


Systems Thinking

Introduction to Systems Thinking

- Let's get the emissions down
- Feedback Loops
- Systems Diagrams (+ case study)
- Leverage Points: Places to intervene in a system




CEMUS

The Global Economy


- Environment, Development and Globalisation

15 credits



What is the real wealth of nations? How is the global economic system performing under increasing ecological and social pressures? Which institutions and actors have the best opportunities to work towards building desirable and sustainable economies?


The course aims to present a variety of theoretical perspectives on issues of political economy in the context of sustainable development. Throughout the semester, different theories and historical examples are analysed and discussed in sessions with knowledgeable and inspiring guest lecturers in order to offer a multidisciplinary understanding of the global economy's role in today's world. Keeping a good balance between abstract and concrete, as well as particular and general, the course constitutes a basic toolbox to understand economies in the 21st century. Embarking on this journey of discovery, international and Swedish students will reflect critically on the past and current state of the economy in order to imagine alternative economic futures.



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SLU

Let's get emissions down!

- We need 6 volunteers!
- The goal: to lower the hula hoop to the floor
 - This represents lowering our emissions
- Two important rules
 - Must support the hoop *only* with your index finger from below
 - All must always have contact with the hoop

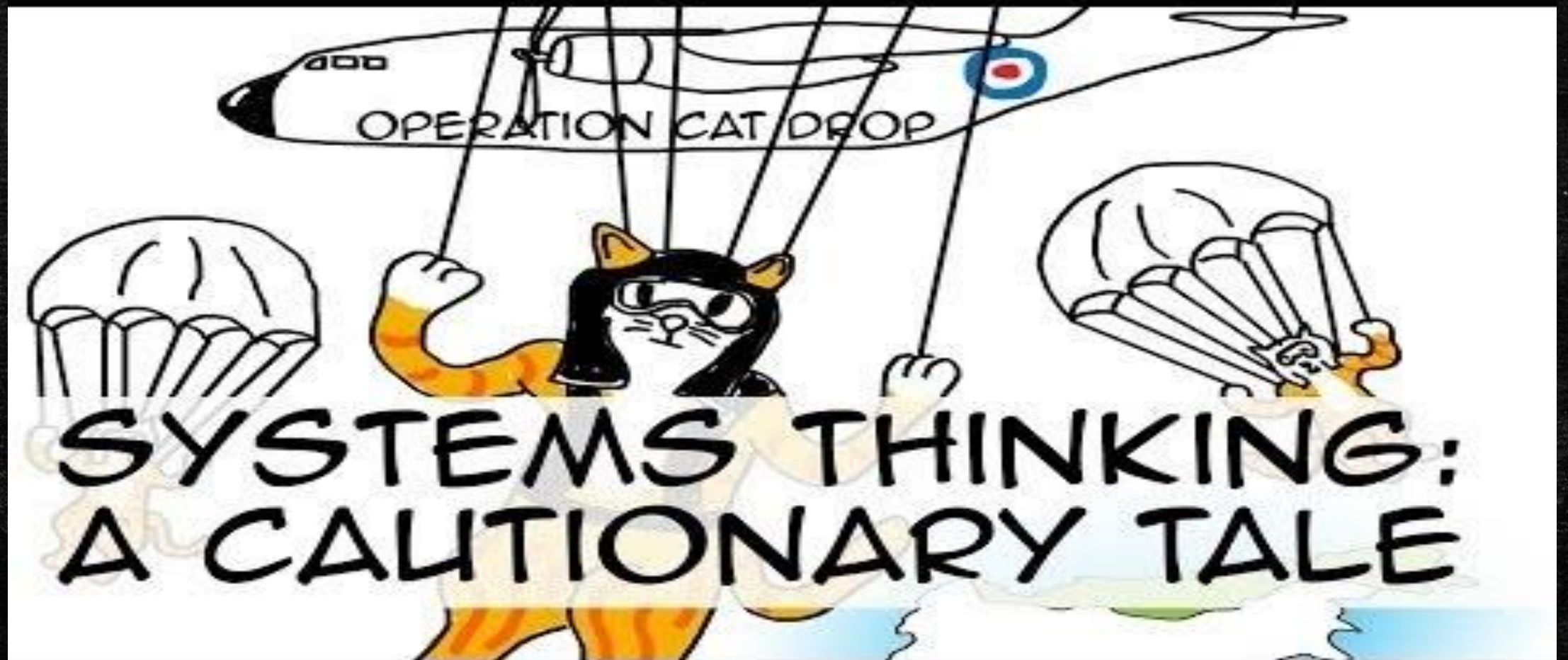
Let's get emissions down!

- What happened?
- *When a group of smart, well-intentioned people like our group here fail to do something that they all want to do, there must be a systemic reason.*
- Why did that happen here?

Triangles

- Choose two other people in the classroom (silently) as reference points
- Then form an equilateral triangle with them
- What happened?

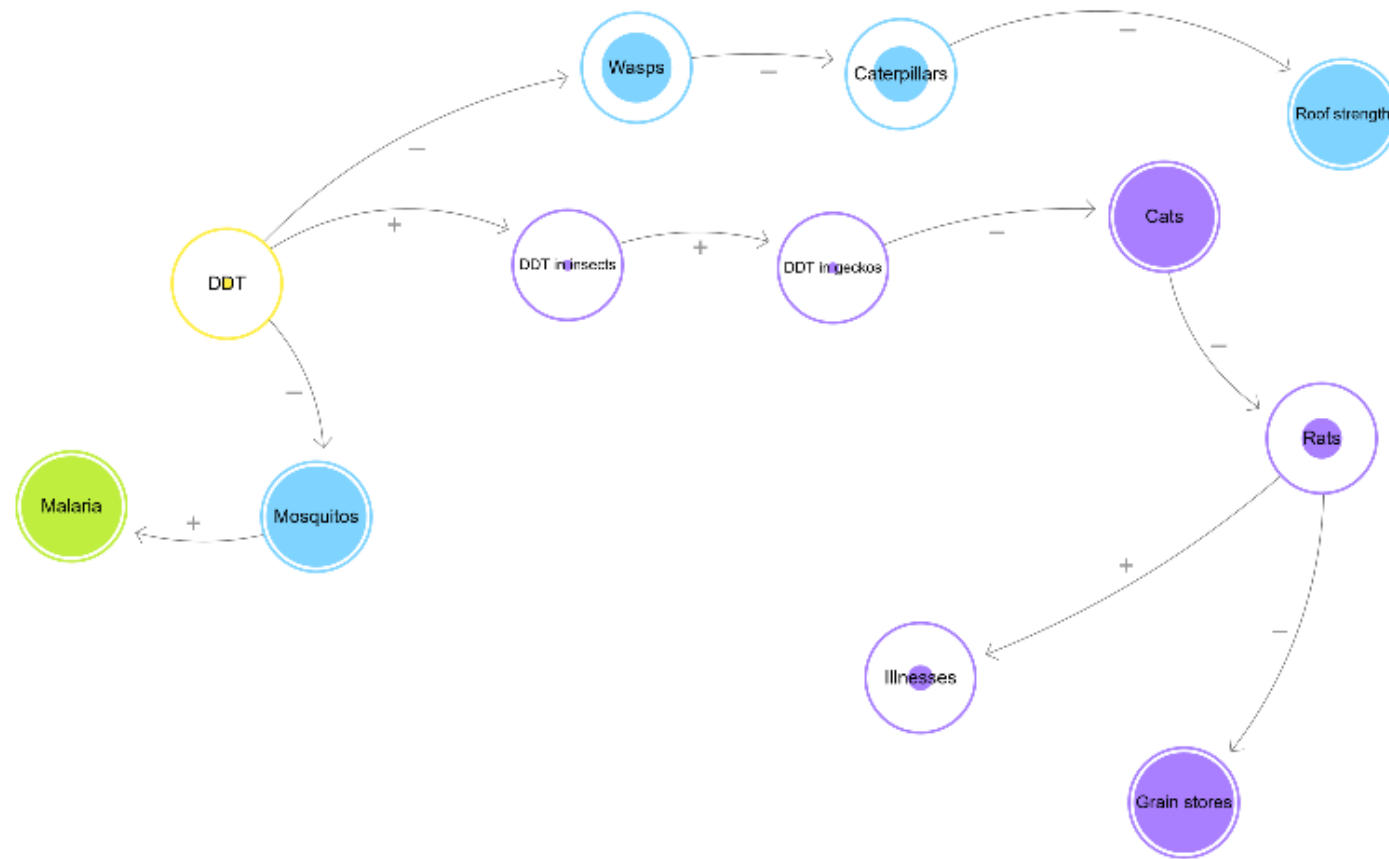
Systems thinking – a short video



Positive and negative feedback loops

- Form a large circle and hold each others hands
- Positive feedback / Reinforcing loop
 - When the person before you raises or lowers their hand, you copy their movement
- What happened?
- Negative feedback / Balancing loop
 - When the person before you raises or lowers their hand, you do the opposite movement
- What happened?
- Delays

System thinking – a potential system diagram



BREAK

How can system thinking help the Baltic Sea?

