Systems Thinking as a core competence
for Sustainable Development and
Digital Transformation

SYSTEMA Project - Funded under the Erasmus+ KA2- 2020-1-IT02-KA204-080082

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1° module – the basics and basic tools for systems thinking

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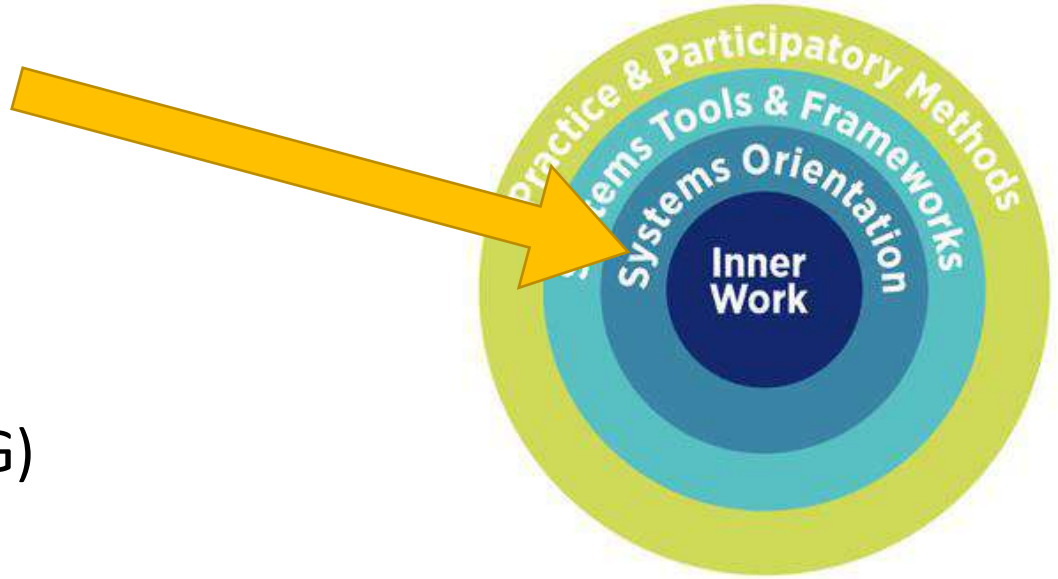
1° module – the basics and basic tools for systems thinking

- ❑ A living system of systems
- ❑ Definition of system
- ❑ Frames
- ❑ Behaviour-over-time graph (BOTG)



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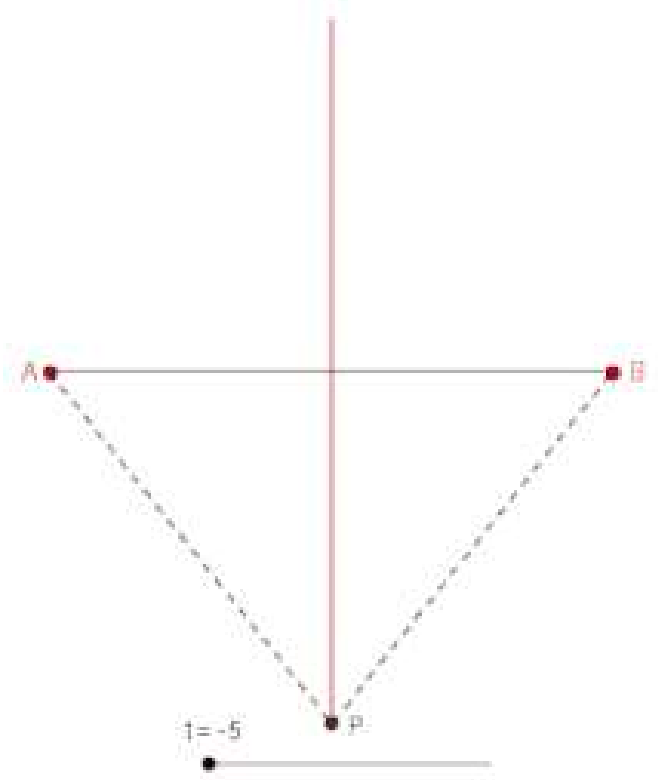
A living system of systems: “Triangles”

The participation game “Triangles” quickly illustrates the concept of leverage points through concrete changes made to the group’s structure.



“Systems thinking is the discipline for seeing the ‘structures’ that underlie complex situations, and for discerning high from low leverage change. [Peter Senge, The Fifth Discipline 1990 [Chapter 5, page 69.]

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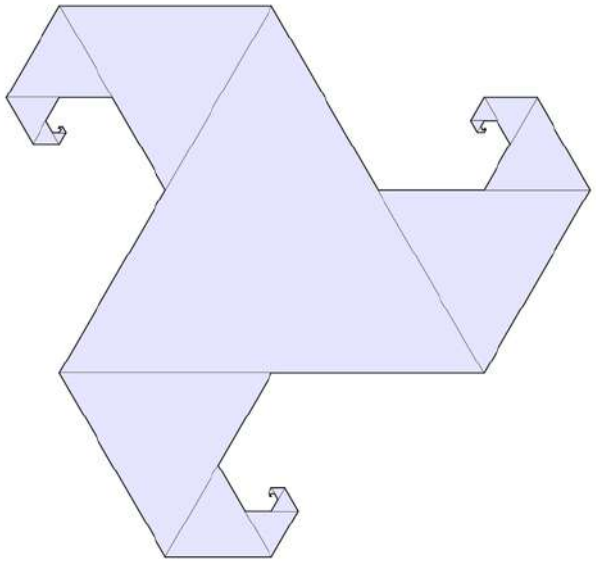
Characteristics of the systems that can be deduced from the game “Triangles”:

- a change in one point also has an impact in other places and with a certain delay
- unpredictable behaviours can emerge from simple initial changes
- systems tend to reach an equilibrium, even if dynamic (eg oscillations)
- in any system there are leverage points



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A system …

"[…] As interdependency increases, we must learn to learn in a new way.

We must have a common language and framework for sharing our specialized knowledge, expertise and experience with "local experts" from other parts of the web.

We need a systems Esperanto

Barry Richmond

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A system …

a set of parts

interconnected and organized

in a way that achieves something

(Donella Meadows)

A system …

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A system …

Consider a real system and specify its:

1. **name**
2. **tangible elements**
3. **intangible elements**
4. **purpose / function**
5. **wider system containing it and its role in it**

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A system …

The parts of a system must all be present for the System to perform its function (≠ collection)

