Mind Mapping Systems Thinker’s attitudes facing a sepsis problem
Aims of the paper

to evaluate a proposed systems thinking mind-map against the mental processes applied in a case study identifying new treatments for sepsis.
1 - What do we need as systemists?

• To be able to **communicate** the **basis of systems thinking and systems science** to everyday people.
• To provide a **framework for understanding** systems thinking behaviours and **concepts**.
• To provide a **basis for expanding and improving** our **knowledge in systems science and practice**.
• To provide a **foundation** for **Systemists discipline**.
• To **exercise** Systems Thinking.
1 - Why these needs?

Without science, we will continue to practice Alsystemy!

“Until recently, most of systems thinking could be best characterized as descriptive, faith-based, anti-reductionist approaches... we argue that we are on the cusp of appearance of a more testable “science” of systems.” – Luke Friendshuh and Len Troncale 2012. Presented summer 2012 at the International Society for Systems Sciences

“It is the function of science to discover the existence of a general reign of order in nature and to find the causes governing this order. And this refers in equal measure to the relations of man – social and political – and to the entire universe as a whole.”

Dmitri Mendeleev
2 - The beginnings of the systems tree?

2012

INCOSE French chapter requests a booklet on Systems Thinking

Mind Map of Systems Thinker’s postures and Systems Concepts

2013

DGA systems Thinking training.

Discovering of the systems coupling diagram of Lawson
2 - The beginnings of the systems tree?

2014

Understanding Disease with Systems Thinking INCOSE/ISSS

Validation of the branches and formation of the roots

Concept presented at EMEASEC

2015

Work begins on « Health, Disease and Systems Thinking »

Sepsis is a nexus for integrating many topics

INCOSE/ISSS
« The System Tree »

Attitudes of a Systems Thinker

TOGETHERNESS
- Boundary
- Integrity

SYSTEM
- Roots

STRUCTURE
- Components
- Hierarchy
- Networks
- Interaction

RELATIONSHIPS
- Dependencies
- Influences
- States

BEHAVIOUR
- Patterns
- Outputs
- Functions

CONTEXT
- Stakeholders' perspective
- Emergence
- Needs

Drivers
- Inputs
- Outputs

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3 - Method
Systems Thinking in action!

The Systems Thinker frees him/herself of the three unities rule of classical theatrical drama: time, place and action.
The Systems Thinker

dives into past events;

propels into the future;

to understand a present day situation.
The Systems Thinker: approaches a subject in its wholeness;

accepts different perspectives of diverse stakeholders of a situation;

is able to play the role of any other actor at any time.
Exercising Systems Thinker attitudes leads to:
ask the right questions at the right time;
reassess situations.
3 - Method
What is the point of Systems Thinking?

By sharpening the global understanding of a situation, the Systems Thinker can change the world!

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Dialogue between Archimedes and a butterfly:

- “Give me a lever and a place to stand, and I will move the world”, says Archimedes
- “Myself, I can set off a tornado” answers the butterfly.

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« Introduction au Penser Système » - Brigitte Daniel Allegro
With the permission of Christelle Fritz for the illustration
3 – The method to use the “systems tree” as systems thinkers
Illustrated by a case study in the healthcare domain

#SystemsThinking is to perceive an overall situation in order to understand it.

Exercising with the sepsis problem
3 – The method to use the “systems tree” as systems thinkers

- Gather Data
- Try to make sense of it
- Formulate the big picture
- Validate impressions with experts
4 - When a Systems Thinker is facing a sepsis problem...

Inflammation – the anomaly behind complex disease

+ Infection = SEPSIS
Stays with septicaemia (sepsis) have the highest aggregate hospital costs in comparison to all other conditions (US 2011 $20.3 billion costs have more than quadrupled since 1997.)
4 - When a Systems Thinker is facing a sepsis problem...

Gathering data

Role of spleen in integrated control of splanchnic vascular tone: physiology and pathophysiology

Shureen M. Hamza and Susan Kaufman

Sepsis, severe sepsis and septic shock: changes in incidence, pathogens and outcomes

Greg S Martin
Division of Pulmonary, Allergy and Critical Care, Emory University School of Medicine, and Grady Memorial Hospital, 49 Jesse Hill Jr Drive, SE, Atlanta, GA 30303, USA

Sepsis: Current Dogma and New Perspectives

Clifford S. Deutschman and Kevin J. Tracey
1Department of Anesthesiology and Critical Care and Surgery and Sepsis Research Program, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA 19104, USA
2Feinstein Institute for Medical Research, 350 Community Drive, Manhasset, NY 11030, USA

Endocrine dysfunction in sepsis: a beneficial or deleterious host response?

Valeriu Gheorghia, Alina Elena Barbu, Monica Liviu Gheorghiu, Florin Alexandru Cămanu

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26/07/2015
When a Systems Thinker is facing a sepsis problem...