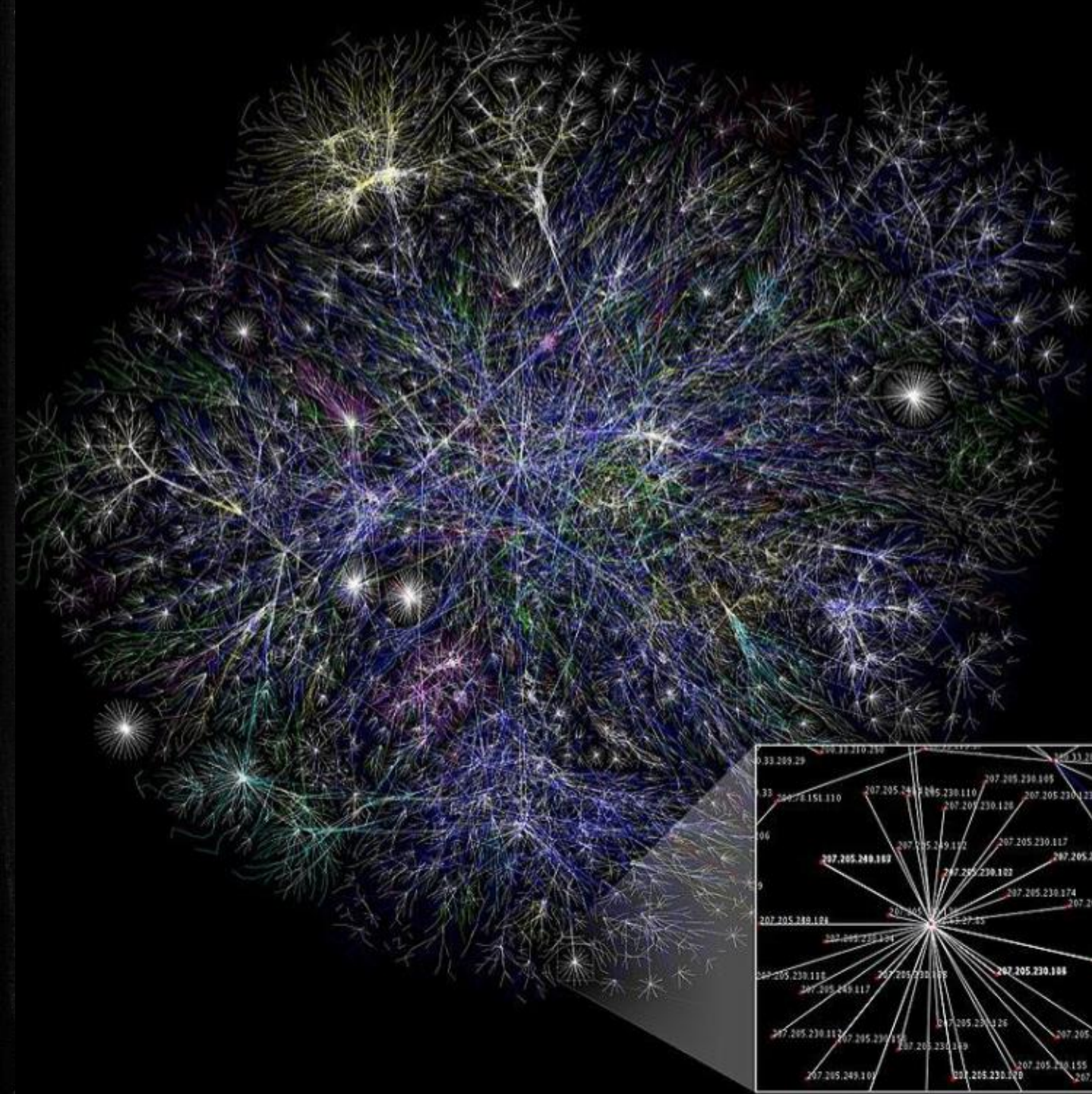
- *In groups* do some quick research on the Baltic Sea (or perhaps you already know something)
- Consider social-ecological dynamics of
 - Eutrophication
 - Overfishing
 - Transport
 - Whatever else you know or can find!
- How can we draw a system diagram of the Baltic Sea?
- Think about
 - Feedbacks, delays
 - Draft on paper, but if you like, use loopy <https://ncase.me/loopy/v1.1/>

BREAK

Leverage points

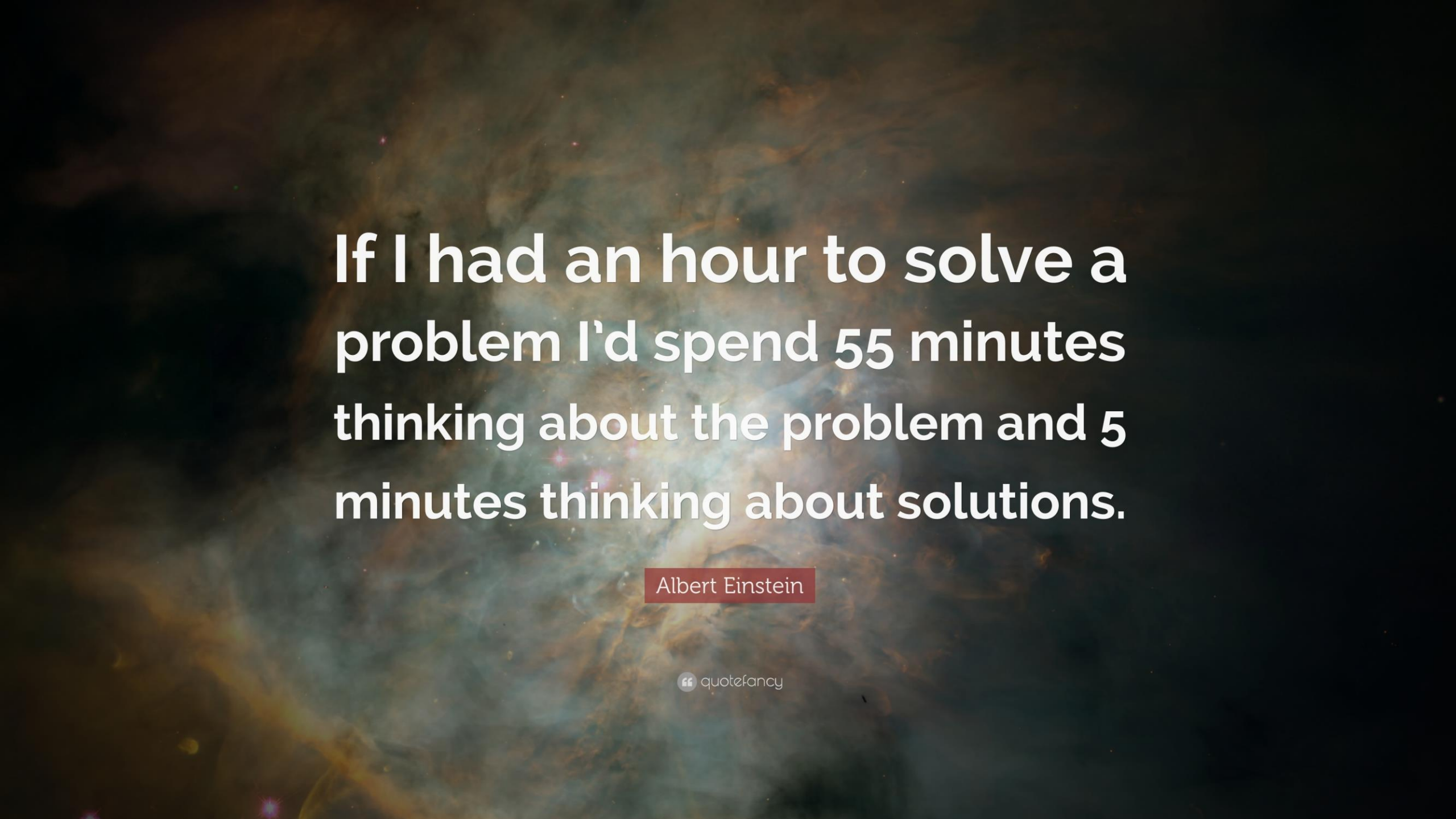
A little folk wisdom

- Look for solutions where it is easiest, i.e. old habits, ways of thinking
- Problem lies somewhere else, where its harder to see
- We may need new tools for searching in the dark



*"Before you disturb
the system in any
way, watch how it
behaves...study its
beat"*

- Donella Meadows

The background of the image is a deep space scene featuring a complex nebula with swirling clouds of gas in shades of blue, orange, and white. Numerous stars of varying brightness are scattered throughout the dark cosmic void.