The parts of a System must be organized in a specific way

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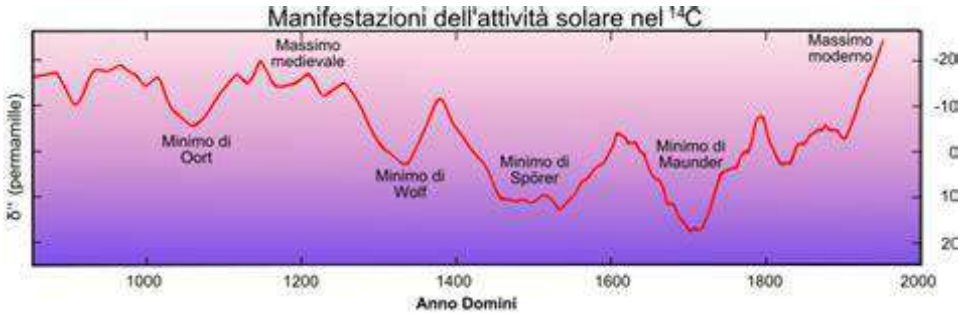
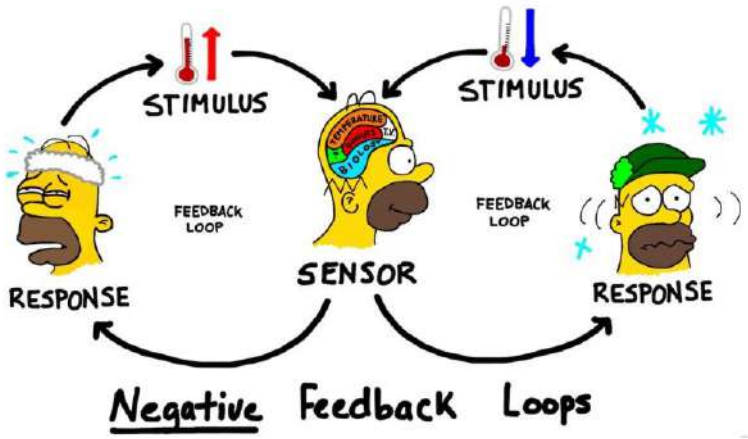
A system …

Systems have a specific purpose within larger systems

They maintain their stability through fluctuations and adjustments



Their behavior emerges from internal feedbacks



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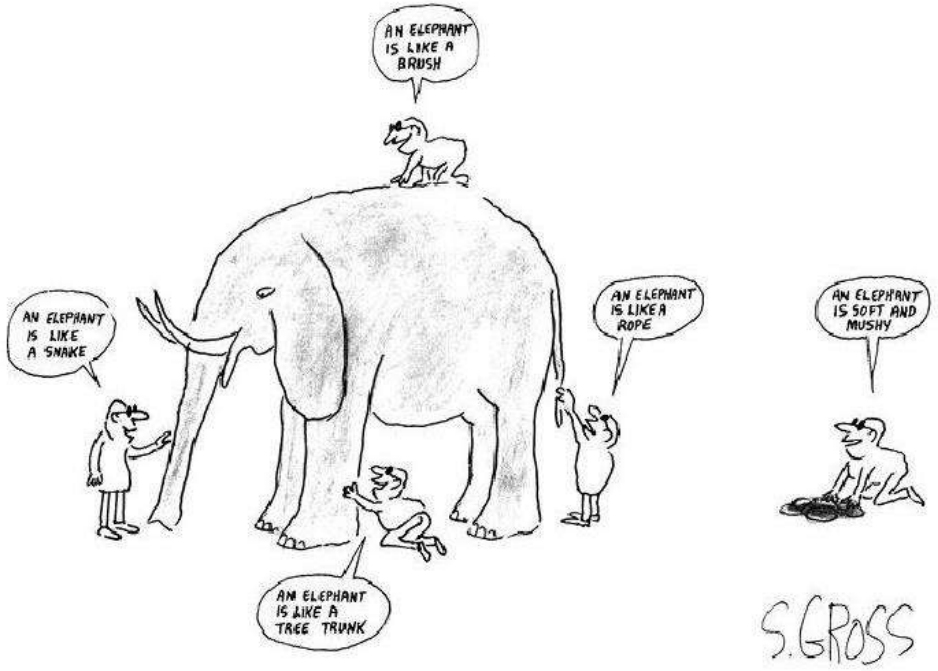
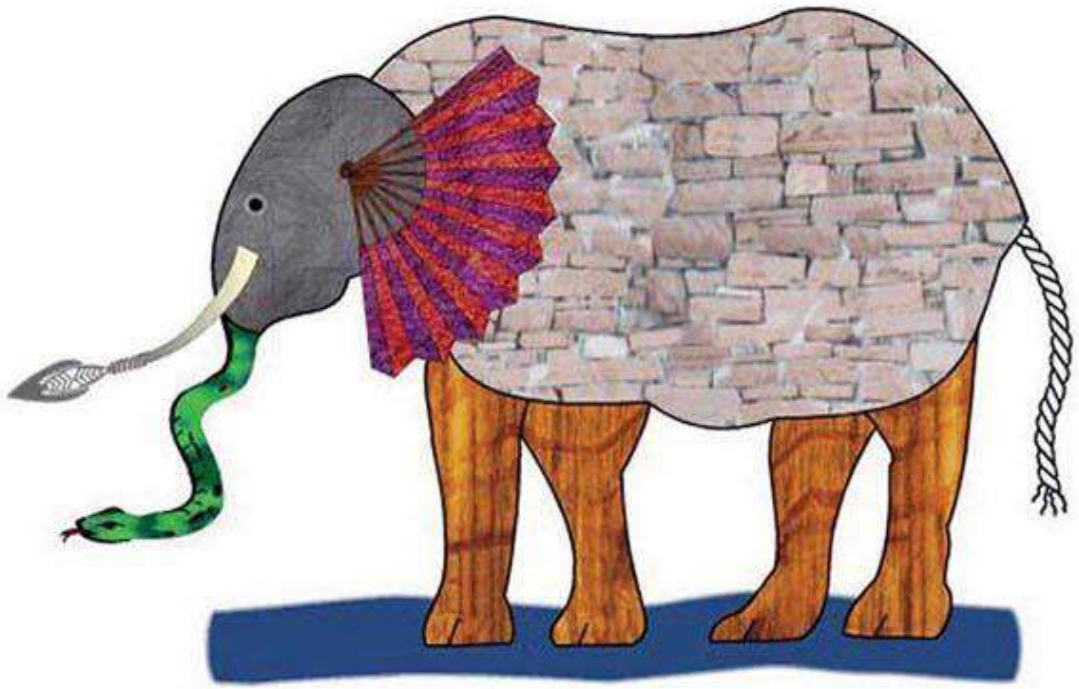
A linear thinking …





