System thinking for decision making

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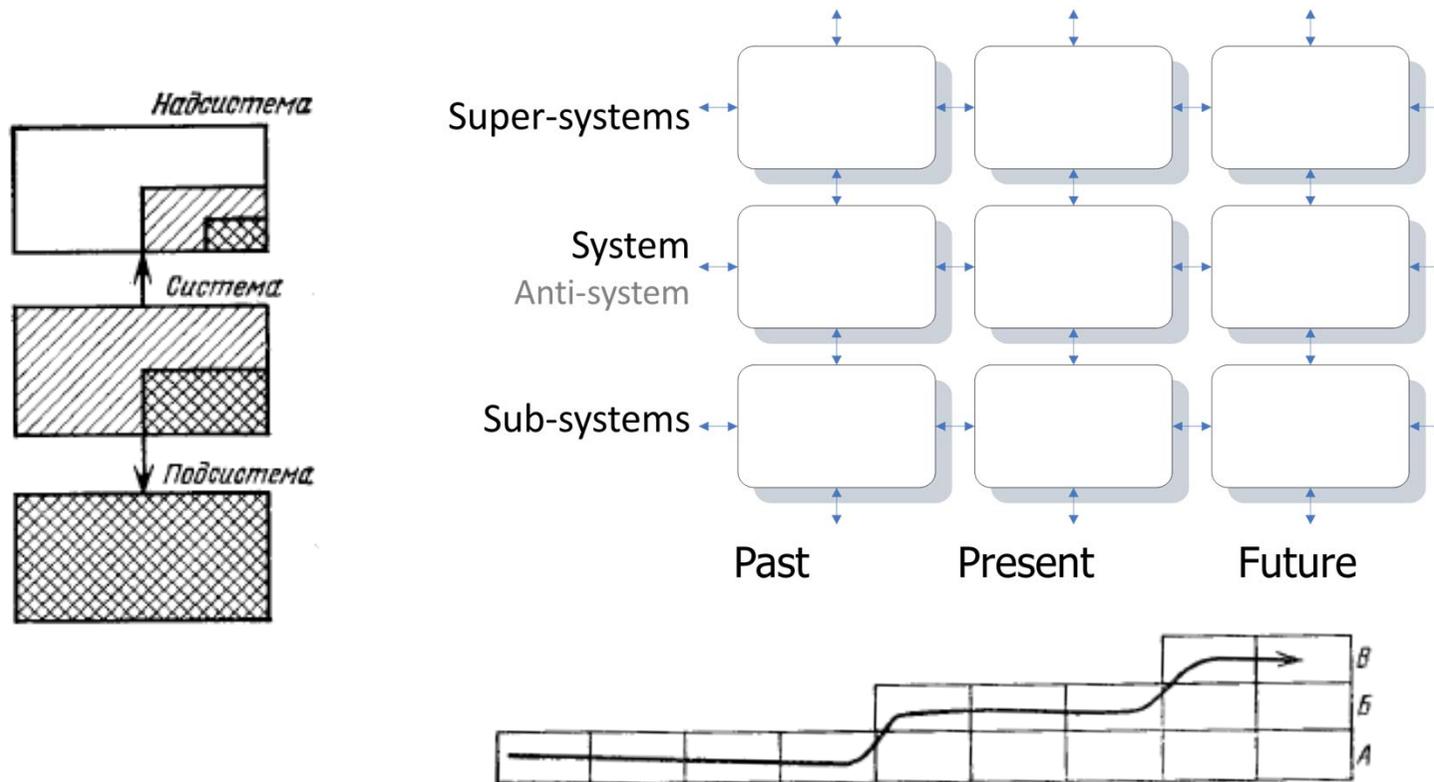dzmitry.kucharavy@polimi.it – http://www.seecore.org

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basic ideas* of the system approach