**If I had an hour to solve a
problem I'd spend 55 minutes
thinking about the problem and 5
minutes thinking about solutions.**

Albert Einstein

Leverage Points in Systems

Based on Donella Meadows

We need 4 volunteers please

OPEN THE BOTTLE



"A lever amplifies an input force to provide a greater output force, which is said to provide leverage"

So what is a system?

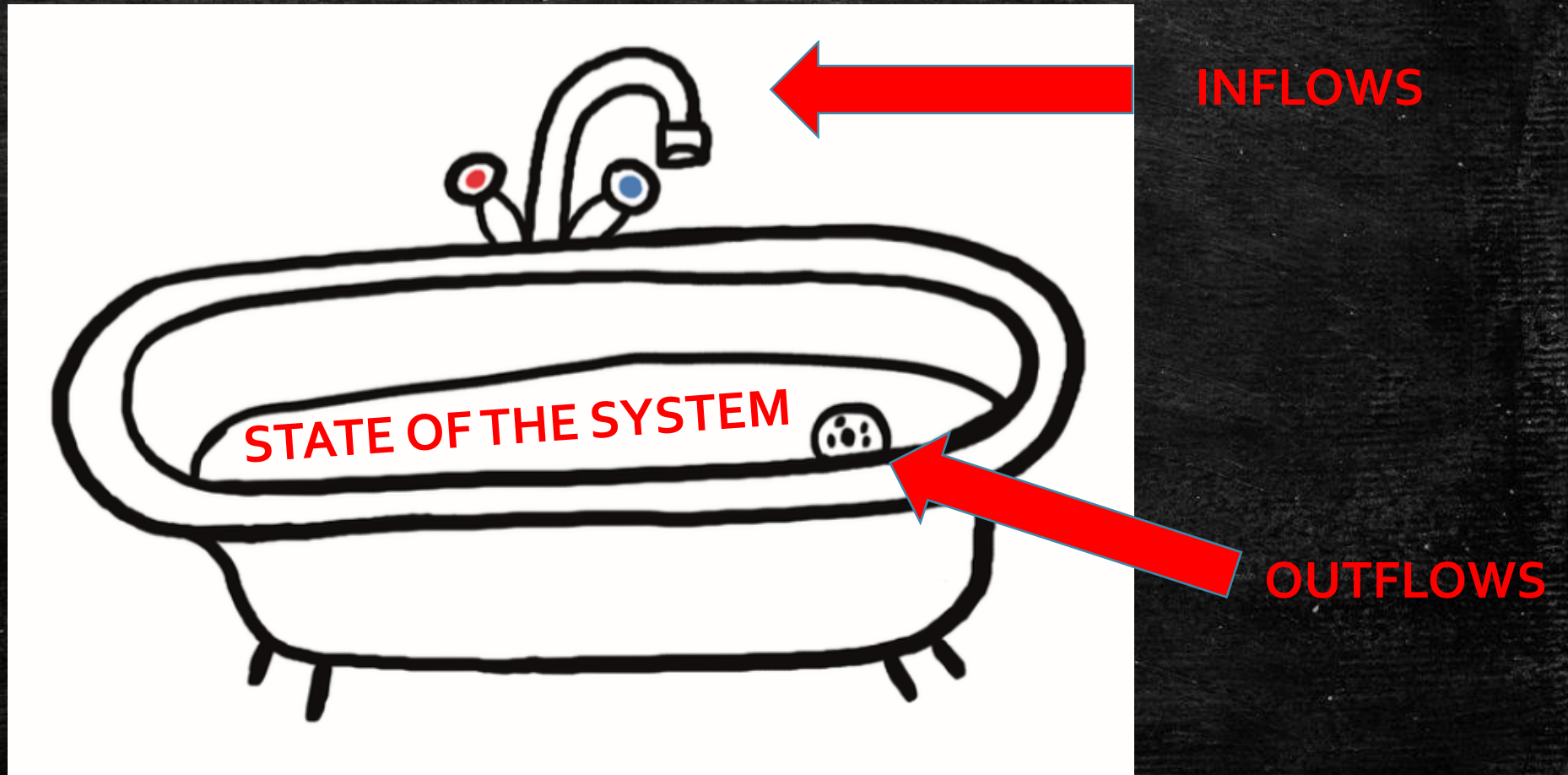
"A system is a group of interacting or interrelated entities that form a unified whole. A system is delineated by its spatial and temporal boundaries, surrounded and influenced by its environment, described by its structure and purpose and expressed in its functioning."

- Meadows (2008)