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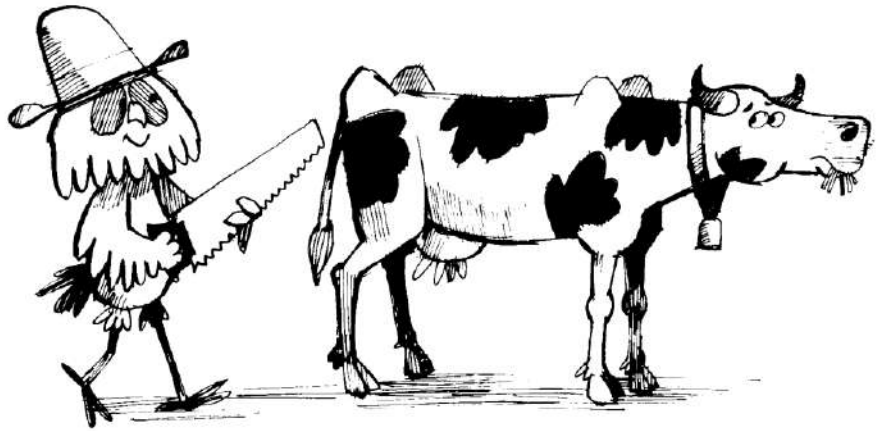
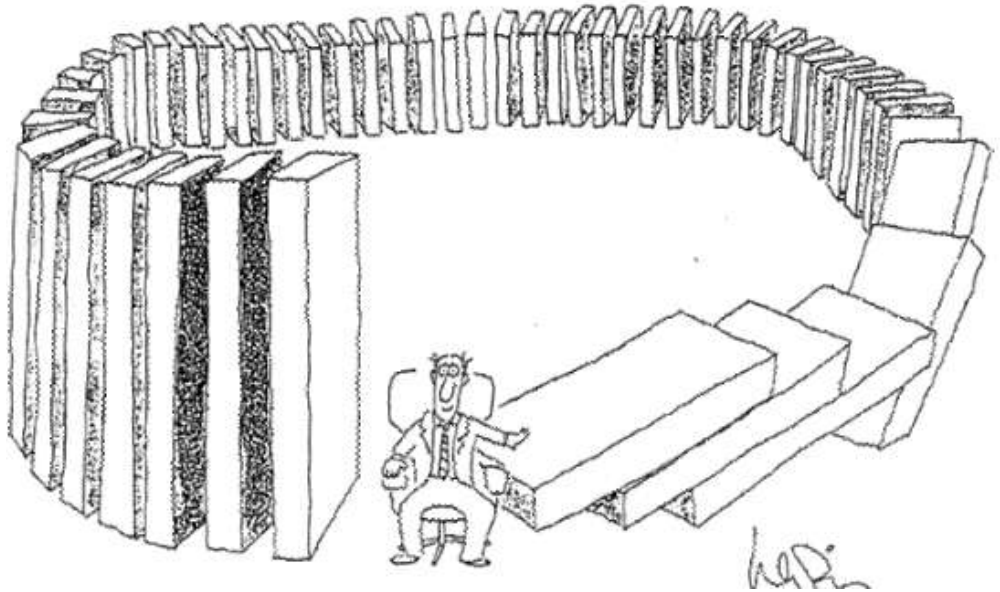
A linear thinking …



Kauffmann, 1991



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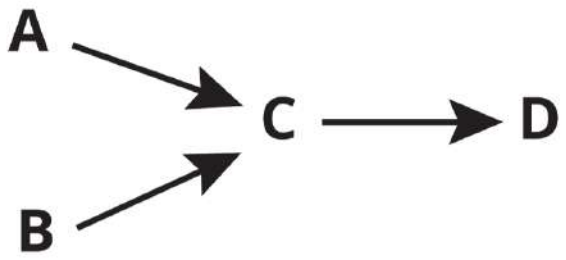
A linear thinking …

Event Oriented Thinking

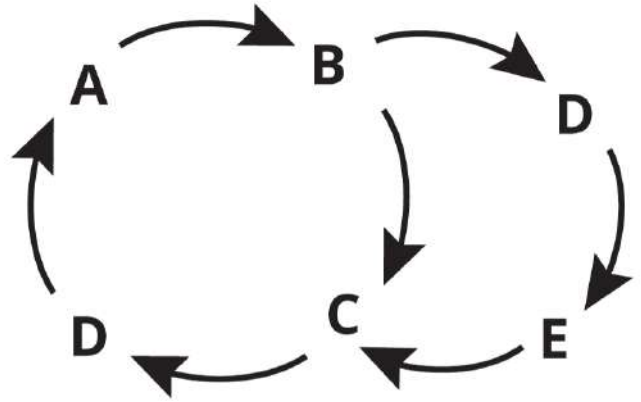
Thinks in straight lines



In event oriented thinking everything can be explained by causal chains of events. From this perspective the **root causes** are the events starting the chains of cause and effect, such as A and B.

Systems Thinking

Thinks in loop structure



In systems thinking a system's behavior emerges from the structure of its feedback loops. **Root causes** are not individual nodes. They are the forces emerging from particular feedback loops.

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FRAMES

The frames we use to look at the reality shape our understanding.

We are often unaware of how we are framing a problem.

To find effective solutions, it is often essential for us consciously to reframe our dilemmas, to redefine their boundaries.

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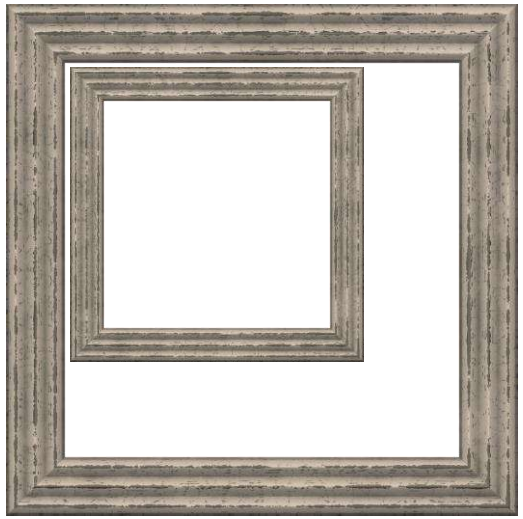
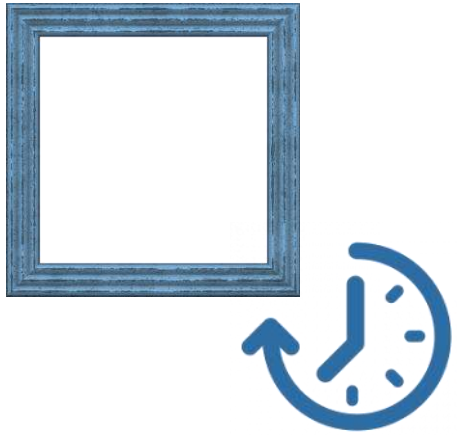
FRAMES

The game “frames” helps to illustrate the impact of choosing different frames or points of view when defining a problem and seeking solutions.

