ŠIAULIŲ UNIVERSITETAS

12-15 June 2017

UNIVERSITY OF ŠIAULIAI

SMC "SCIENTIA EDUCOLOGICA"

2nd International Baltic Symposium on Science and Technology Education

BalticSTE2017

"SCIENCE AND TECHNOLOGY EDUCATION: ENGAGING THE NEW GENERATION"

Thursday

15th June 2017

09:00-10:30

INTERACTIVE PLENARY

(Second Floor, Room 205, Library of Siauliai University, Vytauto Street 84, Šiauliai)

*Moderator: **Vincentas Lamanauskas***

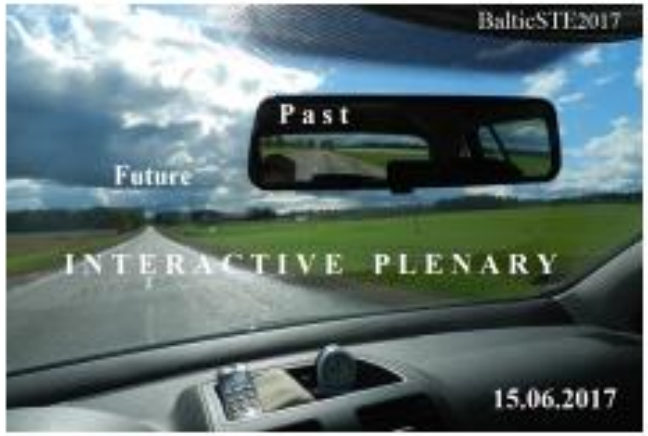
Andris Broks. Systems Thinking - joint philosopchical and psychological basis for modern Science and Technology education (University of Latvia, Riga)

Reviews to the theme:

Raffaele Pisano, Italy
Angela James, South Africa
Jack Holbrook, Estonia
Boris Aberšek, Slovenia

Discussion

INTRODUCTION

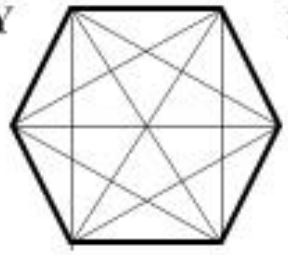


Let us STOP at least for a moment and think a little bit about

SYSTEMS THINKING !

University of Latvia
Prof., Dr. Phys. ANDRIS BROKS
andris.broks@lu.lv
https://blogi.lu.lv/broks/category/materials-in-english/

PHILOSOPHY **PSYCHOLOGY**



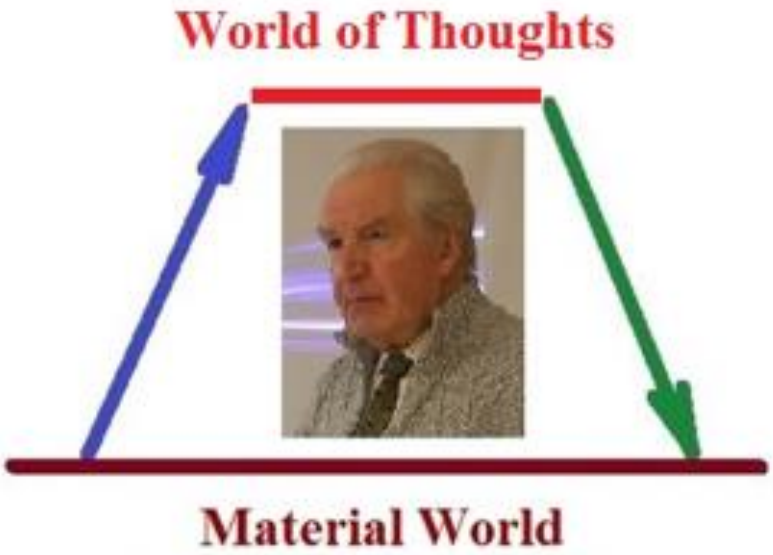
SYSTEMS **THINKING**

SCIENCE and TECHNOLOGY EDUCATION

Systems Thinking:
joint philosophical and psychological basis for modern science and technology education