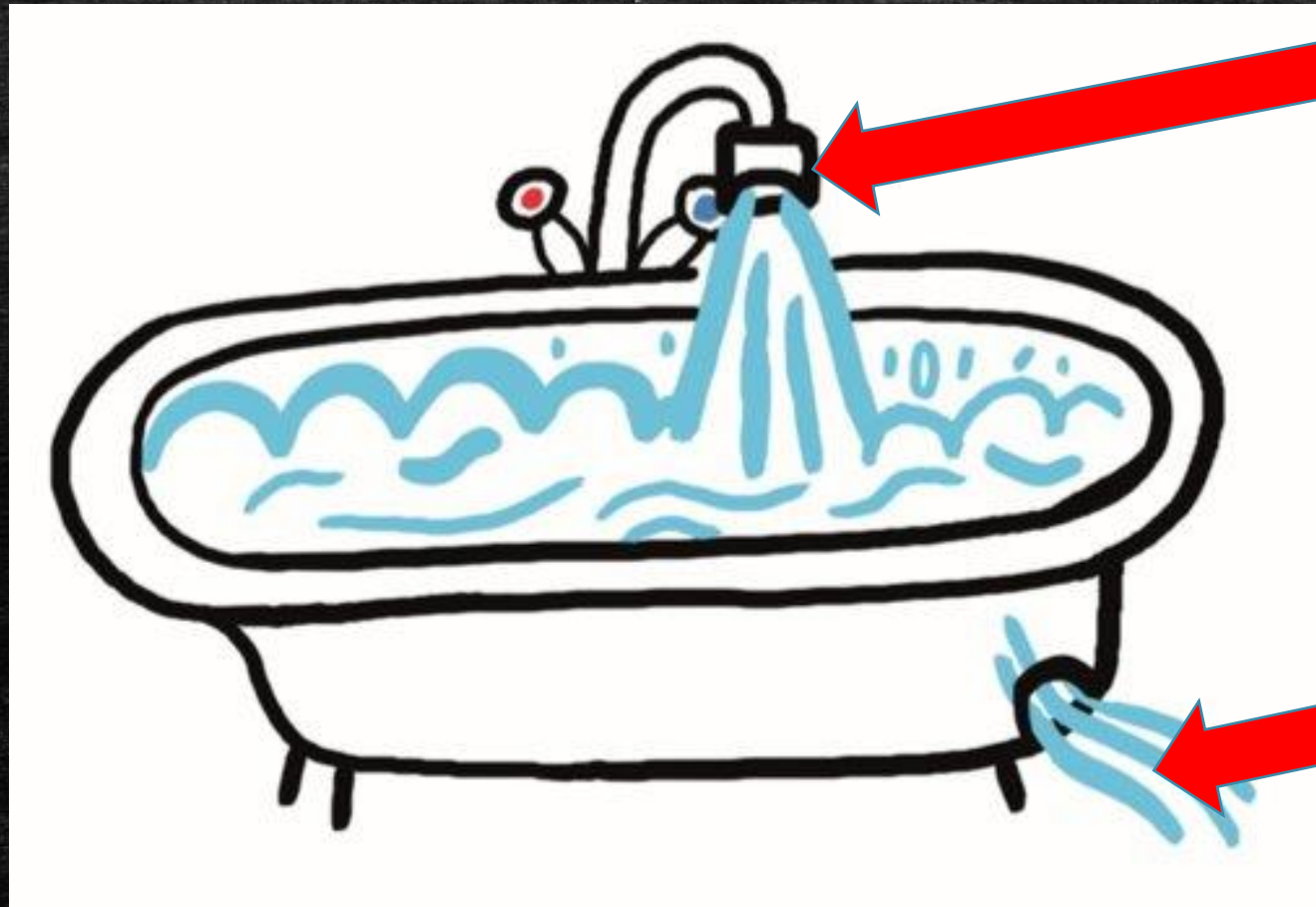
Example of a system



Example of a system



Example of a system



INFLOWS

SYSTEMS GOAL

OUTFLOWS

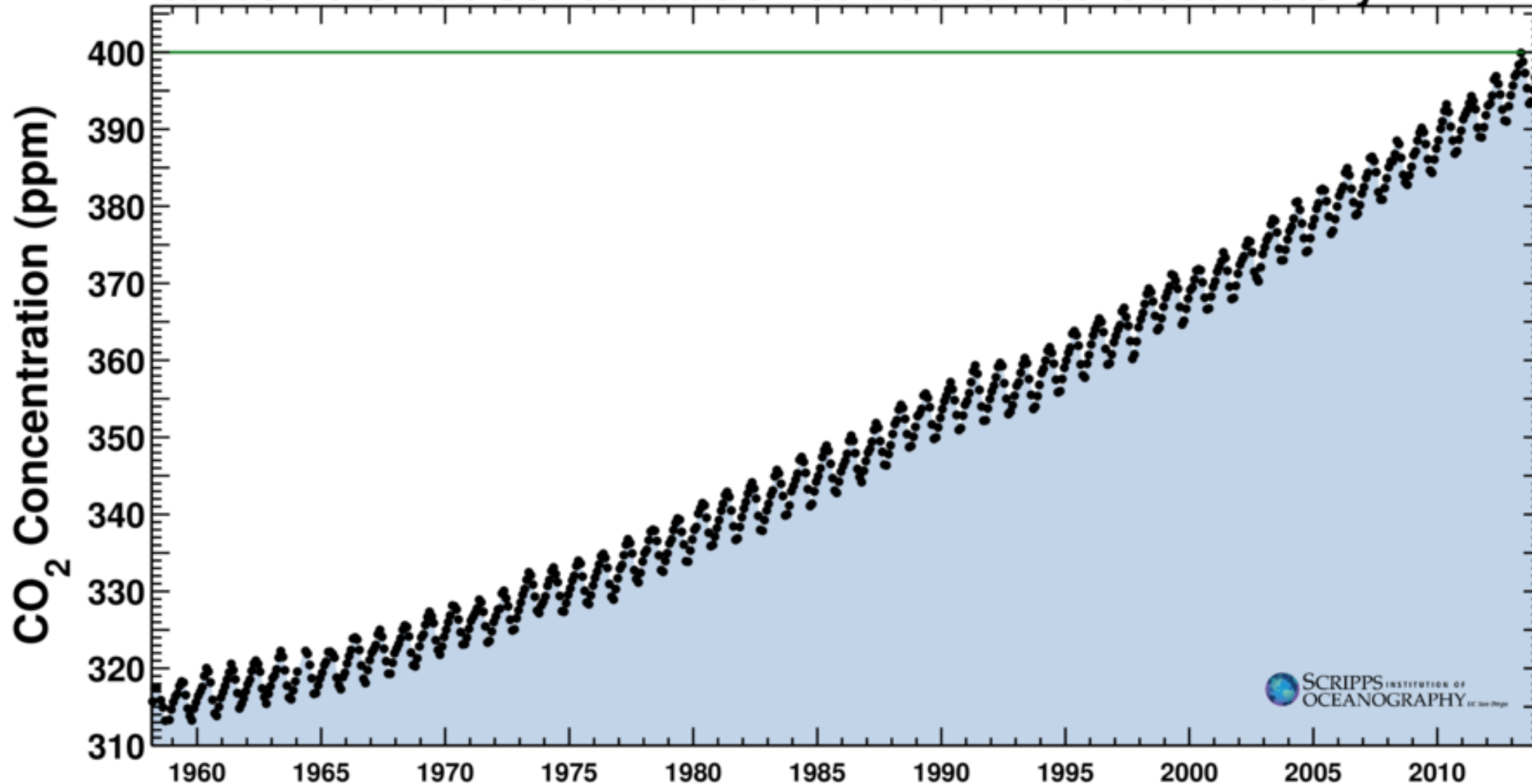
Constants, Parameters, Numbers



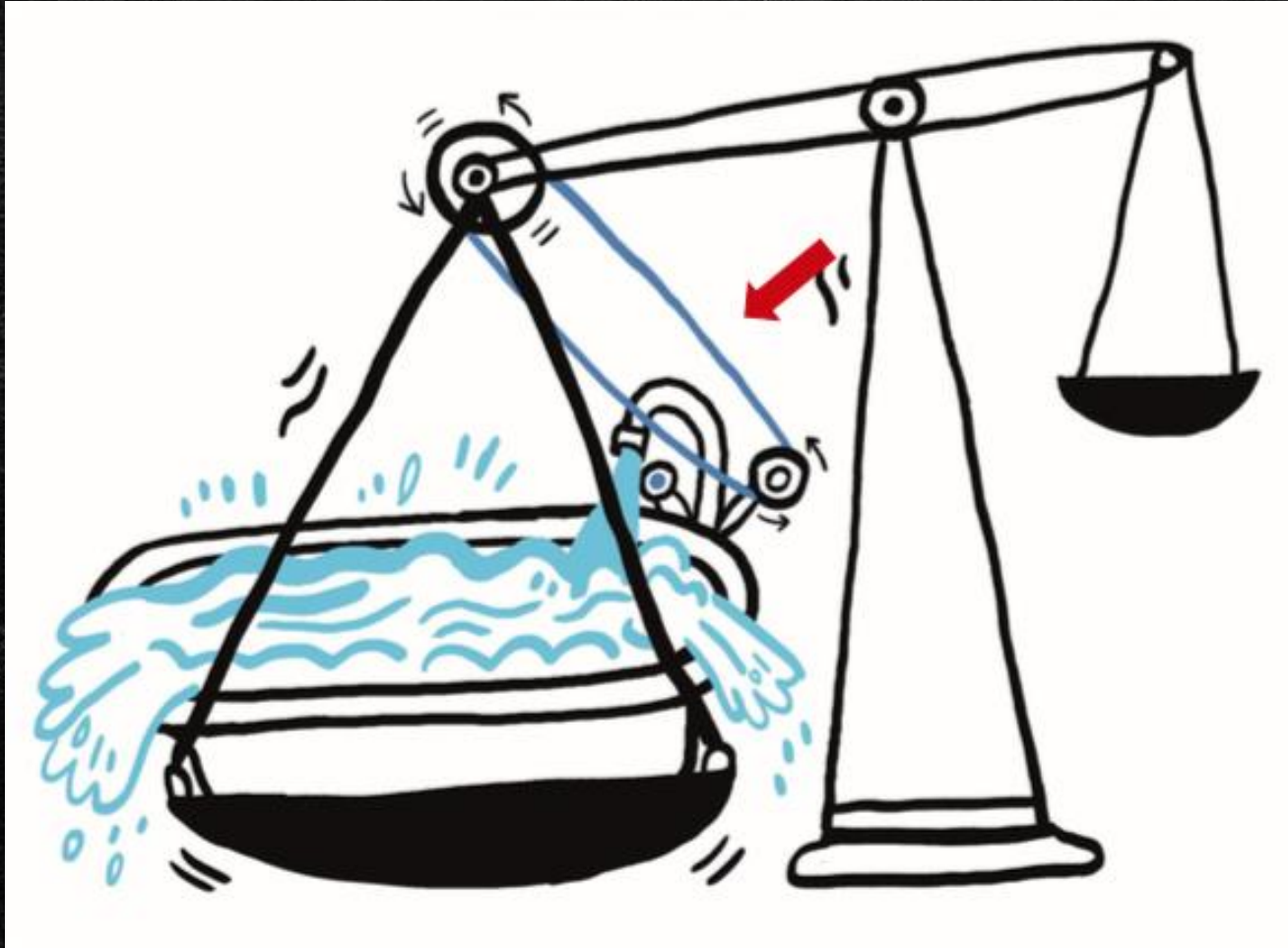
EXAMPLES

- Air quality standards
- Wage rates
- Product prices
- Research budgets

Carbon dioxide concentration at Mauna Loa Observatory



The gain around driving positive feedback loops



= *SELF REINFORCEMENT*

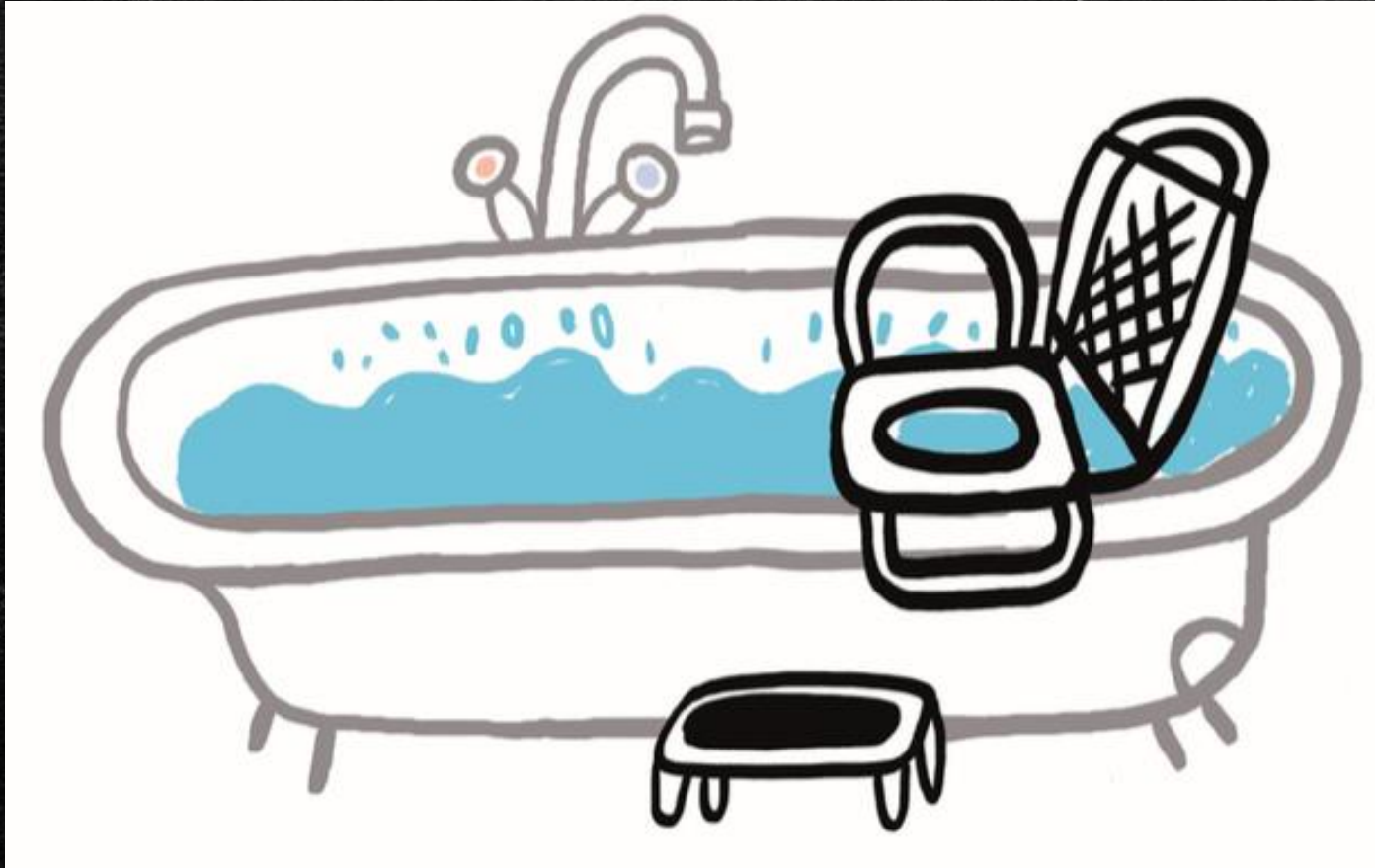
EXAMPLES

- Climate changes
- The more people catch the flu the more they infect others
- "Success to the successful"

The gain around driving positive feedback loops



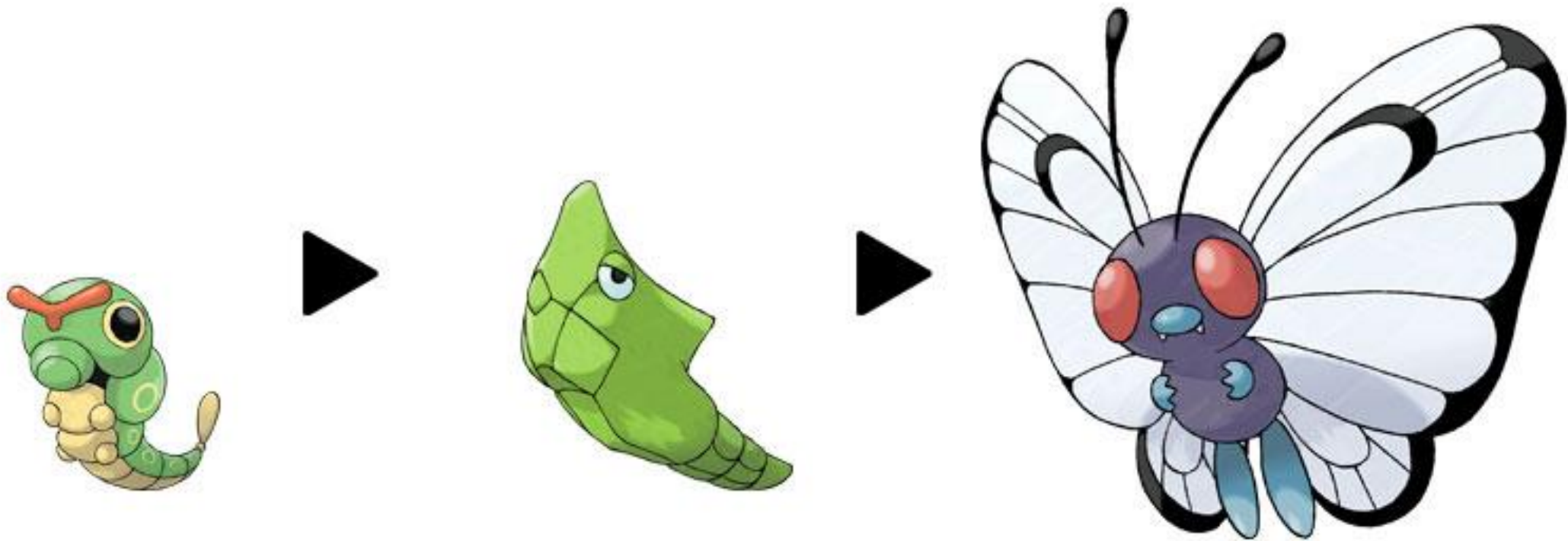
The power to add, change, evolve or
self-organise system structures



EXAMPLES

- Evolution
- Presidential orders

The power to add, change, evolve or
self-organise system structures




Buffers



EXAMPLES

- Savings in your bank account
- Difference between flooding likelihood of lakes and rivers

A person stands on a rocky outcrop in the foreground, looking out over a vast, icy fjord. The water is dark blue with numerous icebergs floating on its surface. In the background, jagged, snow-capped mountains rise steeply from the water's edge. The sun is setting on the right side of the frame, casting a warm, golden glow across the sky and the mountains. The sky is filled with dramatic, dark clouds, some of which are illuminated by the low sun. The overall scene is one of natural beauty and tranquility.

The size of **BUFFERS**
and other stabilising
stocks relative to their
flows

The Rules of the System



EXAMPLES

- Voting rights
- Freedom of speech
- Sporting rules

A close-up photograph of a person's hands, wearing a dark grey or black suit jacket, tearing at the top edge of a white sheet of paper. The paper is held taut by the hands, and the word "RULES" is written in large, bold, black, cursive-style capital letters across the center of the paper. The background is a plain, light grey surface. The lighting is even, highlighting the texture of the paper and the fabric of the suit.

