before you enter the theatre you discover that you **lost** a **\$10**. Would you pay **\$10 for another** ticket? **Yes: 46%**

# Example

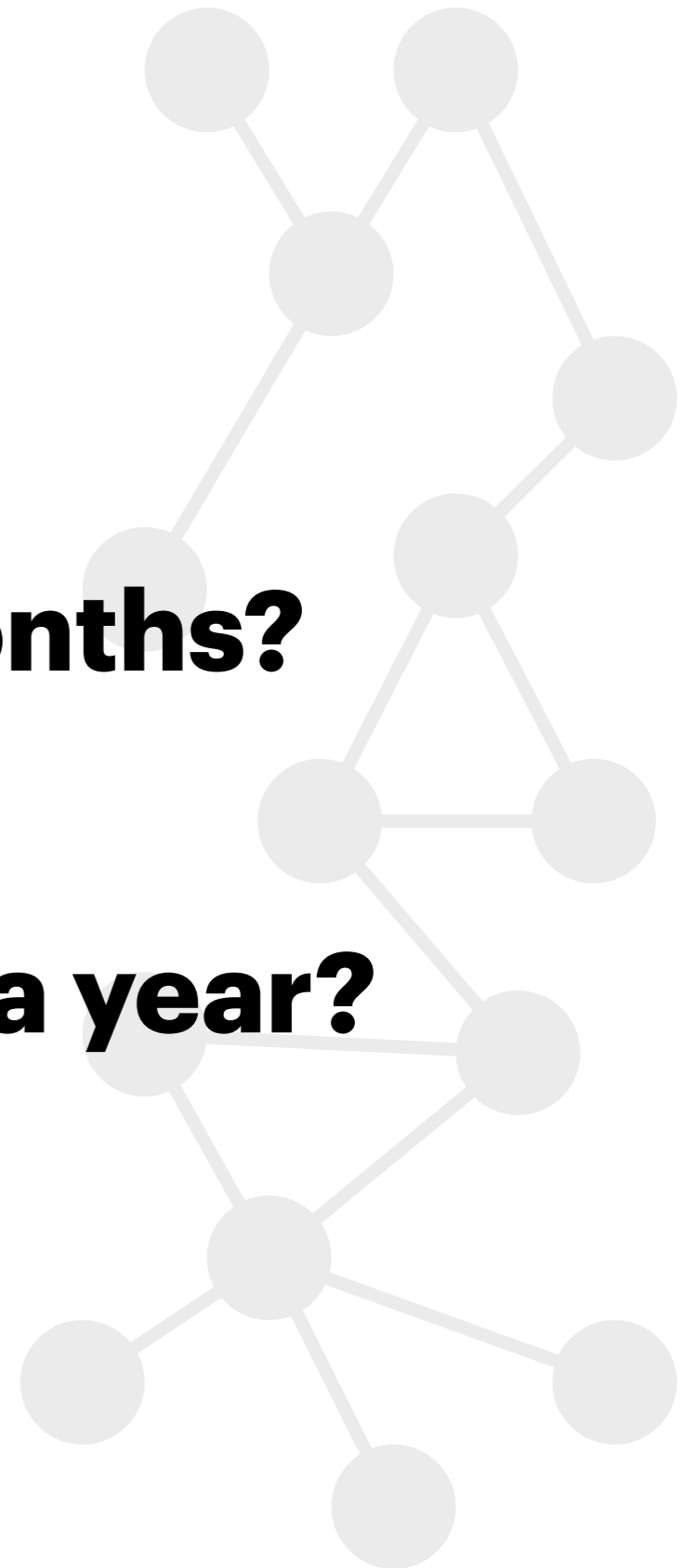
**£50 now or £100 in six months?**



# Example

**£50 now or £100 in six months?