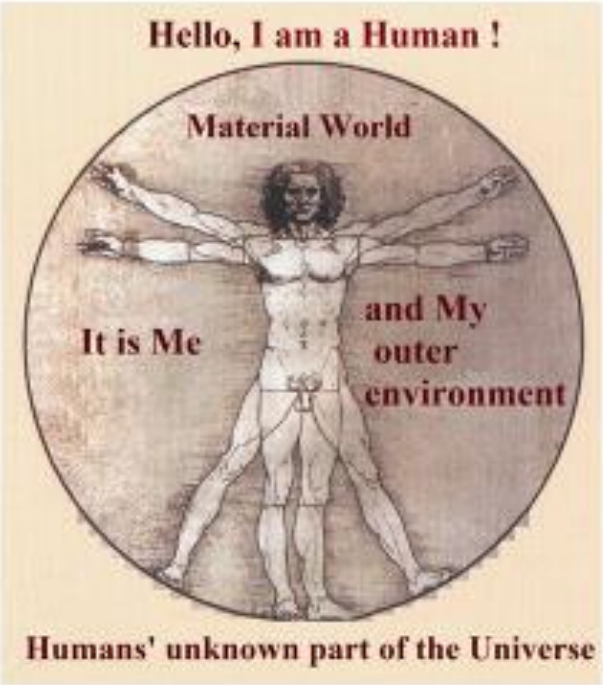
Part 1 WORLD and HUMAN – two worlds

DIALECTICS



Humans' life purposeful activities:
cognition – **consideration** - **behaviour**

W O R L D and H U M A N



Human within the World and
World within the Human –
TWO WORLDS

Material World -
where Human is part of it

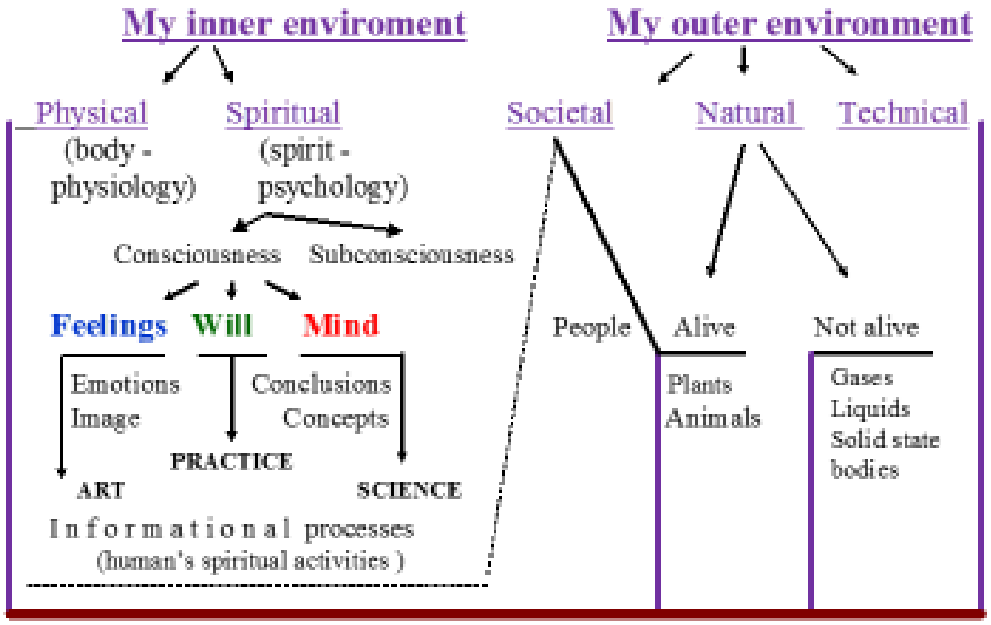
Material World – it is a set of diverse phenomena (changing bodies)

All material world's phenomena are reflected –
cognized within **Human's World of Thouhgts** as SYSTEMS