1. One should examine objectives before considering ways of solving a problem;

2. One should begin by describing a system in general terms before proceeding to the specific.
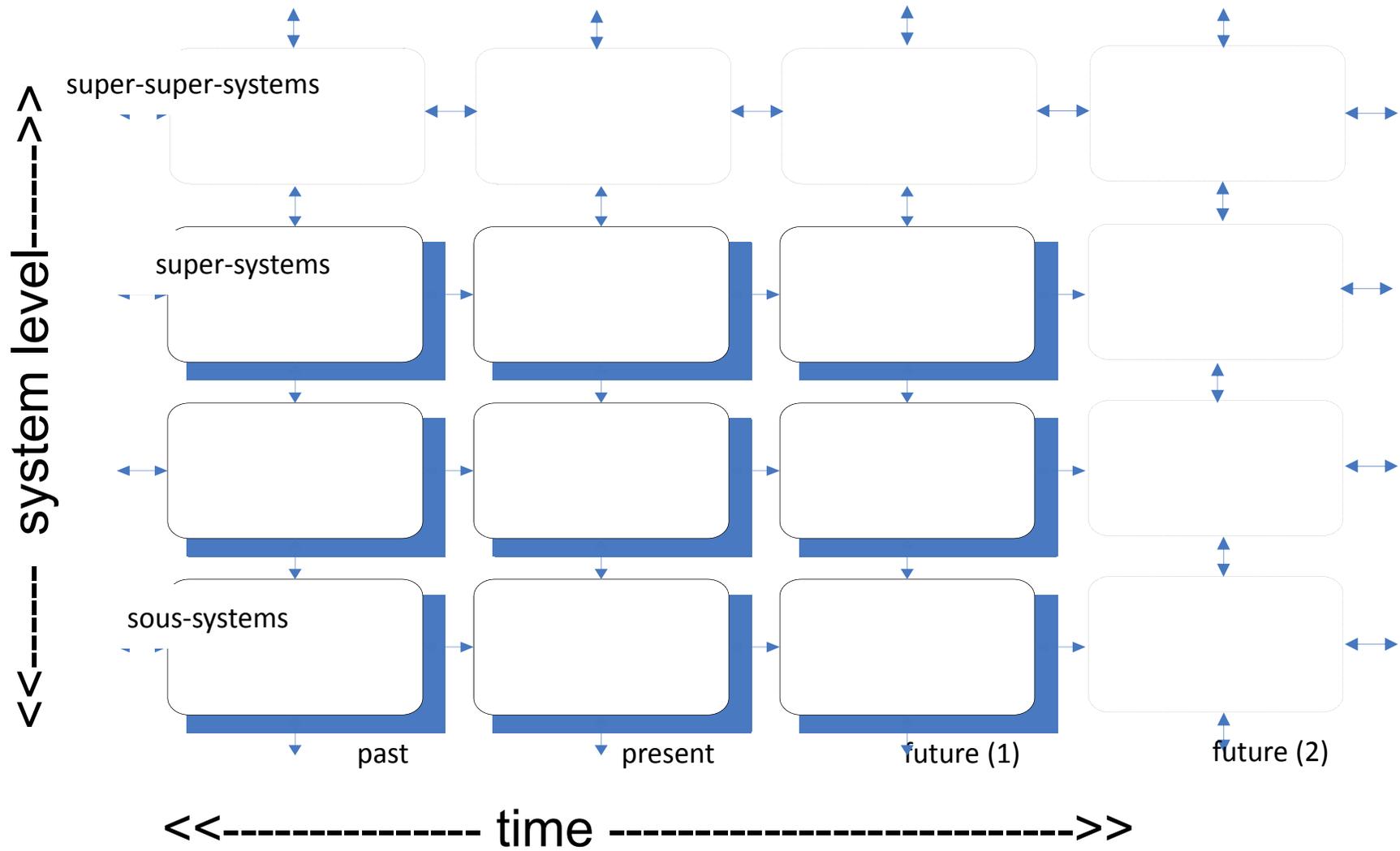
* Armstrong, J. S. (1985)

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Inventive problem solving & system thinking

G. Altshuller (1979):

System operator or Multi-screen scheme of advanced thinking.