RULES

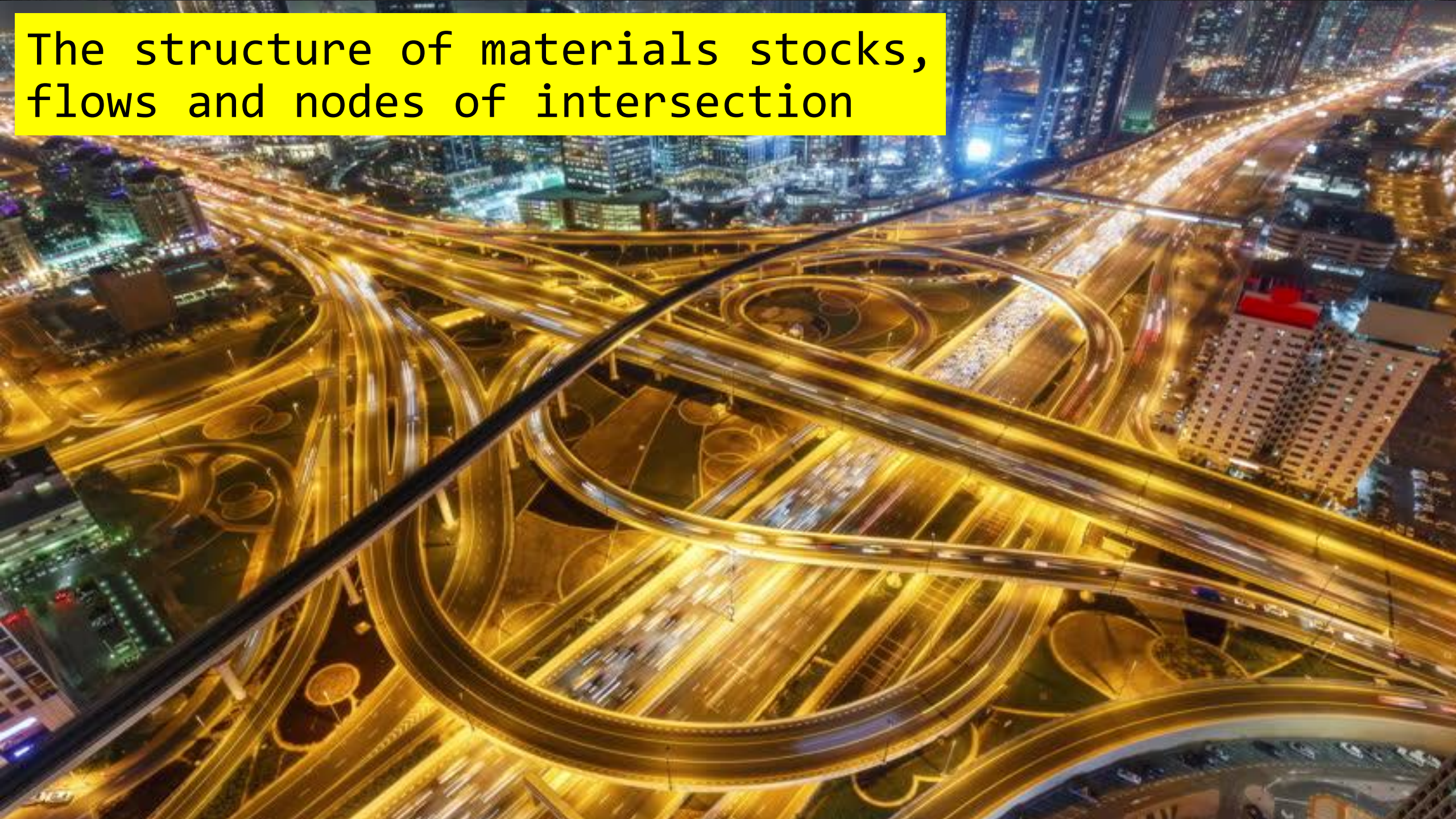
The structure of materials stocks, flows and nodes of intersection



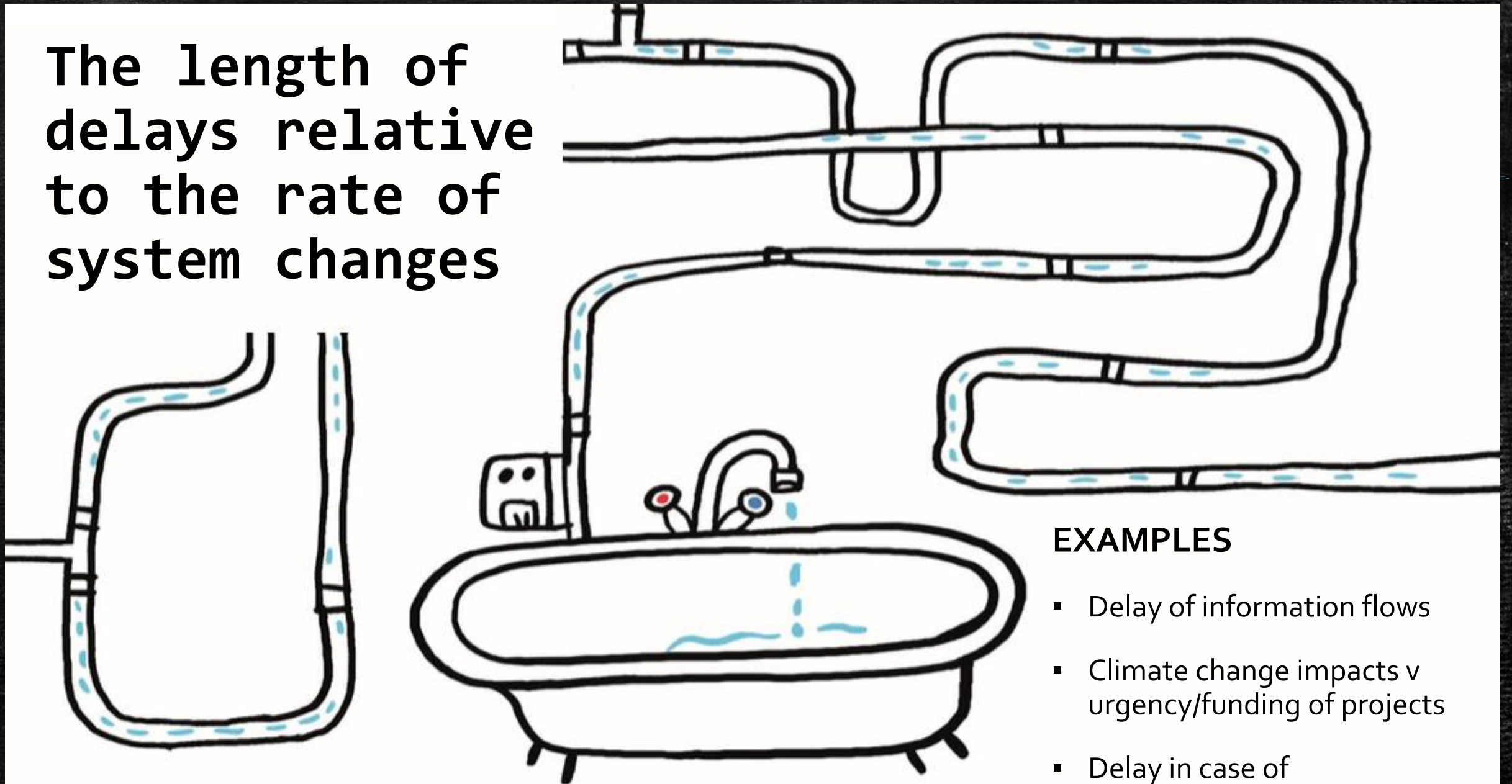
EXAMPLES

- Built environment
- Molecular structures
- Road networks
- Capital flows

The structure of materials stocks,
flows and nodes of intersection



The length of
delays relative
to the rate of
system changes



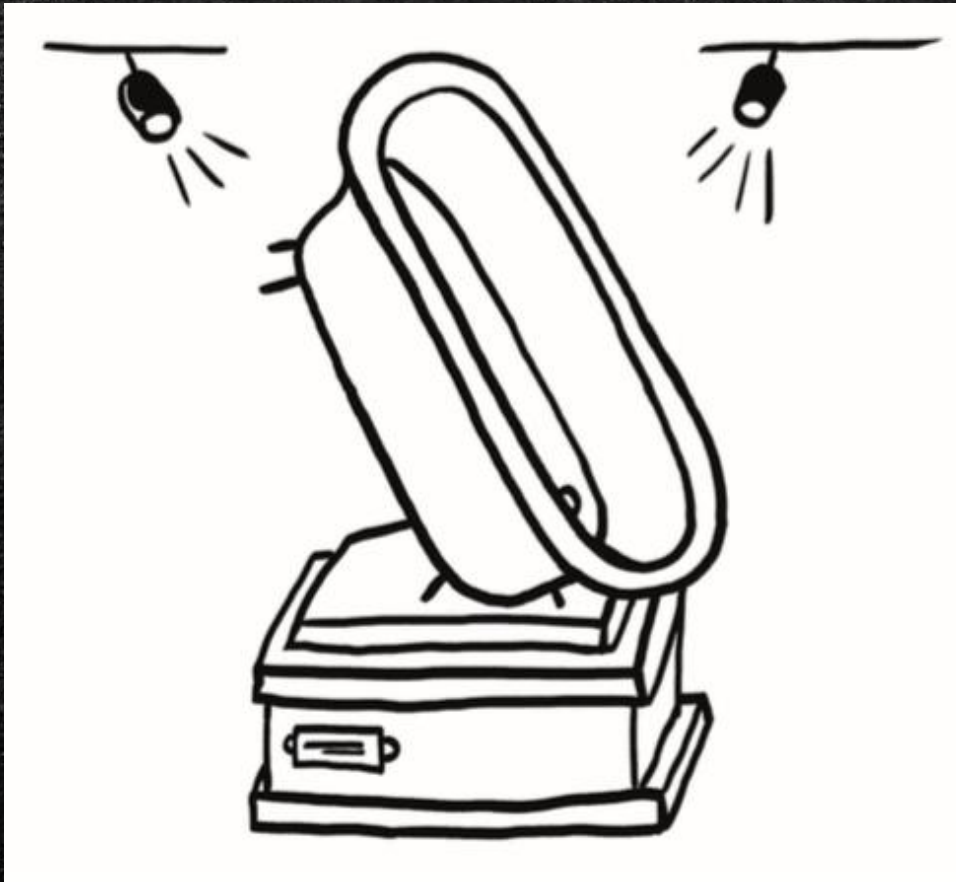
EXAMPLES

- Delay of information flows
- Climate change impacts v urgency/funding of projects
- Delay in case of flooding/epidemics

An aerial photograph showing a vast area of land inundated with muddy brown floodwater. In the lower-left quadrant, several rectangular plots of green vineyards are visible, their rows of vines partially submerged. To the right and in the upper half of the image, dense clusters of dark green trees stand in the water, their canopies partially obscured by the flood. A few small, white-roofed buildings are visible in the bottom-left corner, surrounded by the floodwater. The overall scene depicts a significant natural disaster, likely a major flood event.