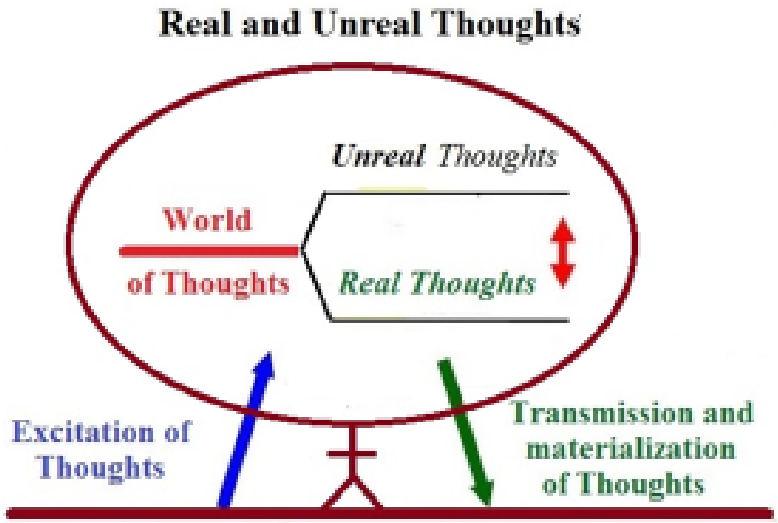
W O R L D and H U M A N

Human - spiritualized alive material being – part of the Material World

Material World - it is ME and my outer environment



Material environment of human's life



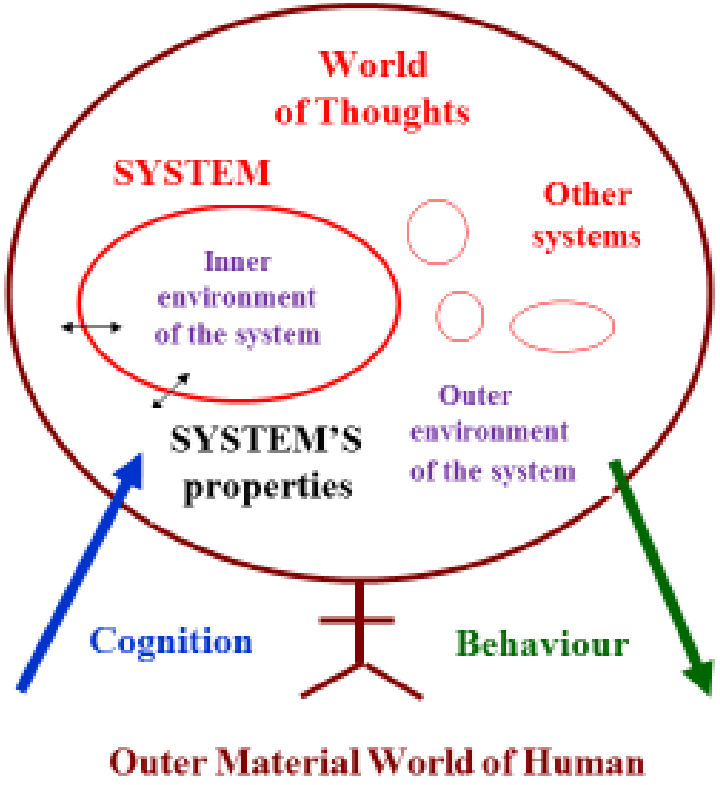
Material (perceptible or real) world

Part 2 Systems Thinking – spiritual activity of Human

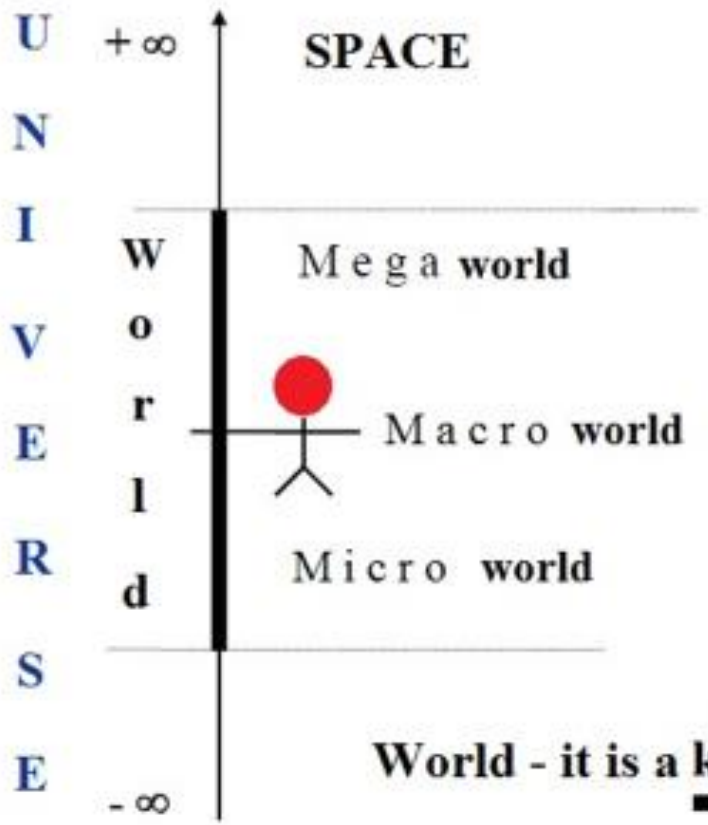
All material world's phenomena are reflected – cognized within Human's World of Thoughts as **SYSTEMS**