Super-systems		
System Anti-system		
Sub-systems		
Past	Present	Future

* Source: Altshuller, G.S. *Creativity as an Exact Science: The Theory of the Solution of Inventive Problems*. (Gordon and Breach Science Publishers, 1984), 320. (in Russian - 1979)
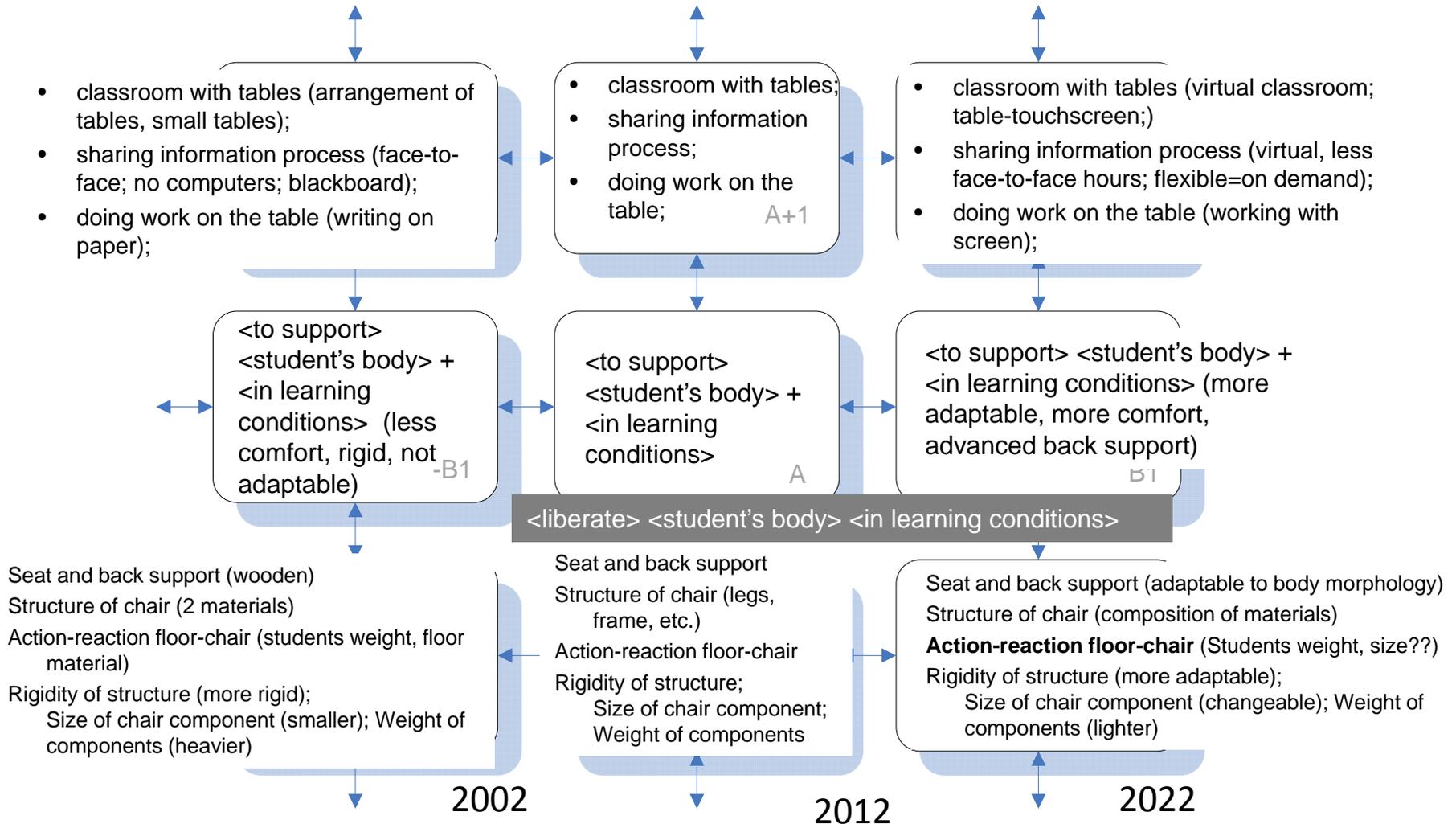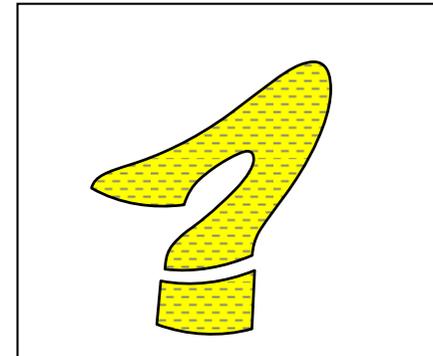
system thinking by SYSTEM OPERATOR