**

**£50 in 6 months or £100 in a year?**



# Hyperbolic discounting

We are **not good at judging time**

We want everything **now**

**Instant** gratification

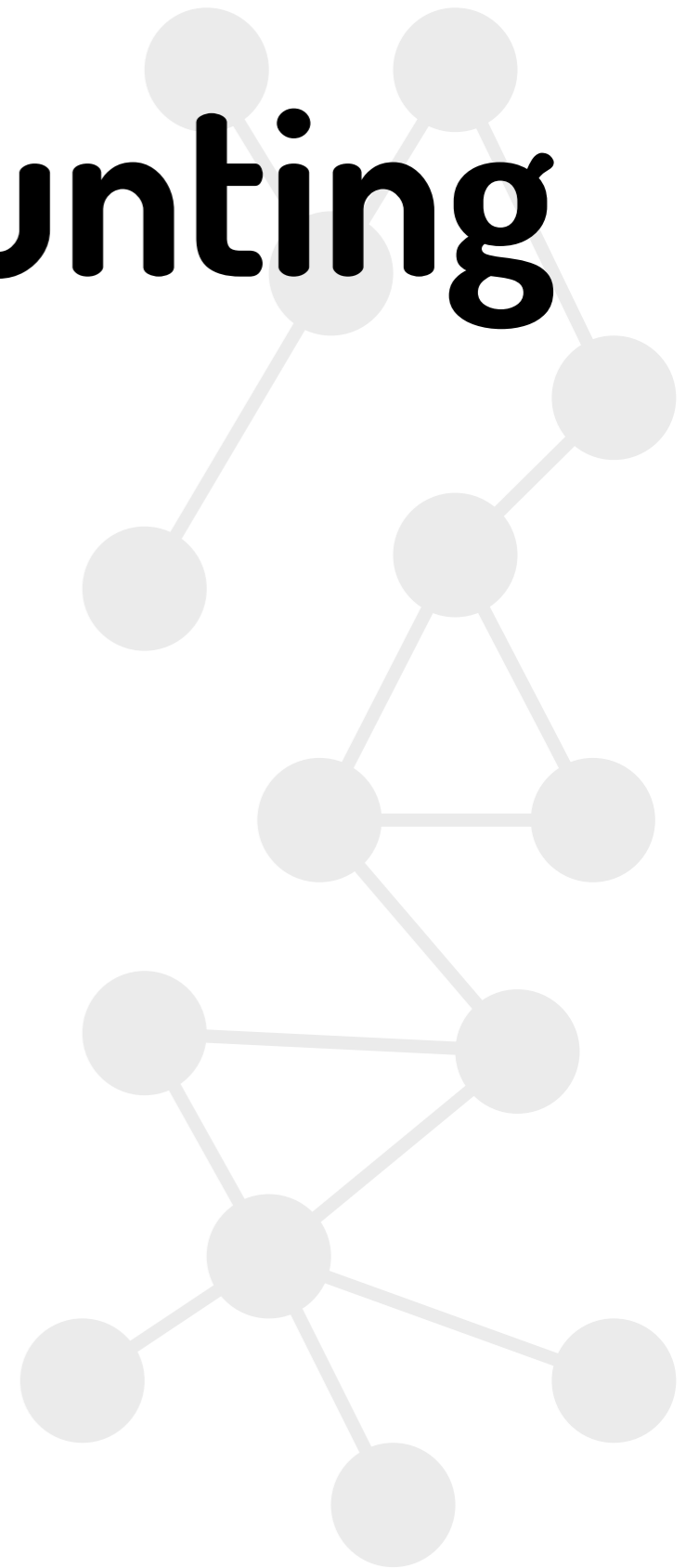




# Hyperbolic discounting

**Classical  
economics**