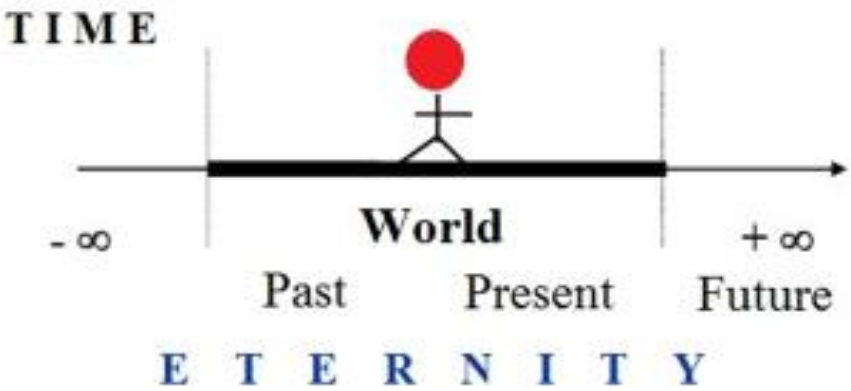
SYSTEM – it is the whole, what contains interconnected parts (inner environment of the system) **and what is surrounded by other systems** (outer environment of the system)

Cause of everything is interconnection of everything



World - it is a set of changing diverse bodies, what is reflected as a SYSTEM in
Human's World of Thoughts



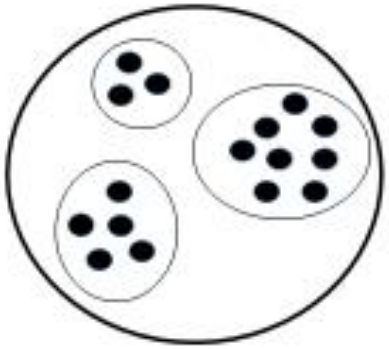


World - it is a known part of the UNIVERSE and ETERNITY

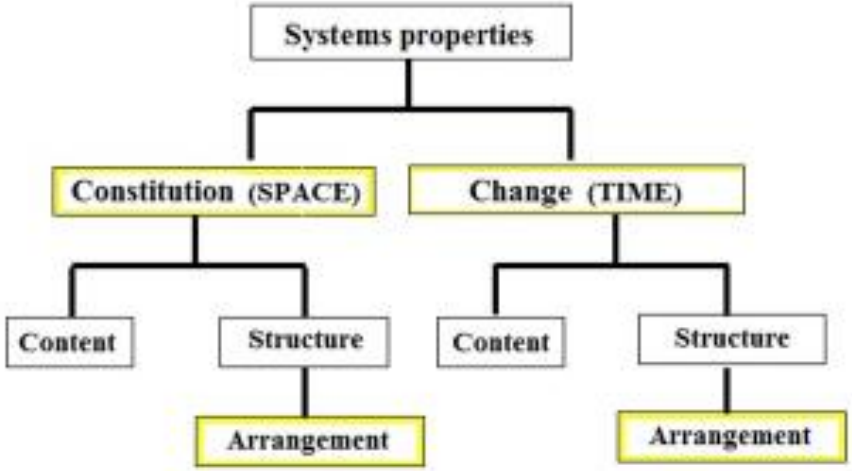
Hierarchical structures of the systems, arrangement of systems' structures

Simple functional structures and **complex** stochastic structures of systems as observed material world phenomena reflections in human's World of thoughts

Simple plain hierarchy structure – horizontal and vertical arrangement of system's elements



General classification of systems properties



Systems thinking : human cognizes world by parts (analysis), comparing them and connecting them together (synthesis)

What we are thinking about?

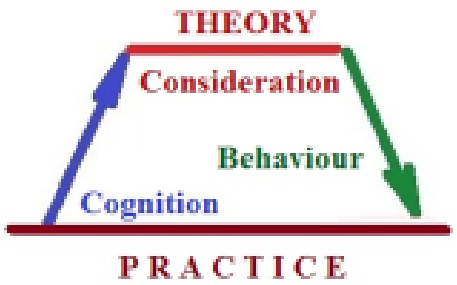
SYSTEM – it is the whole as a set of interconnected system's parts within the outer environment of other systems

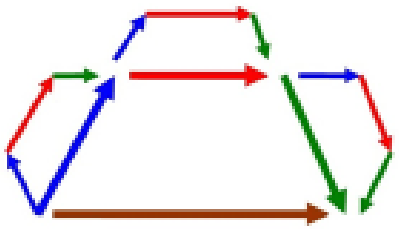
System's BASIC PROPERTIES are **CONSTITUTION** of the system and **CHANGES** of system's properties

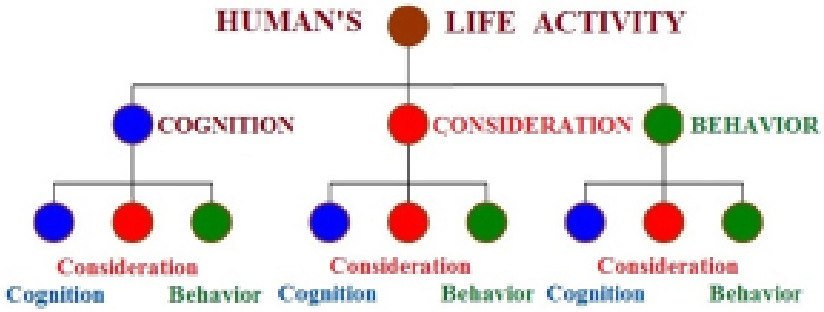
CAUSE of everything is interconnection of everyhing

What we are thinking about and how we are thinking – so we are living!