SPATIAL FRAMING



TEMPORAL FRAMING



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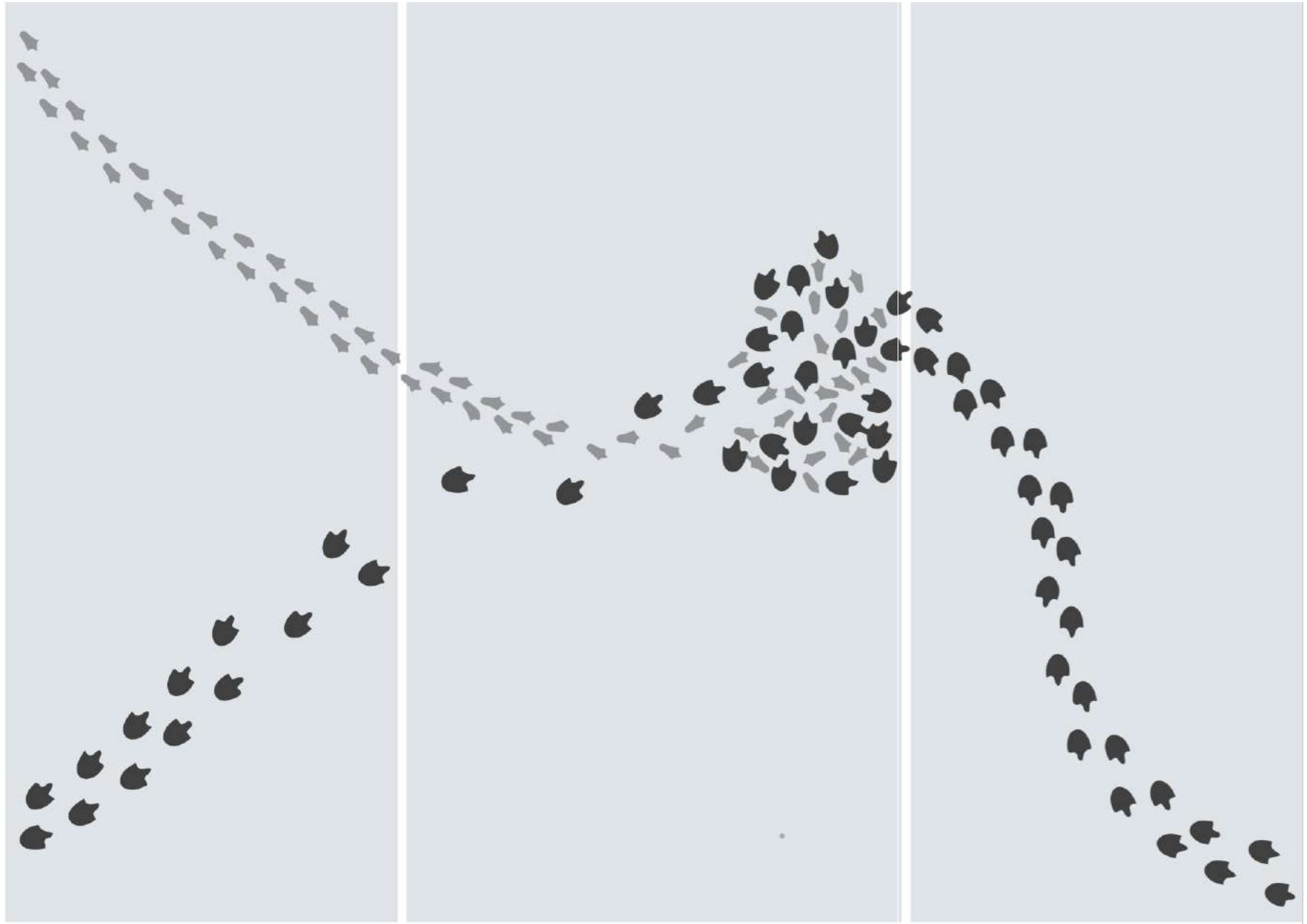
FRAMES



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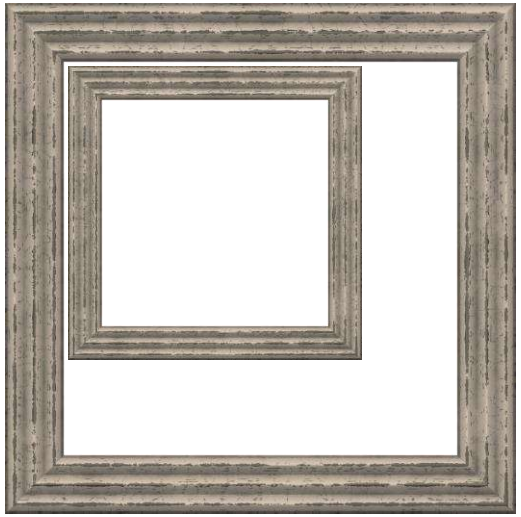
FRAMES

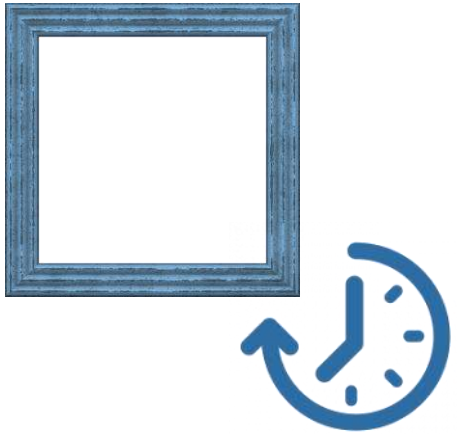
SPATIAL FRAMING



Team exercise:

- *find examples of systems / problems for which changing frames would have changed things*
- *try distinguish and name three different frames relating to the same problem*

TEMPORAL FRAMING



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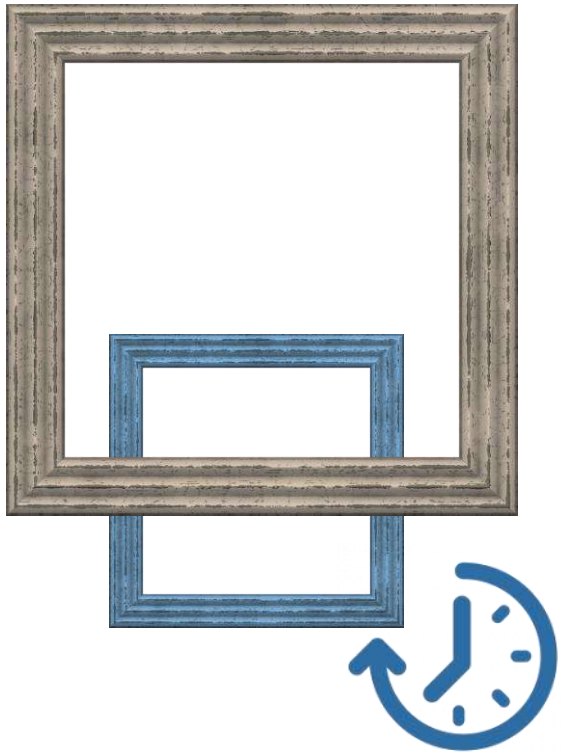
FRAMES



Debriefing

What is the relation of this exercise to our observations about climate change?

What period of time is implicit in the data we use to think about climate change?

How can we know if we have taken a long enough view of the system to detect important changes?

How could we increase the length of time implicit in people's discussion about climate change?

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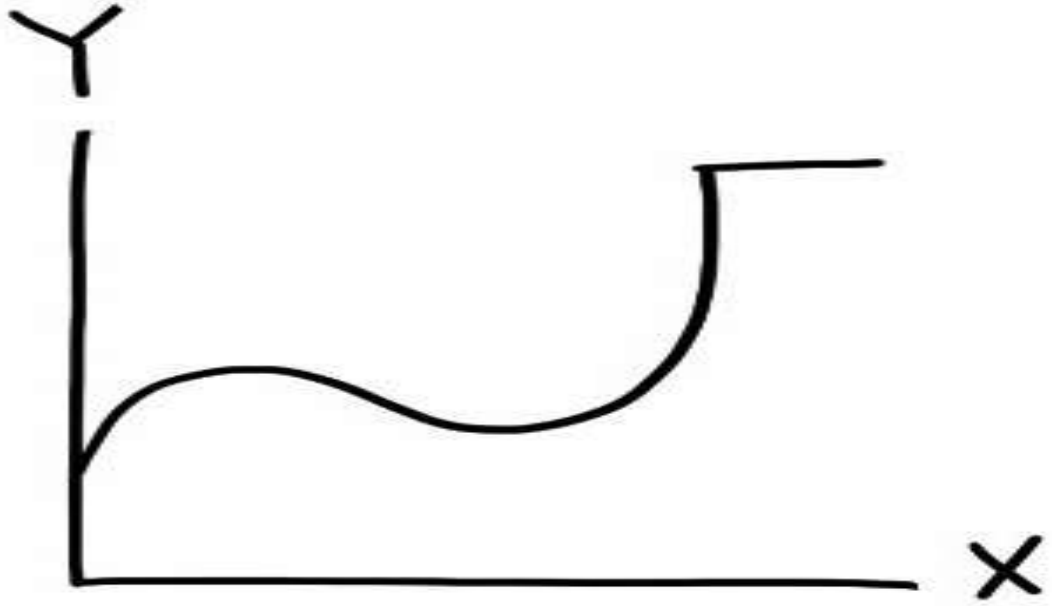
Behaviour-over-time graph (BOTG)

Systems thinkers focus on the nature of change over time.