$$\frac{1}{1+k}^t$$

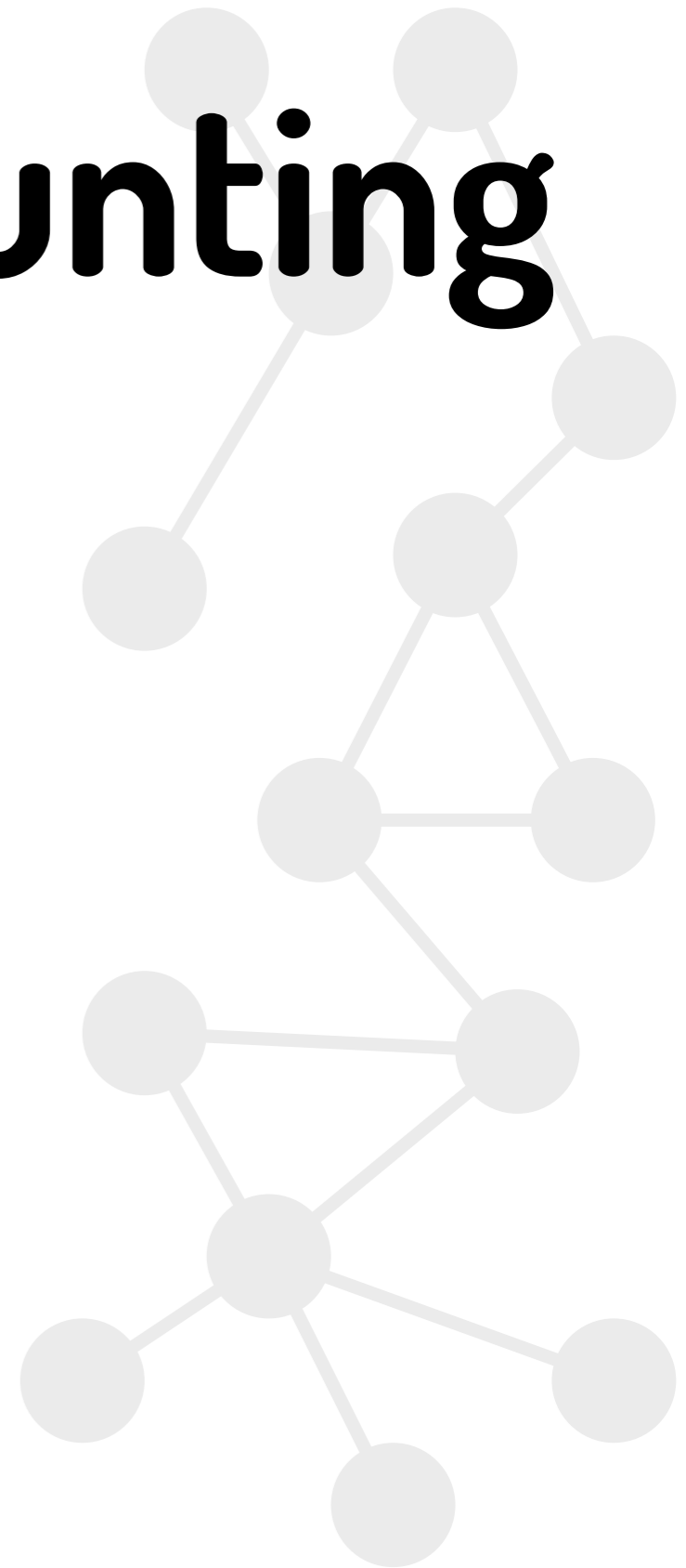


# Hyperbolic discounting

**Classical  
economics  
Reality  
(Behavioural  
economics)**

$$\frac{1}{1+k}^t$$

$$\frac{1}{1+kt}$$

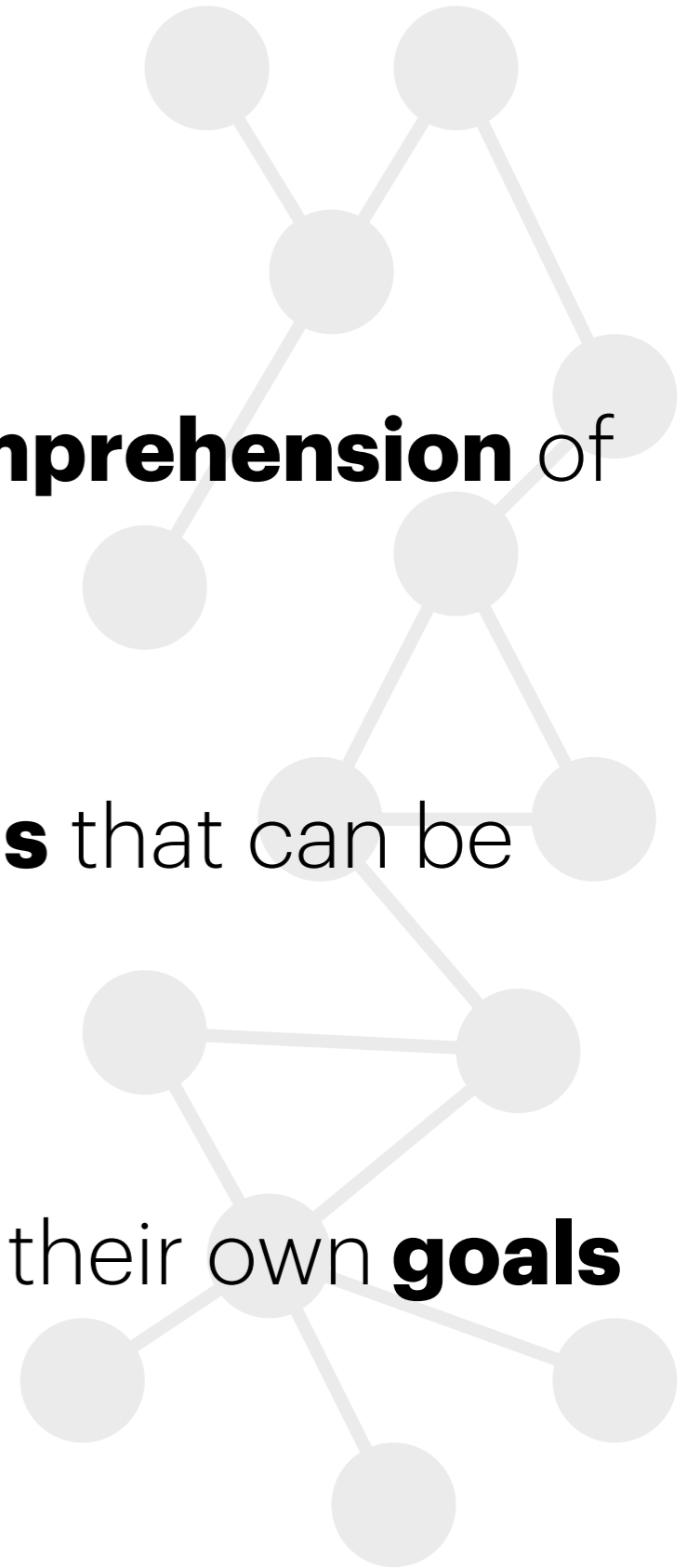


# Learning

Agents have a **limited** or even a **wrong comprehension** of their environment

They master **only a subset of all the actions** that can be conceived in order to face a given situation

They have an **imprecise understanding of** their own **goals** and **preferences.**