Universal hiearchical structure of human's purposeful activities



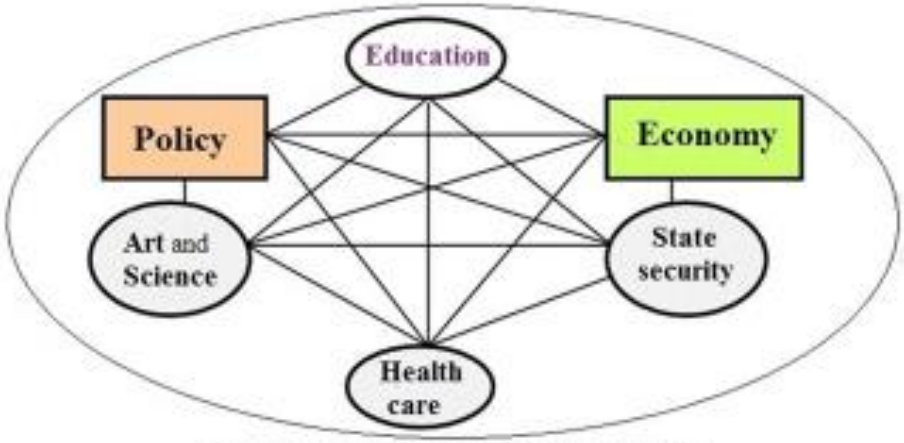




Human's LIFE – system of diverse human activities to satisfy their needs of life

Part 3 Modern LIFE and EDUCATION today for tomorrow

General structure of modern State



State's outer environment (other states)

General structure of purposeful Life activities

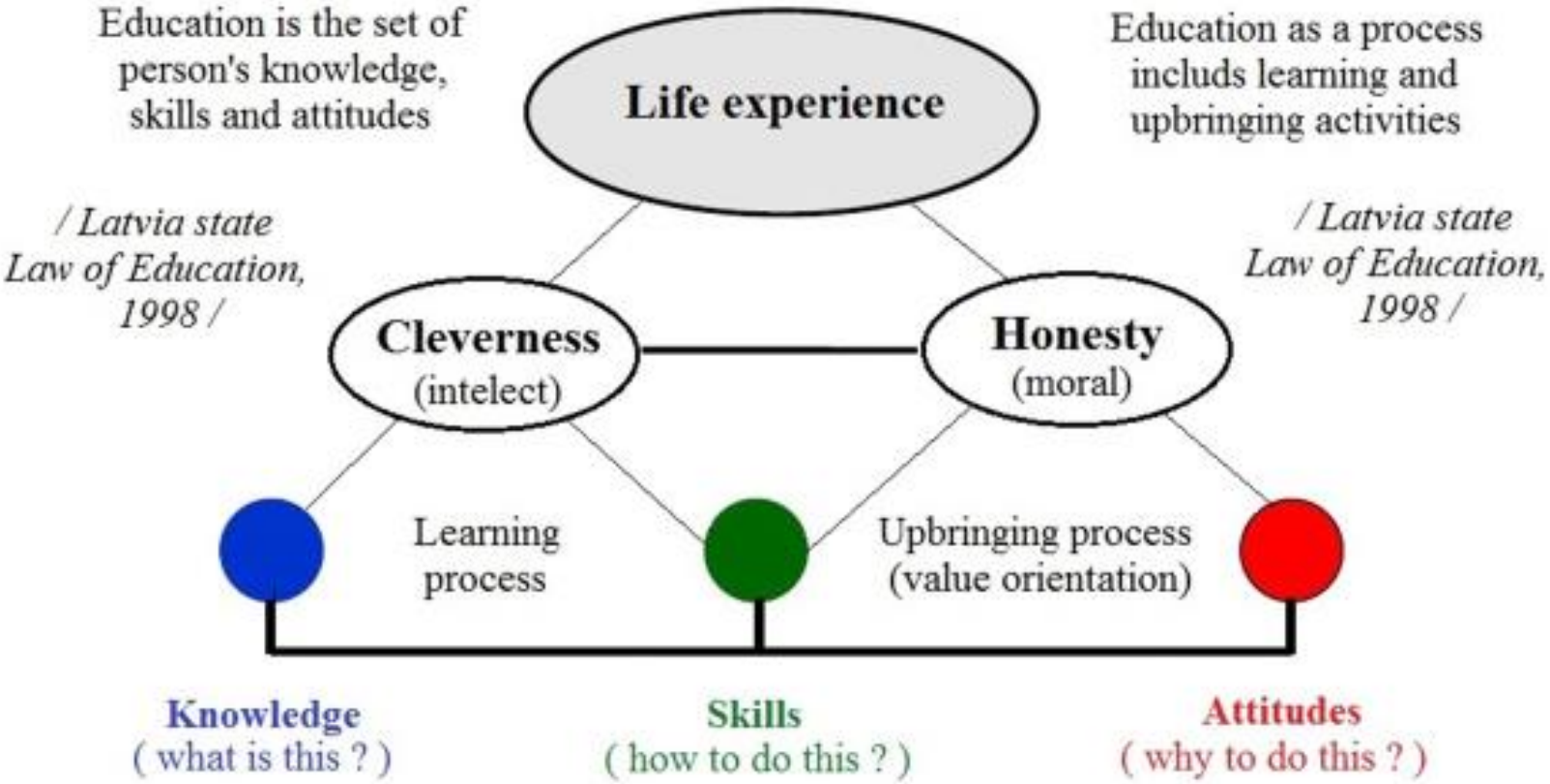
LIFE – joint physical and spiritual activity of Human as well as of Society