system level----->>

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super-super-systems

super-systems

sous-systems

past   present   future (1)   future (2)

<<-------------- time -------------------->>

Purpose: *to improve the classroom* chair for students*

Viewpoint: *students, designer*

• classroom with tables (arrangement of tables, small tables); • sharing information process (face-to-face; no computers; blackboard); • doing work on the table (writing on paper);	• classroom with tables; • sharing information process; • doing work on the table; A+1	• classroom with tables (virtual classroom; table-touchscreen;) • sharing information process (virtual, less face-to-face hours; flexible=on demand); • doing work on the table (working with screen);

<to support> <student's body> + <in learning conditions> (less comfort, rigid, not adaptable) -B1	<to support> <student's body> + <in learning conditions> A	<to support> <student's body> + <in learning conditions> (more adaptable, more comfort, advanced back support) B1

<liberate> <student's body> <in learning conditions>

Seat and back support (wooden) Structure of chair (2 materials) Action-reaction floor-chair (students weight, floor material) Rigidity of structure (more rigid); Size of chair component (smaller); Weight of components (heavier)	Seat and back support Structure of chair (legs, frame, etc.) Action-reaction floor-chair Rigidity of structure; Size of chair component; Weight of components	Seat and back support (adaptable to body morphology) Structure of chair (composition of materials) **Action-reaction floor-chair** (Students weight, size??) Rigidity of structure (more adaptable); Size of chair component (changeable); Weight of components (lighter)

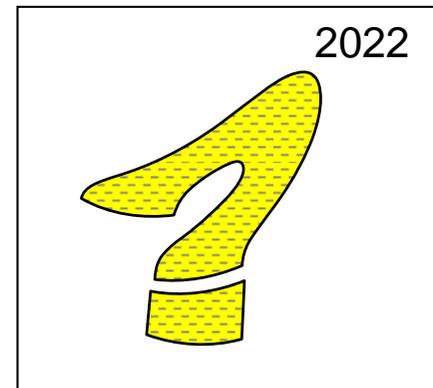2002   2012   2022
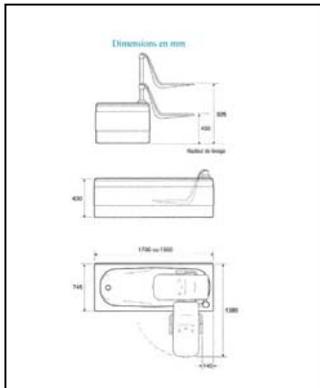
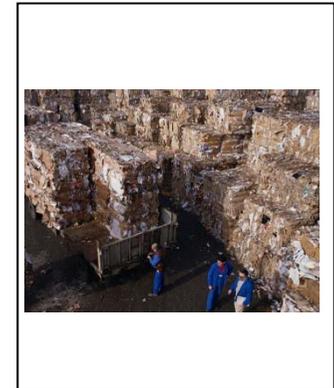# Define system in context of its evolution
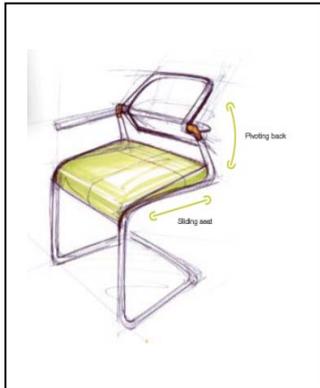
2002