BOTGs are simple tools that illustrate patterns and trends and demonstrate how something changes over time



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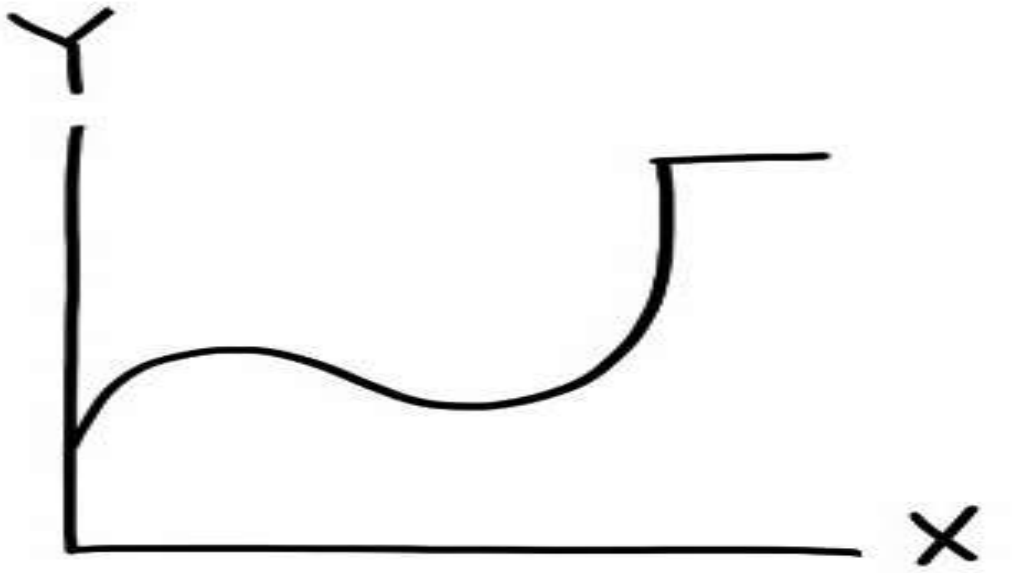
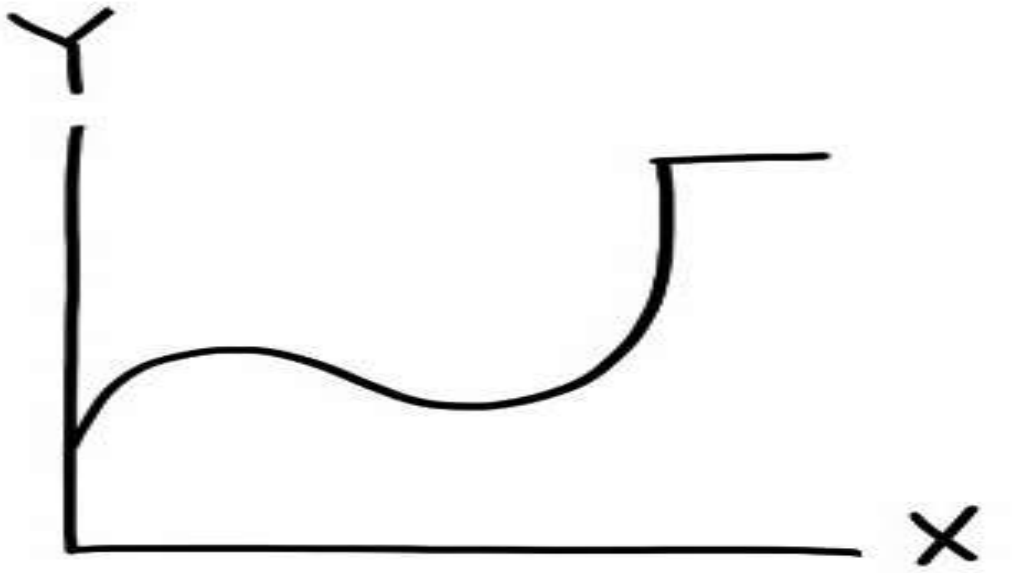
Behaviour-over-time graph (BOTG)



Some sample questions to ask when analyzing parts of a system that change over time:

1. What important elements have changed over time?
2. How has _____ changed over time?
3. During what period of time have the changes occurred?
4. Where on the y-axis should the graph start and why?
5. How would you label the bottom/middle/top of the y-axis?
6. What evidence supports the graph being created?

Behaviour-over-time graph (BOTG)



Questions to consider once BOTGs have been created:

1. What caused any changes in direction or slope?
2. How are interpretations of a graphed element the same or different?
3. What changes may happen in the future based on what has been happening?
4. Do you see any connections (interdependencies or causal relationships) between/among graphs?