- **Artistic** (feelings-images)
- **Practical** (will-actions)
- **Scientific** (mind-concepts)

EDUCATION – it is specially gained Life experience for Life

- **Humanitarian education**
- **Social education**
- **Natural science and technology education**

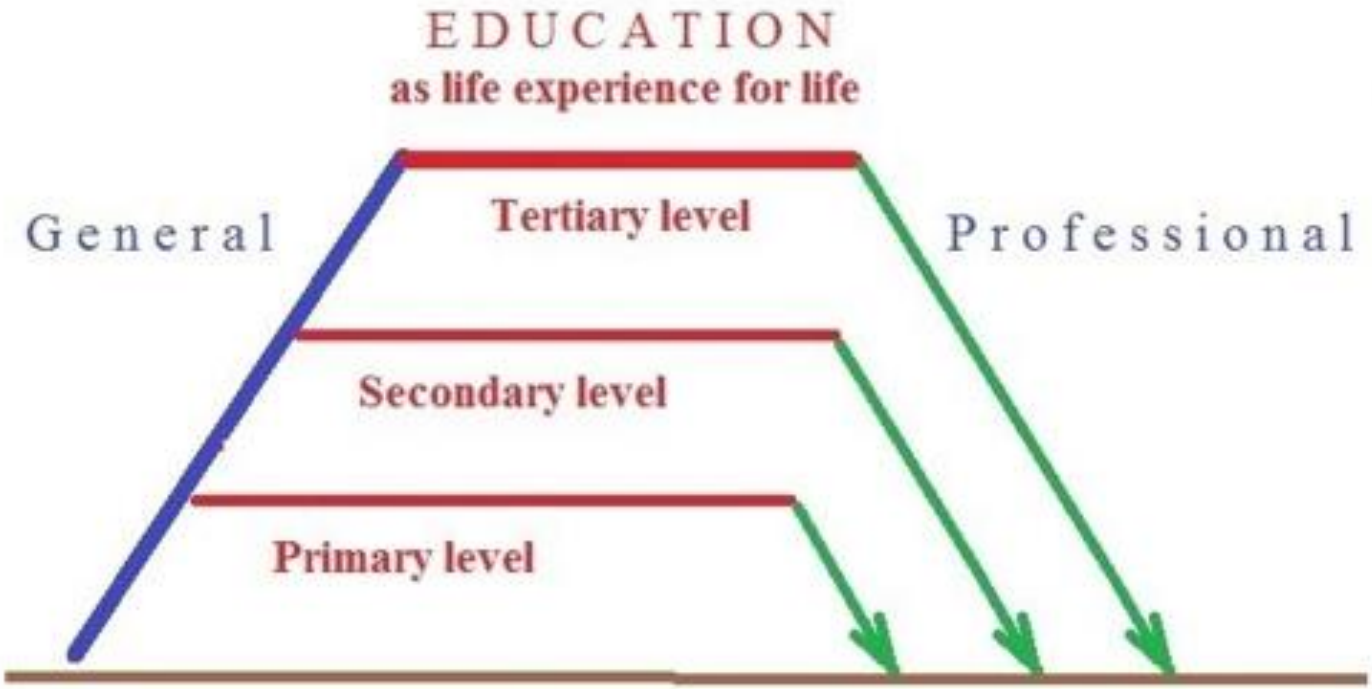
Basic structure of LIFE experience as well as of EDUCATION



Human's research activities as gaining new Life experience for Life

Hierachical structure of Human's realized research activities

Educational Research within General education -
it is gaining new educatie's personal life experience and includes
both Fundamental and Applied Research experiences



Diverse people realize different LIFE styles - thev need different level GENERAL and PROFESSIONAL EDUCATION

What Education for what Life tomorrow?