# Objects of Learning

**Models of the world**

**Parameters within a given model**

**Actions**

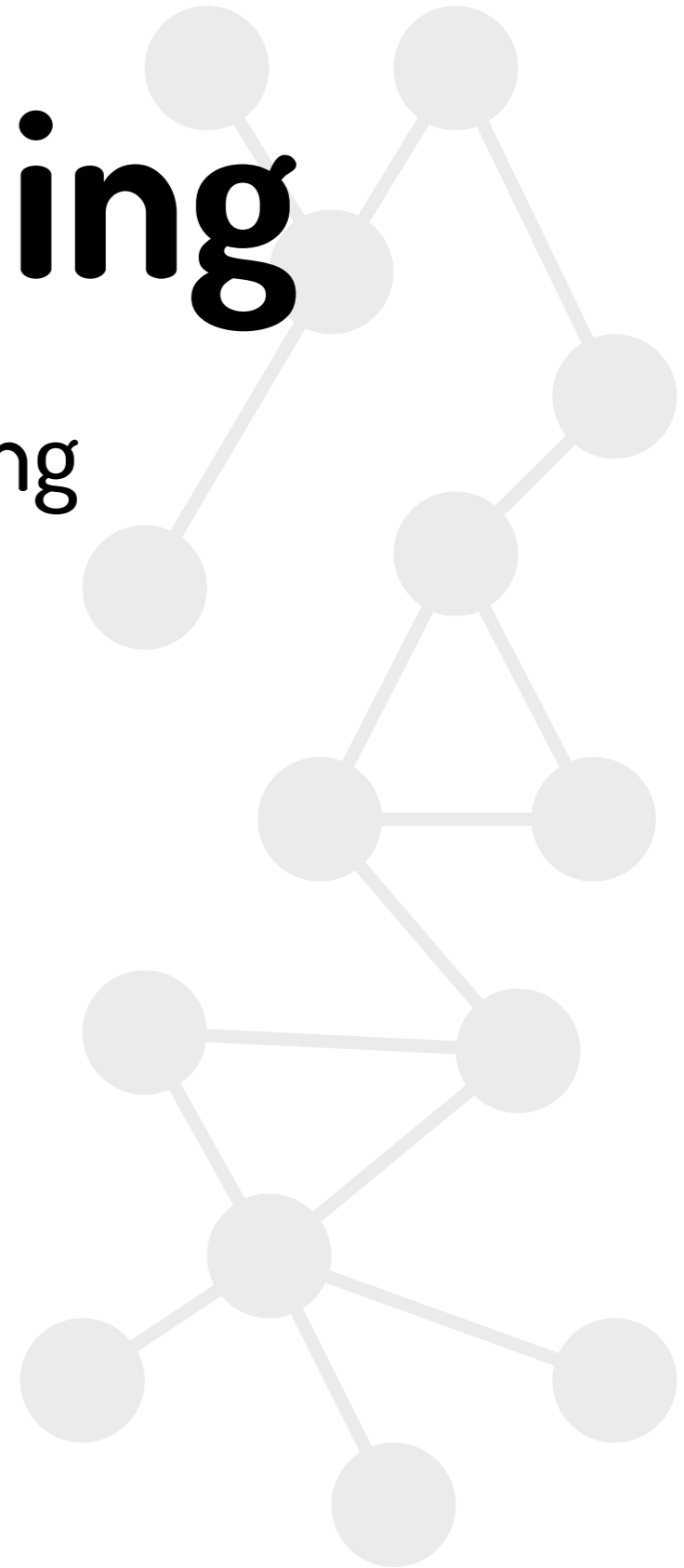
**Realised outcomes**



# Types of Learning

Individual learning

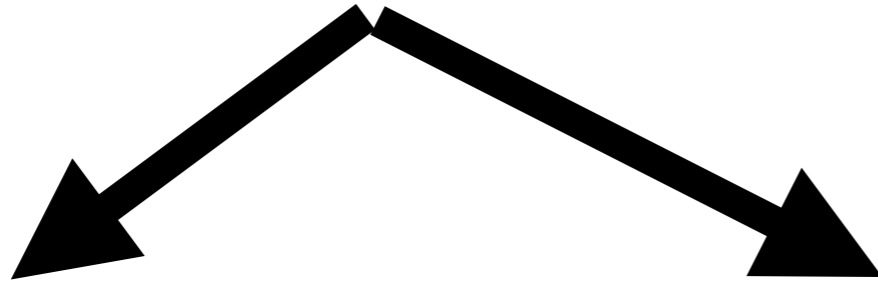
Social learning



# Types of Learning

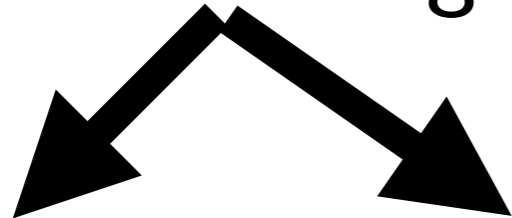
Individual learning

Social learning



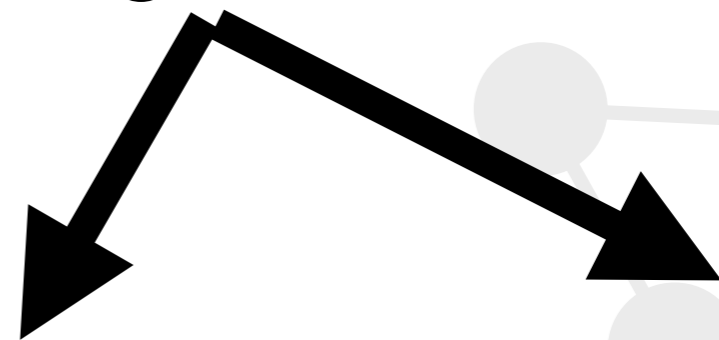