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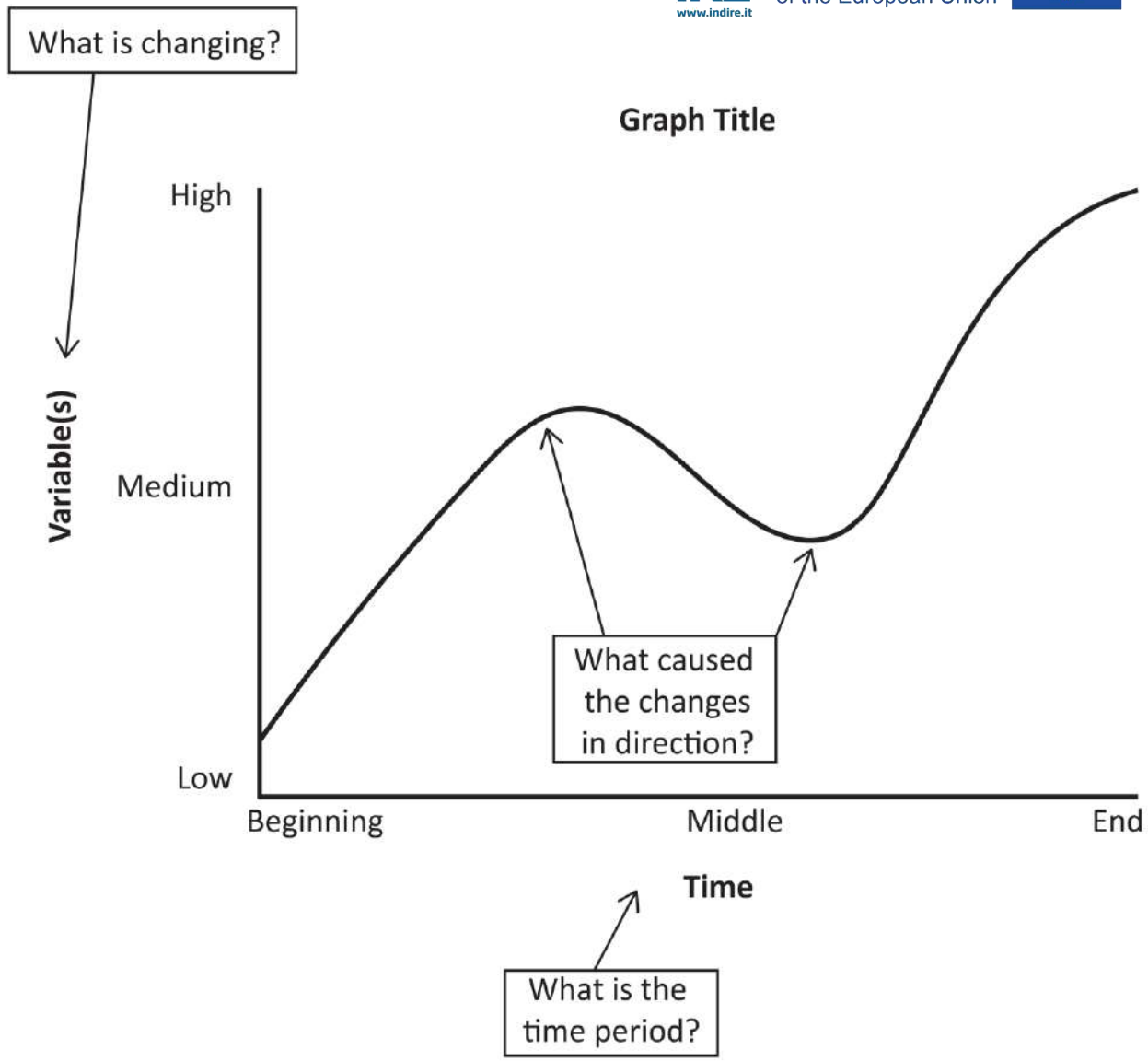
Behaviour-over-time graph (BOTG)

A powerful **question-generator**:

at the beginning of a participatory session, a coaching session, or a strategic conversation within the organization, it is a effective tool for specifying the system concerned.



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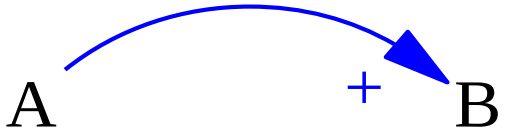
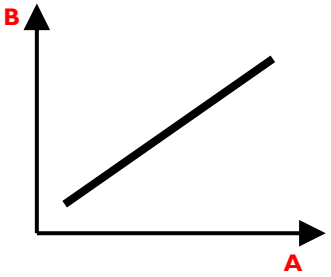
Systems thinking …Esperanto

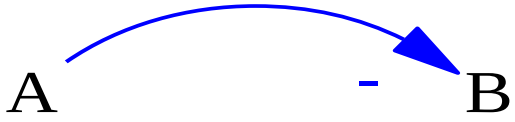
➔ "a change in A causes a change in B"

verbs

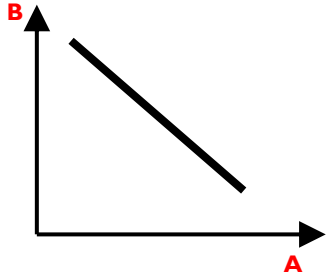


➔ "a change in A causes a change in B in the SAME direction"





➔ "a change in A causes a change in B in the OPPOSITE direction"



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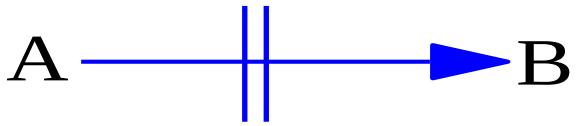
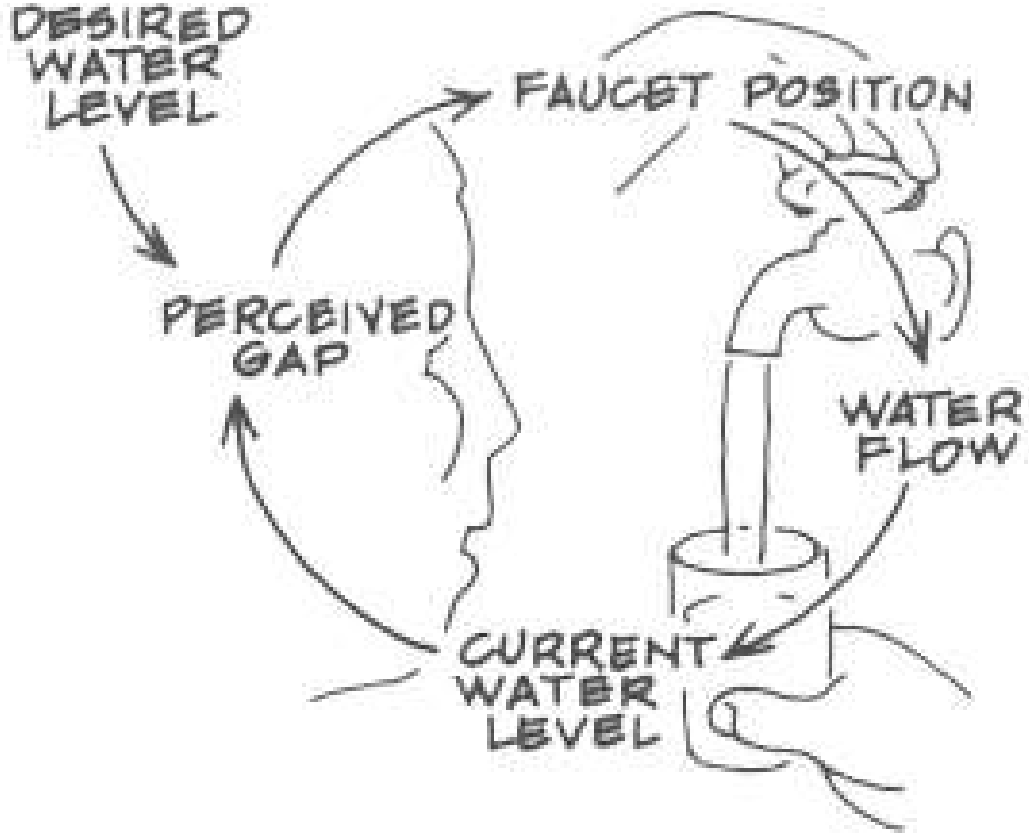
Systems thinking …Esperanto

adverb





At least 4 types of delay!