EDUCATION - specially gained Life experience for Life		Development	Existance
SCIENTIFIC	**MIND** (concepts, conclusions)	Fundamental and applied scientific research	Mindful exploitation and repair of technologies
PRAGMATIC	**WILL** (needs, goals, resources, satisfaction)	Creative practice	Exploitation of scientific and artistic achievements
ARTISTIC	**FEELINGS** (images, emotions)	Fundamental and applied artistic research	Inspiration and interior designe

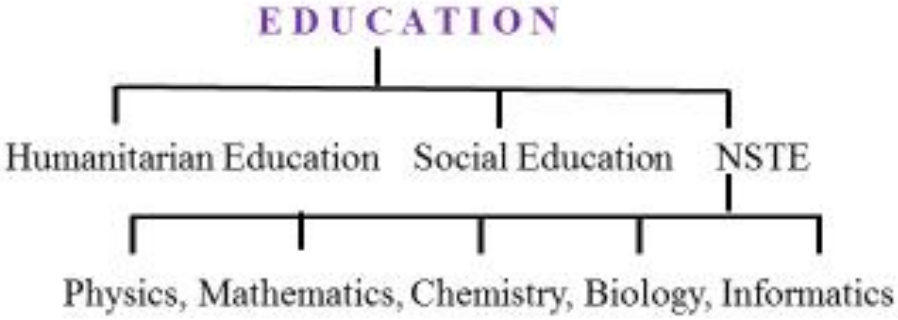
CONCLUSION

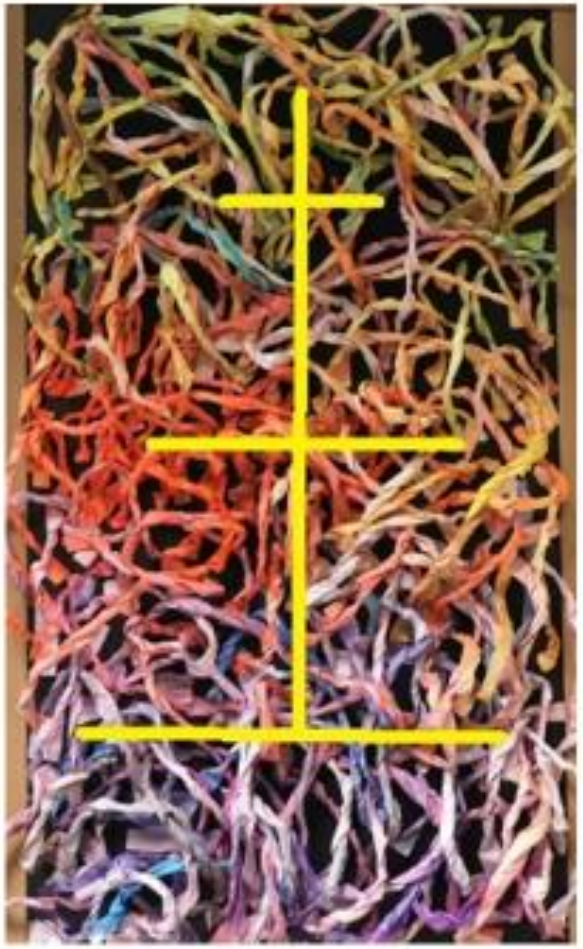
It is the time to look forward again : **changes are all around us and we are part of these changes**

It is not a Big Ban again, but **there is an explosion of information today**. We feel lost within a flow of local as well as global information.

It is the time, when we experience changes within our value orientation.

It is the time we need to develop conscious Systems Thinking!





Let us think about thinking -
SYSTEMS THINKING

What about and how do we think –
such is our life !