The length of delays
relative to the rate
of system changes

The goal of the system



EXAMPLES

- Evolution



SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



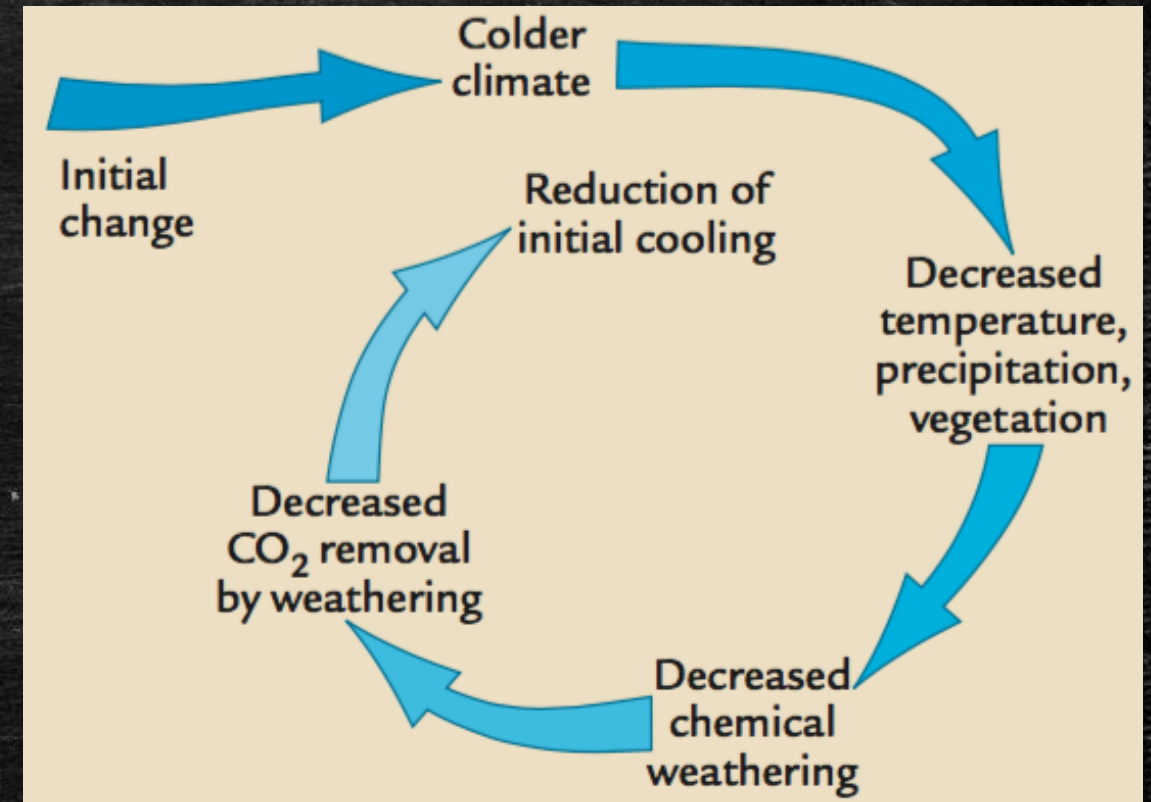
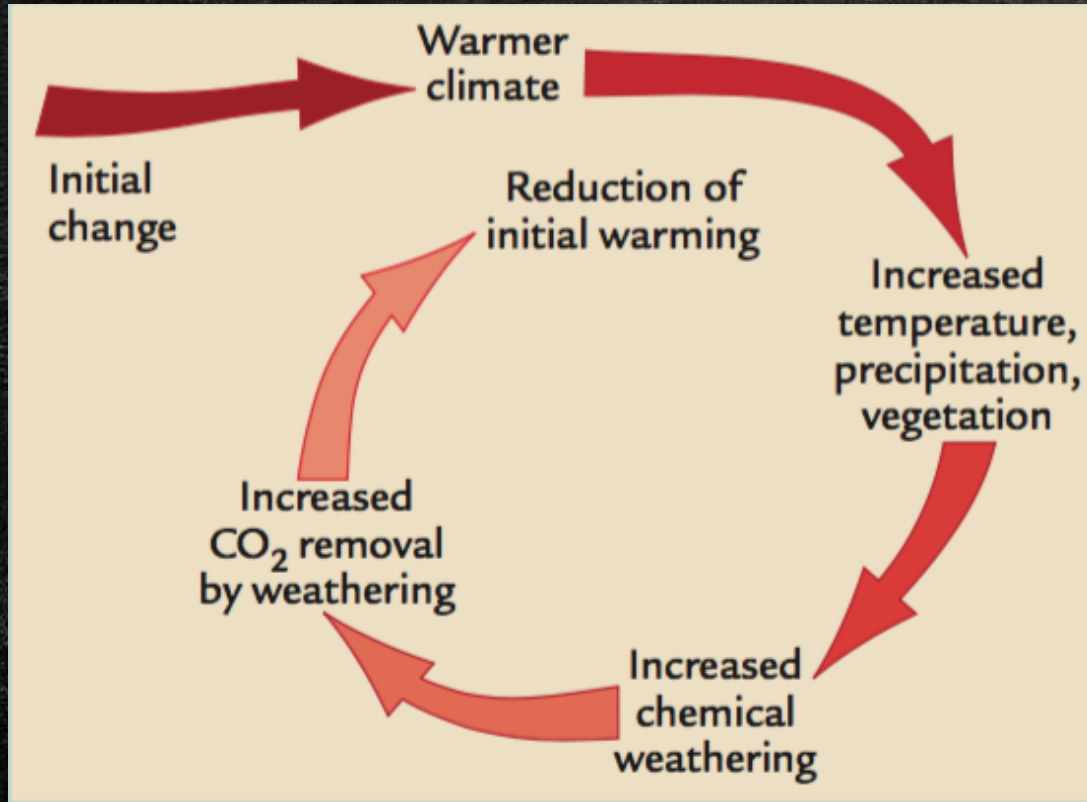
The strength of negative feedback loops, relative to the impact they are trying to correct against



EXAMPLES

- Thermostat
- Prices in an "ideal market"
- Body's ability to regulate body temperature

The strength of negative feedback loops, relative to the impact they are trying to correct against



Chemical weathering acts as a negative climate feedback by reducing the intensity of an imposed climate warming (left) and cooling (right). *Source: Ruddiman 2013.*

The structure of information flows



EXAMPLES

- Transparency in politics
- Investigative journalism
- Independent reporting



There
IS NO
Planet

Let's
change
for
climate
sake!

END
DRC
ON CL
ACTIO
END THE
OUGH
MATE

STOP CLIMATE
CHANGE OR
FIRE

WHY AREN'T
YOU
PANICKING!

THE END
IS NIGH

KEEP
OUR
PLANET
CLEAN
IT'S NOT

STRTV
IF YOU DON'T
ACT LIKE
ADULTS
THEN WE WILL

DENIAL
IS NOT
A POLICY
F-US

i'm missing my
maths test
for this!!