1. **Perception**
2. **Decision**
3. **Action**
4. **Effect**

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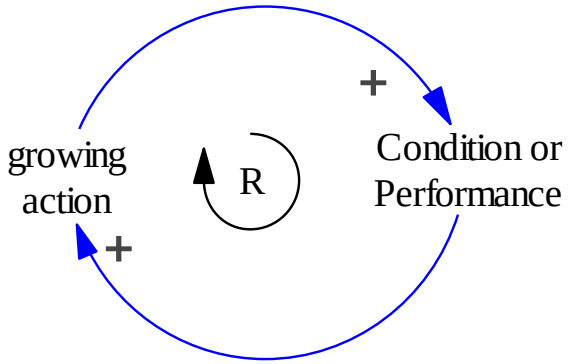
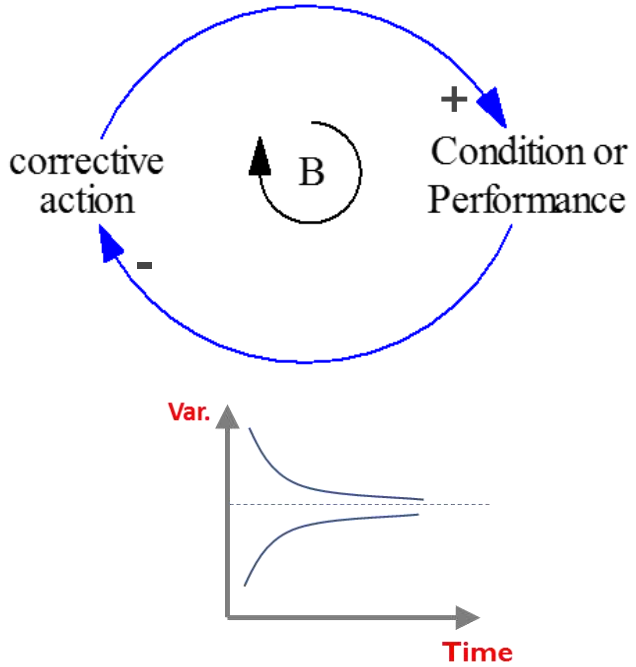
Systems thinking …Esperanto

basic sentences

Reinforcing feedback loop

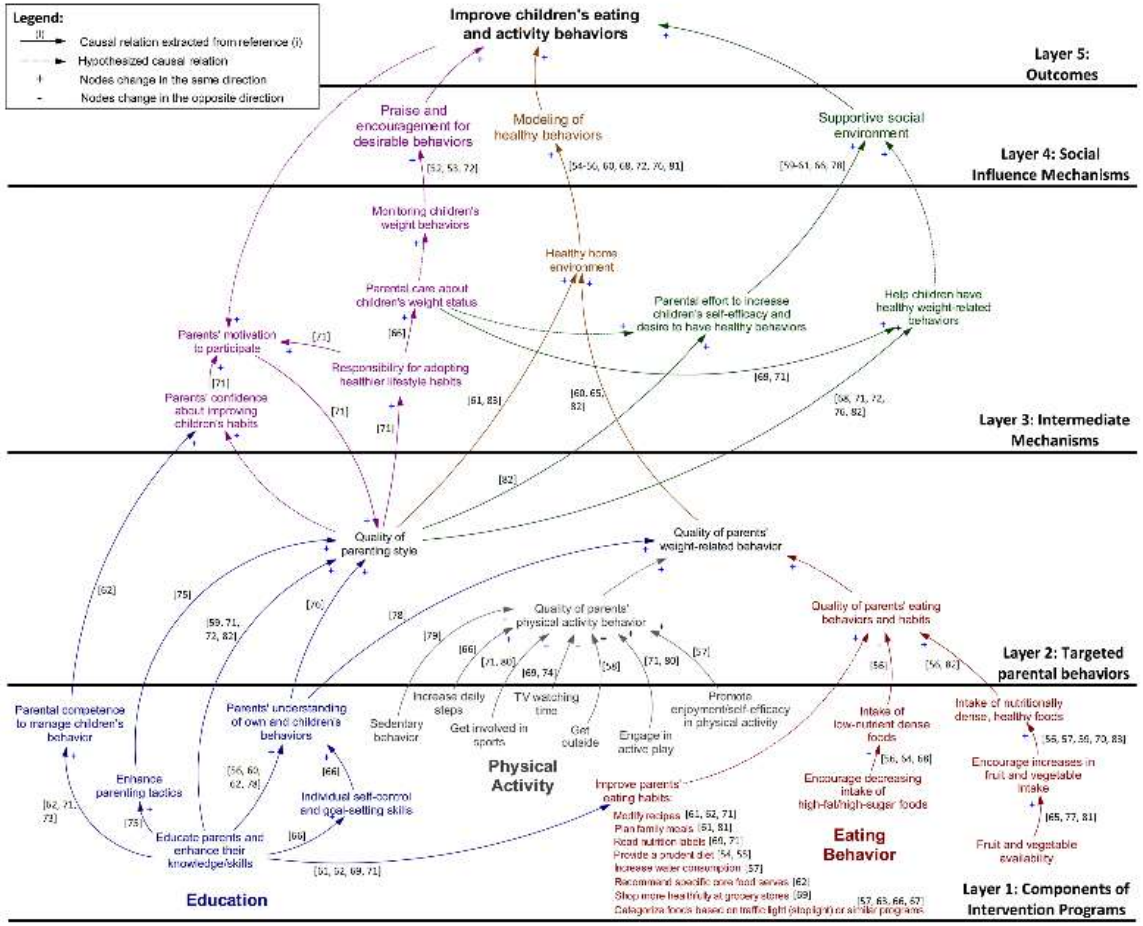


Balancing feedback loop



Systems thinking …Esperanto

discourses



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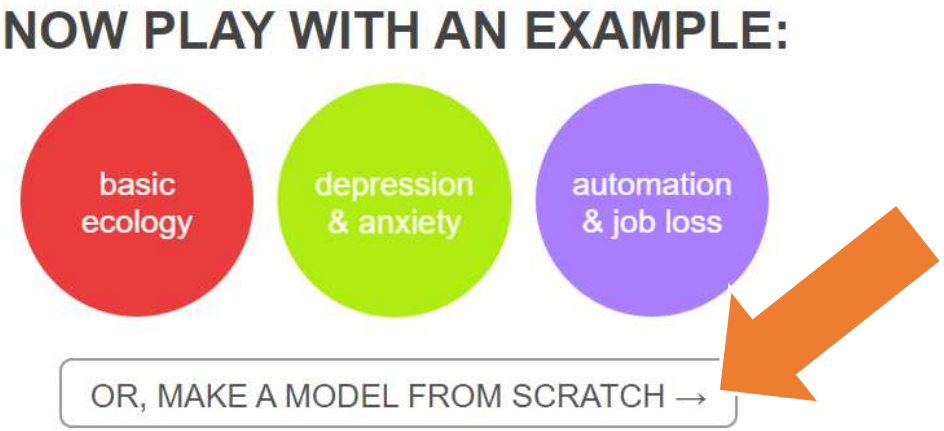
Systems thinking …Esperanto

LOOPY

a tool for thinking in systems

https://ncase.me/loopy/



LANDSCAPE RESEARCH
https://doi.org/10.1080/01426397.2018.1503239

landscape research group
Routledge

Governing mountain landscapes collectively: local responses to emerging challenges within a systems thinking perspective