Systems Theory
top general concept –

EVERYTHING IS INTERCONECTED

SYSTEMS THEORY – general theory of systems thinking

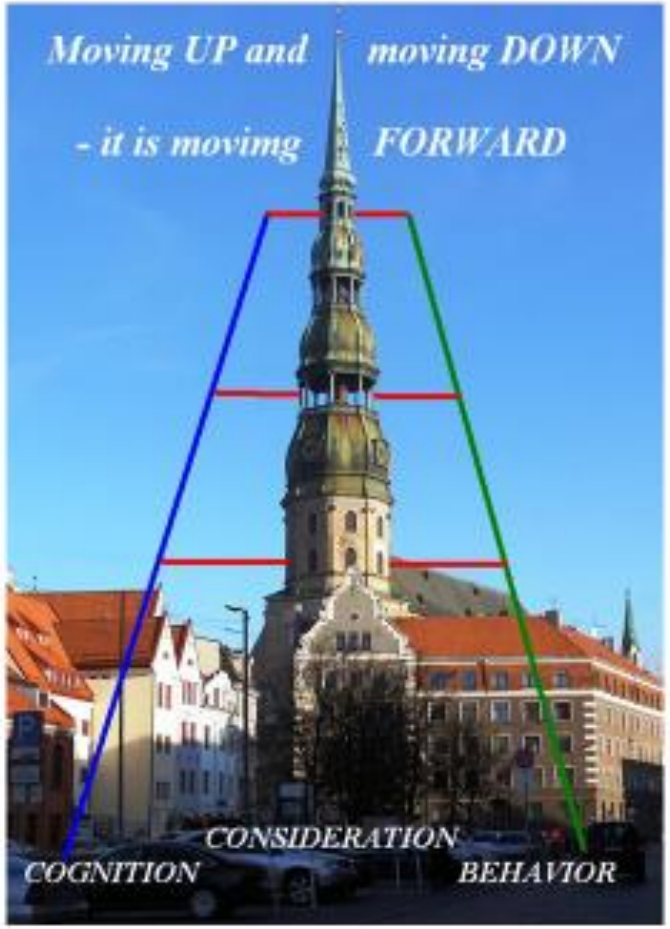
SYSTEMOLOGY – applied systems theory

E D U C A T I O N

Life experience **for Life**

(knowledge, attitudes, skills) **(cognition, consideration, behaviour)**

Systemology of NSTE - applied theory of systems thinking – **fundamental part of modern general education didactics**



Thank you for attention !

My recent short publications:

* **THINKING ABOUT THINKING: START-UP FOR MODERN EDUCATION FOR TOMORROW**
Gamtamokslinis Ugdimas/Natural Science Education, vol.13, No.3, **2016** (pp. 94-95)

* **SYSTEMS THEORY OF SYSTEMS THINKING: GENERAL AND PARTICULAR WITHIN MODERN SCIENCE AND TECHNOLOGY EDUCATION**
Journal of Baltic Science Education, Vol. 15, No. 4, **2016** (pp. 408-410)

* **SCIENTIFIC THINKING – THE BACKBONE OF MODERN SCIENCE AND TECHNOLOGY EDUCATION**
Journal of Baltic Science Education, Vol. 13, No. 6, **2014** (pp. 764-766)

Some my selected materials in English are available in internet :
https://blogi.lu.lv/broks/category/materials-in-english/

A P P E N D I X


IF YOU CAN'T
EXPLAIN IT SIMPLY,
YOU DON'T UNDERSTAND
IT WELL ENOUGH.
- ALBERT EINSTEIN

Explosion of information – changes within our life and education

Systemology of humans' communication – problems within local and global linguistics – regional and international English

What's unusual about Finnish schools?

- Teaching is a highly respected, well-paid profession
- There are no school inspections or teacher evaluations
- The school system is highly centralised and most schools are publicly funded
- School days are short and the summer break is 10 weeks
- Children are assessed by their teachers. The only nationwide exam is for those who continue studying to 18
- Average school size is 195 pupils; average class size is 19 pupils
- Success has been attributed to a traditionally high regard for teaching and reading, as well as a small, largely homogenous population
- Though still high, Finland has been slipping down the Pisa rankings in recent years
- Like other nations, it faces challenges of financial constraints and growing immigration

Philosophy can teach children what Google can't

With jobs being automated and knowledge being devalued, humans need to rediscover flexible thinking. That starts in schools

Ireland's president Michael D Higgins: 'The teaching of philosophy is one of the most powerful tools we have at our disposal to empower children.'

Amid the political uncertainties of 2016, the Irish president Michael D Higgins provided a beacon of leadership in this area. "The teaching of philosophy," he said in November, **"is one of the most powerful tools we have at our disposal to empower children into acting as free and responsible subjects in an ever more complex, interconnected, and uncertain world."** Philosophy in the classroom, he emphasised, offers a "path to a humanistic and vibrant democratic culture".

In 2013, as Ireland struggled with the after-effects of the financial crisis, Higgins launched a nationwide initiative calling for debate about what Ireland valued as a society. The result is that for the first time philosophy was introduced into Irish schools in September.

A new optional course for 12- to 16-year-olds invites young people to reflect on questions that – until now – have been glaringly absent from school curriculums. In the UK, a network of philosophers and teachers is still lobbying hard for a GCSE equivalent. And Ireland, a nation that was once deemed "the most Catholic country", is already exploring reforms to establish **philosophy for children** as a subject within primary schools.