SAVE OUR

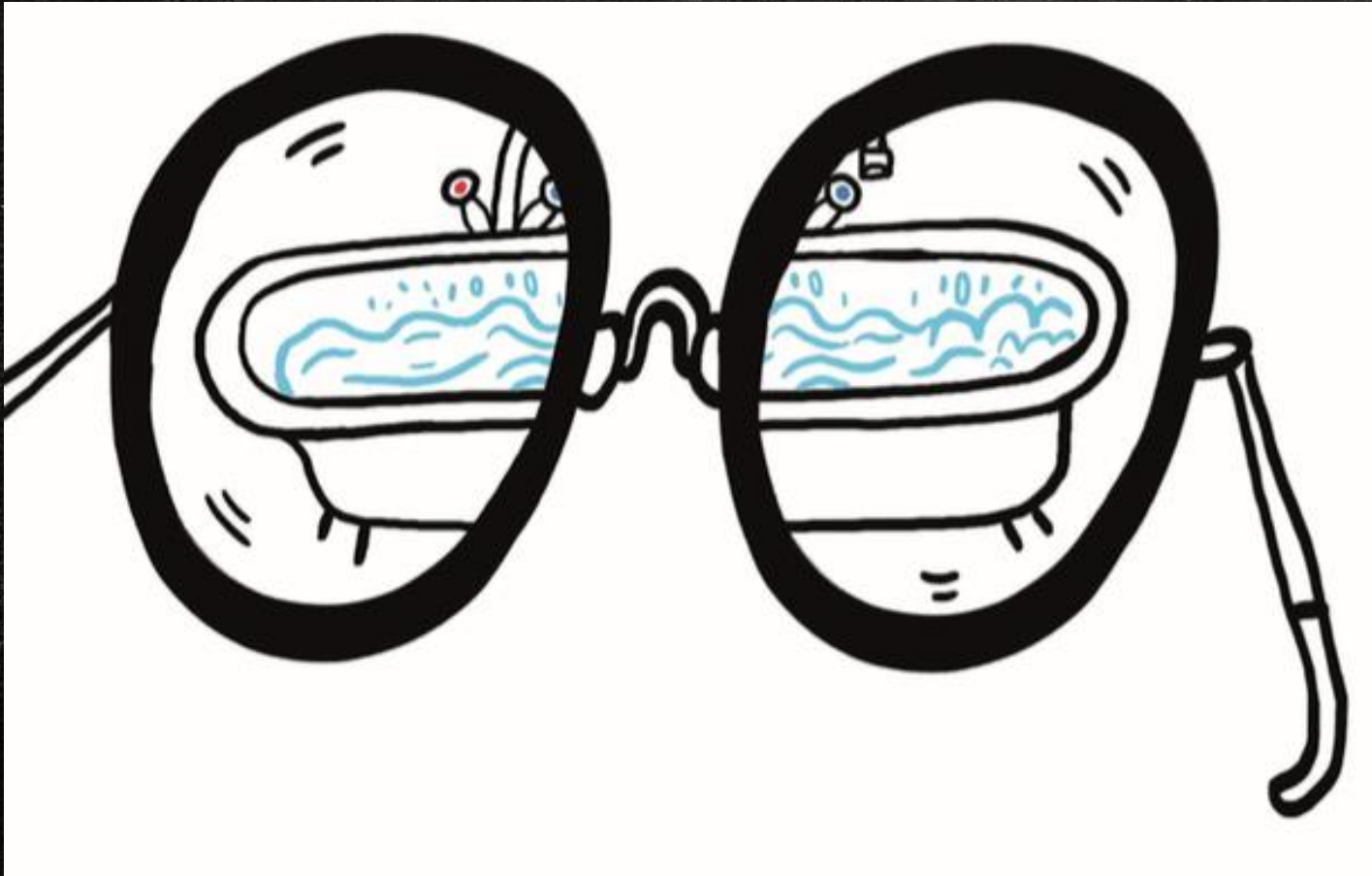
FUTURE

The Environment
IS CHANGING
But We're

STOP
ADANI
COAL
KILLS

CHANGE THE
FUTURE
WIT THE CLIMATE


The mindset or paradigm out of which the system arises



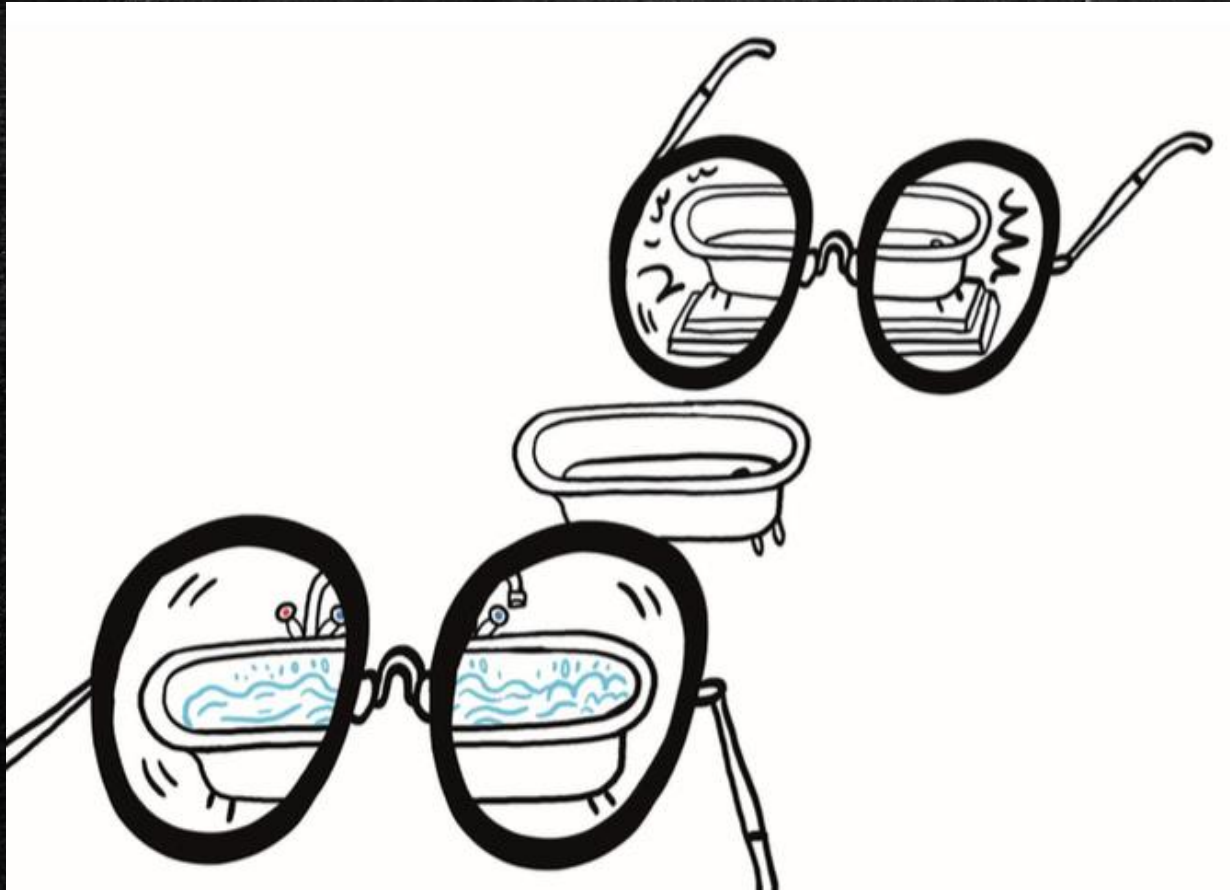
EXAMPLES

- Beliefs and traditions
- Values
- Religions
- Western worldview

The mindset or paradigm out of
which the system arises



The power to transcend paradigms



*"Ability to shift
between different
paradigms and see the
limitations of all of
them"*

- Meadows (2008)

Form teams of five.

Sort the different leverage points
and their potential to make change
in a system.

You have 15 mins.

GO!

12. Constants, Parameters and Numbers



"Probably 90- no- 95- no 99 percent of attention goes to parameters, but there is not a lot of leverage in them. Not that parameters are not important. They can be, especially in the short term and to individuals who stand directly in the flow."

"People care deeply about parameters and fight fierce battles over them. But they rarely change behaviours."



12. Constants, Parameters, Numbers



11. Buffers



10. The structure of material stocks and flows and nodes of intersection



9. The length of delays relative to the rate of system changes



8. The strength of negative feedback loops, relative to the impact they are trying to correct against



7. The gain around driving positive feedback loops



6. The structure of information flows



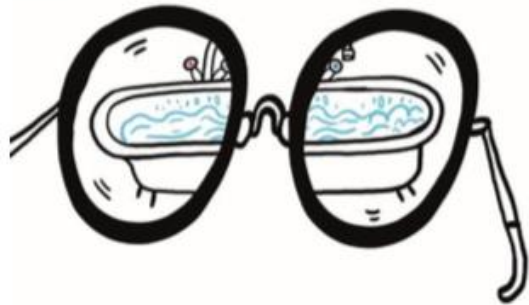
5. The rules of the system



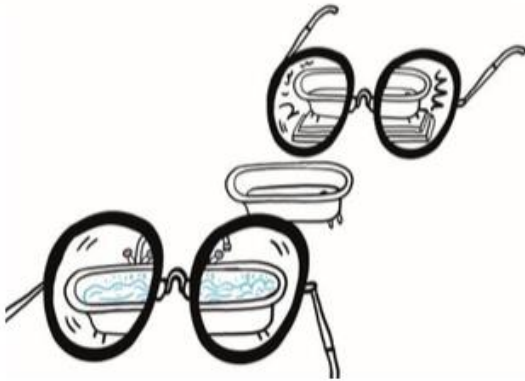
4. The power to add change, evolve or self-organize system structure



3. The goal of the system



2. The mindset or paradigm out of which the system arises



1. The power to transcend paradigms

Reminder: Next 2 classes are mandatory

Thursday 7th: Debate
No preparation needed

Tuesday 12th: Lit Seminar 2 (The Divide)
Please finish the book!

See you Thursday!