Negative emergent properties: rate of sepsis is increasing!

Sepsis situation system – Sepsis states and related costs of the healthcare system
4 - When a Systems Thinker is facing a sepsis problem...

*Negative emergent properties: long term consequences, susceptibility to additional illness and relapse*
4 - When a Systems Thinker is facing a sepsis problem...

**Formulating the big picture**

**“General sepsis” Situation System**

The “patient”, the “healthcare system” and the “infection” are elements which become related in the sepsis problem to solve.

**Respondent system to sepsis**

In order to respond to the SEPSIS situation, the doctors define a strategy and a respondent system.

The strategy consists of:
- quelling the infection
- sustaining the vital organs
- preventing a drop in blood pressure.

The respondent system is based on an appropriate selection of System Assets elements which are integrated into different protocols. Today it is tuned, based on experience.

**System assets supporting the Respondent System**

The system assets provides system services which are available on request by the respondent system. In the sepsis context there are for instance:
- Broad-spectrum antibiotics
- Lab tests capabilities to identify infectious agents
- Medicine that targets microbes
- Protocols to maintain oxygen level of a patient
- Protocols to maintain blood pressure of a patient
- Surgery means and surgeons
- Etc...

Relationships between enterprise and the sepsis situation systems
4 - When a Systems Thinker is facing a sepsis problem...

*Emergence response time is critical to survival*

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**Sepsis**

_is an emergency^1_

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**PURPOSE**

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5 – Results – Formulating the big picture

A starting point for understanding « how »
5 – Results – *Formulating the big picture*

A candidate framework for understanding «what» is happening

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**Sepsis states transition model (static view)**

- **MOD**
  - Organs lose structure and function

- **Severe Sepsis**
  - Massive uncontrolled proliferation of infections causing widespread injury

- **Sepsis**
  - Microorganisms can pass the border security in the gut

- **SIRS**
  - Ability to recognise invaders removed

- **Inflammation**
  - Local repair and remodelling of tissue

- **Health**
  - Homeostasis (Before infection or damage occurs)

- **Complete Failure of the spleen**
  - "Meltdown of tissue"

- **Opportunistic Infection escapes immune system**
  - "Normal" Microorganisms escape from the gut

- **Boundaries of inflamed areas overlap**

- **Injury or damage**

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Events generating a transition from one state to another one

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Results - Formulating the big picture
A candidate framework for understanding « why »

Energy transition diagram (dynamic view)
5 – Results: a reflection on the Systems Thinking
6 – Conclusions

System Thinking is what you have to do when you are faced with a problem that you have not faced before

The “Systems Tree”
Provides a useful framework for systems thinking.

Knowledge of the attitudes can lesson the barriers to productive thinking;

Knowing about the system roots encourages understanding whilst problem solving.

The problem is not the problem. The problem is your attitude about the problem.
Do you understand?
- Captain Jack Sparrow
Brigitte DANIEL ALLEGRO System Engineering and Dependability Senior Adviser

Brigitte is interested in **transversal activities through organizations** and in **mobilizing teams** on projects. She worked 8 years in Nuclear Industry (*EDF, for Electricity of France*) then 18 years in Aeronautics (*AIRBUS*). Her experience in industry has been built on **dependability concerns** both in nuclear and aeronautics, leading to a managerial approach of transversal activities interlinked with system design.

She introduced **System Engineering** and **Human Experience Valorization** in Airbus France in the early 1990's. Based on these two disciplines, she created and managed a training course on how to design aeronautic systems. She deployed these disciplines by using them on new systems developments on Airbus programs and on organization transformation project. Today, she takes advantage of her own experience to coach **System Architect Engineers** and to teach **Systems Thinking for System Engineering** in academic and industrial context.

**Being an engineer and a textile artist**, she is interested as well in the **relationships between Creative Thinking and Creative Engineering both in the artistic field and in the industry field.**

In 2012, she has written for the AFIS (French Chapter of INCOSE) an introduction to Systems Thinking - “Introduction au Penser Système” – Published in 2014.

**Gary Smith biography**

Gary Smith is a senior expert in systems engineering at Airbus Defence and Space and INCOSE ESEP. He has been a lead systems architect for their border protection systems.

He is an active contributor to the INCOSE/ISSS systems science working group and the healthcare working group where he participates as the outreach director for the EMEA region and is an INCOSE Healthcare Ambassador.

In 2004, “just for fun”, he undertook the Open University course S807 Molecules in Medicine and as a direct result of the course published “Cancer, Inflammation and the AT1 and AT2 receptors in the BMC Journal of Inflammation. This was featured in the UK national press, “Open University Student publishes new theory of inflammation”. The paper has over 95 citations, including one in Nature Review Oncology.

His more recent paper “Angiotensin and Systems Thinking: Wrapping your mind around the big picture” describes a mental model for understanding disease.