2012

2022

Base
Seat
Back

Base
Ergonomic sliding seat
Flexible pivoting back
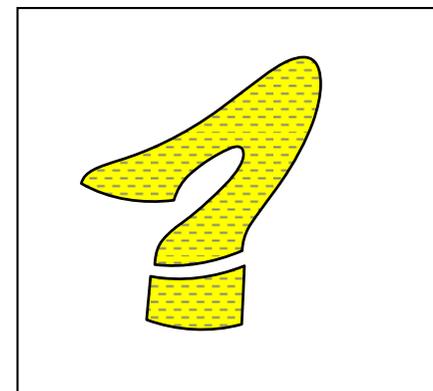
Define system in context of application (life cycle)
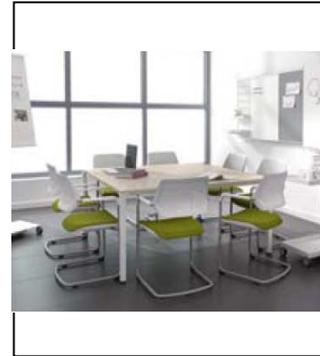
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System is a group of interacting, interrelated, and interdependent components performing a certain function.

Super-system is the system where the selected System is the component (super-system cannot operate without System).

Sub-system is a component of the selected System.

Neighbor-system is a component of a Super-system, relating to selected System.

Super-Systems or Neighbor Systems

super-system

super-system (2)

system (2.1)

system (2.2)

system

sub-system (c)

sub-system (b)

sub-system

system (3.1)

system (3.2)