Statistical learning

Fitness learning



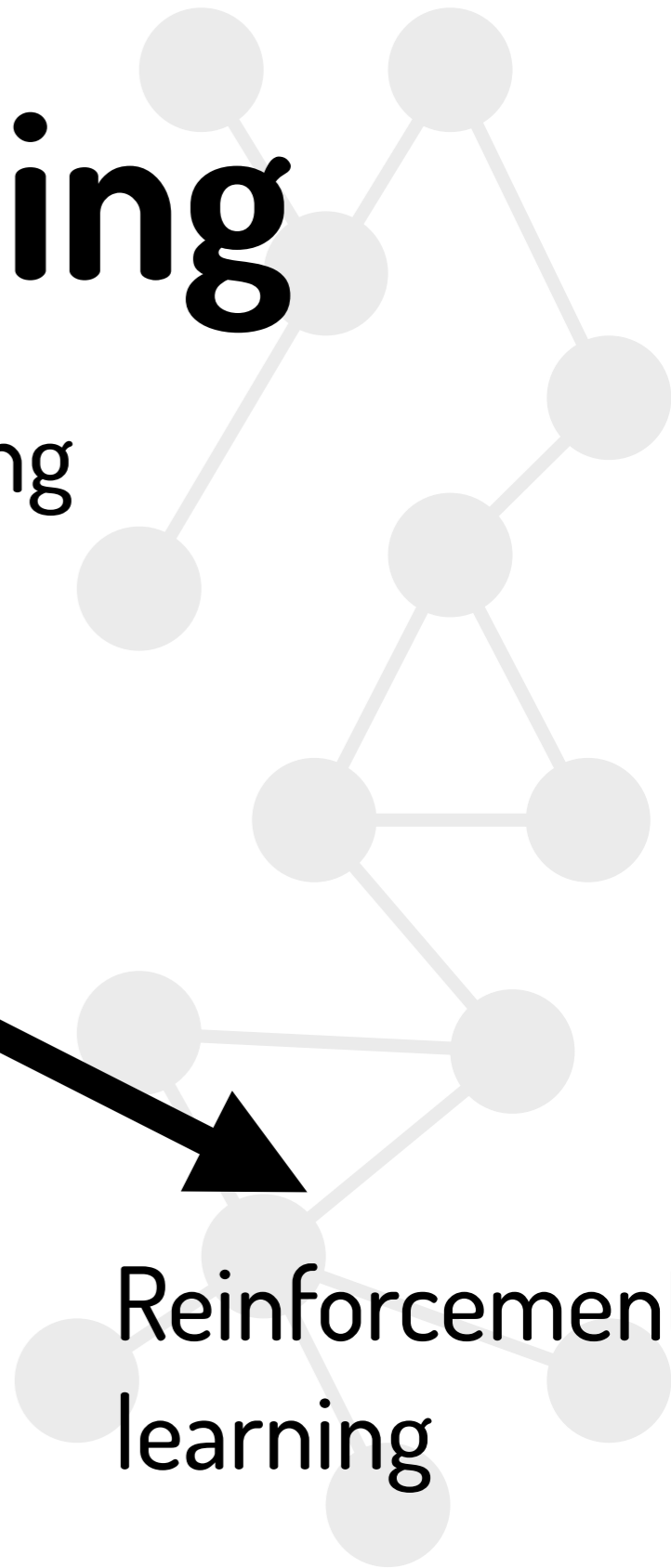
Econometrics

Likelihood



Evolutionary algorithms

Reinforcement learning



# Exercise

Can you name a situation where you would need learning agents?



# Summary

## (How to design agents)

Foundations of **decision making**

Characteristics of **Individual behaviour** (bounded rationality)

**Learning** processes