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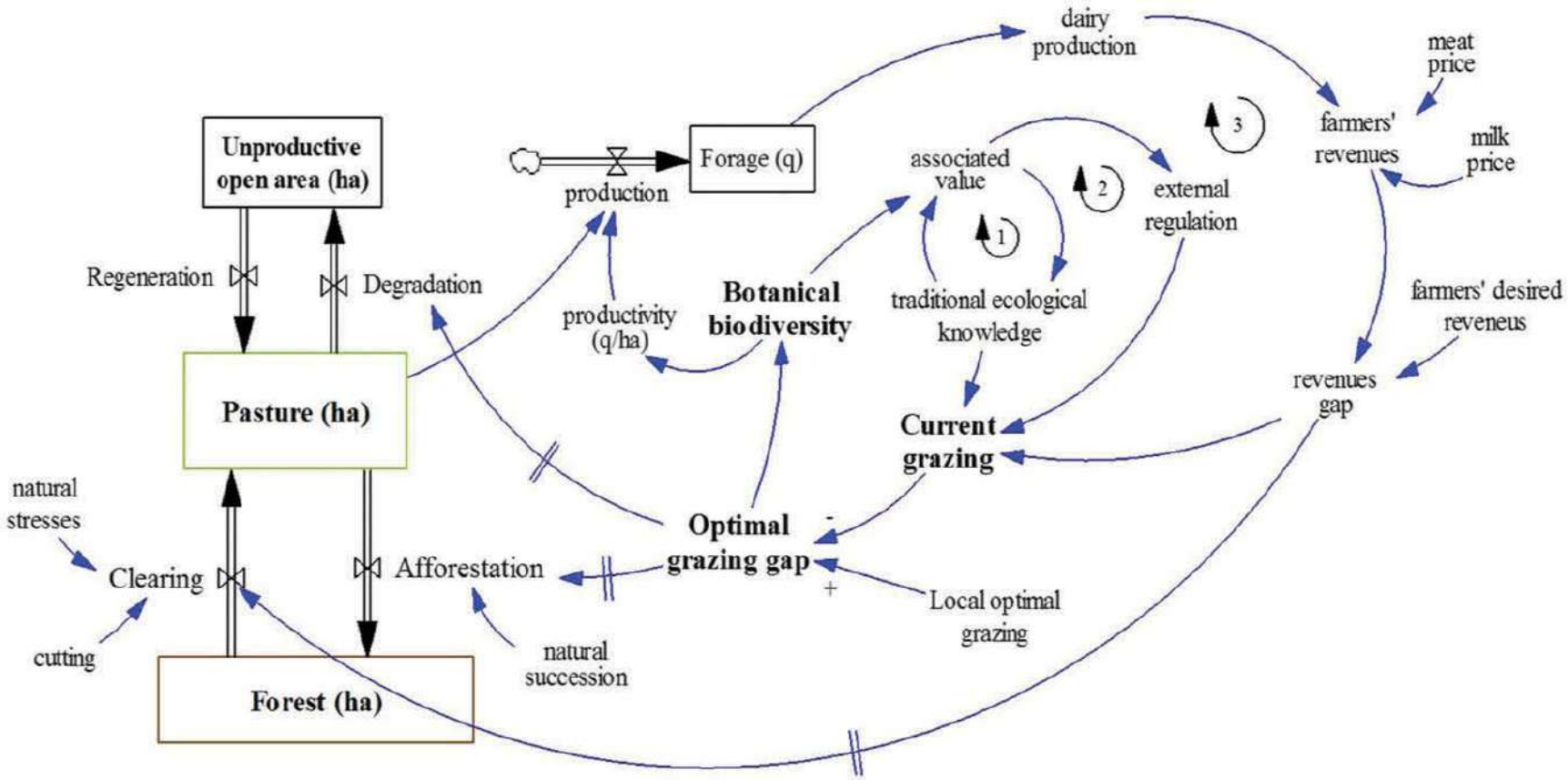
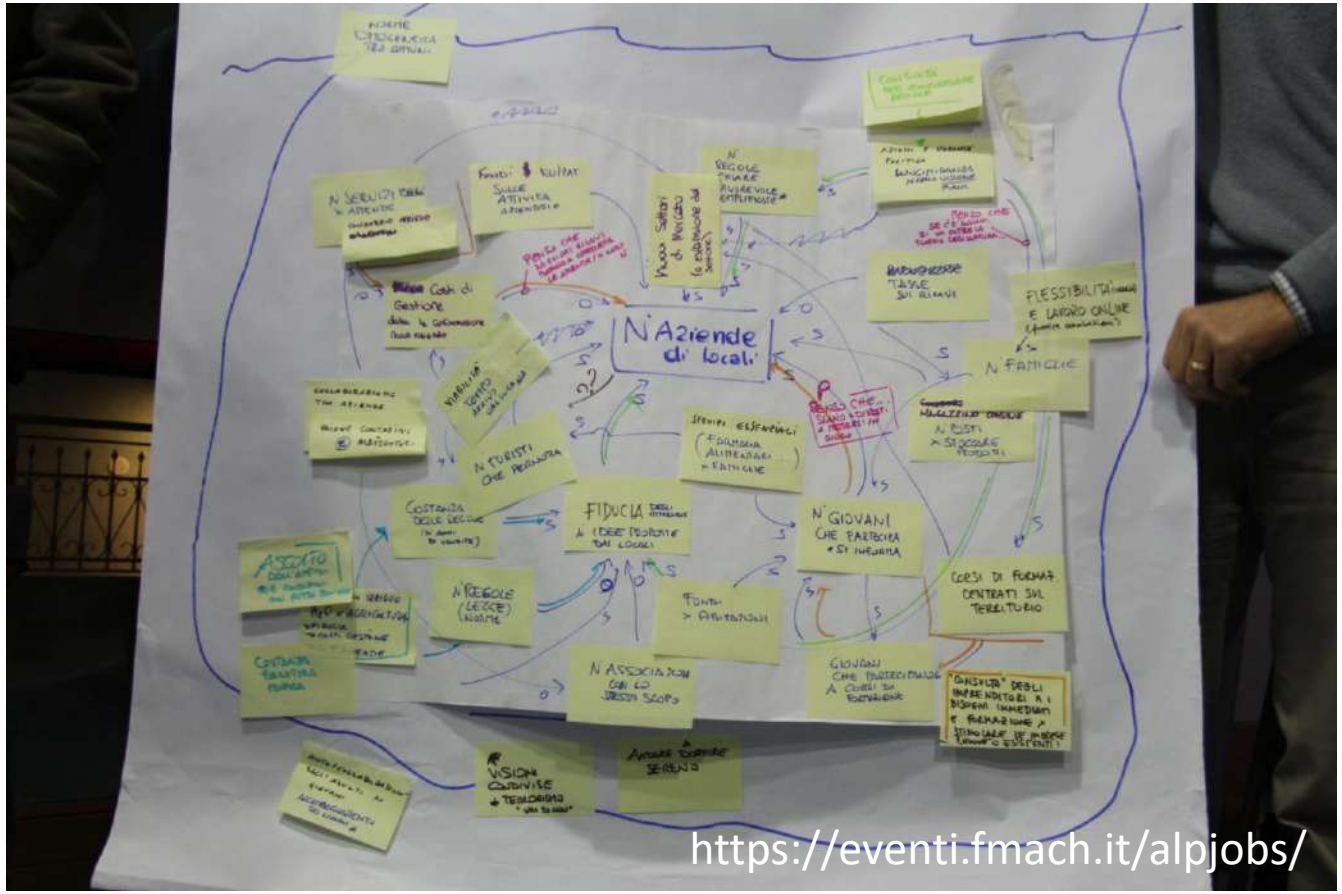
Systems thinking …Esperanto

discourses & discussions



Systems thinking …Esperanto

Conversations & discussions



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