system (3.3)
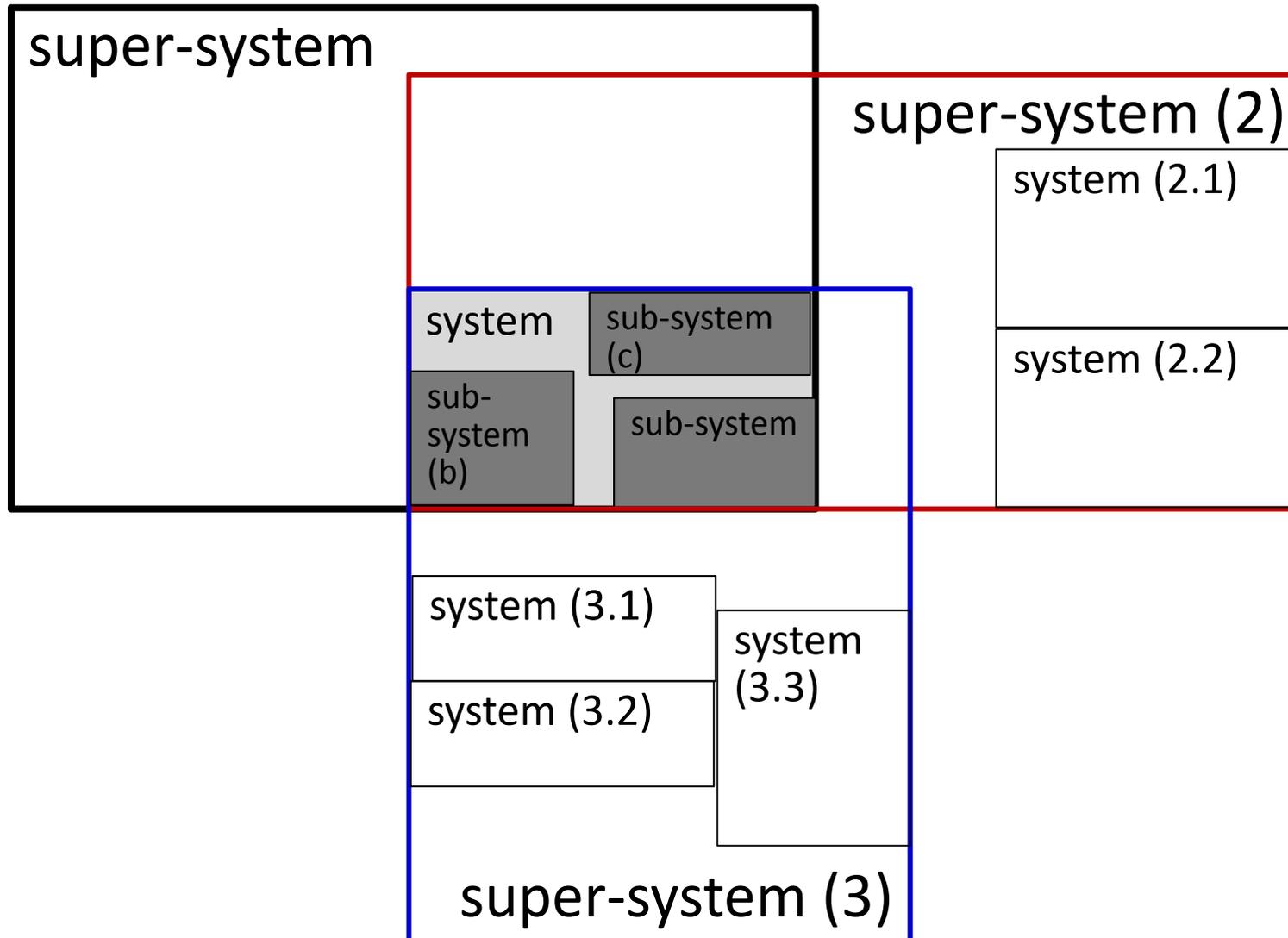
super-system (3)

1. **Define Purpose**
   (Why does one need to run the study?)

2. **Define Viewpoint**
   (Who is going to make study?)

1. Present axis:

a) Define the function of a SYSTEM (central screen)

b) Define main components of the system (sub-systems)

c) Define contexts (super-systems)

2. Past axis:

a) Define a time span for the past-system (days, months, years, etc)

b) Identify difference(s) for the past system (function)

c) What was different at the level of sub-systems?

d) What was different at the level of super-systems?

3. Future axis:

a)   Apply the chosen time span value to the description of the future.

b)   What will be different at the level of super-systems?

c)   What should be different at the level of system (function)?

d)   What will not change at the level of sub-systems?

4. Review of system operator:

    a)   Define the ANTI-SYSTEM
        (system with an opposite function).

    b)   Review function of the SYSTEM and check consistency
        with developed screens.

1. Describe the function using common words and expressions

   pencil – to write, to draw

2. Reformulate the defined function according to the pattern:

   <verb> + <subject/noun> + <..additives/object..>

   <draw> <letters>

3. Reformulate the defined function according to the pattern:

   <change> + <features (values)>

   <change> <color>;

   <change> <...>;

   <change> <...>;

   <change> <...>

* adapted version of what was suggested in 2001 by Nikolai Khomenko

Anti-System

1. Specify function of SYSTEM:

   chair : <to support> <student's body> + <in learning conditions>

   to support = restrict movement

2. Formulate the function of ANTI-SYSTEM by replacing the verb by an opposite one :

   <opposite verb> + <subject/noun> +
   <..additives/object..>

   chair: <to liberate> <student's body> + <in learning conditions>

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