The Answer Cannot Always Be „Well, It Depends…“

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Agenda

- Typical challenges in projects
- How do people react on complexity?
- Ways to deal with complexity
- Summary

Introduction

Current Assignment: Systems Engineering Consultant – Freelancer

Work Experience: 20 Years Industry Experience

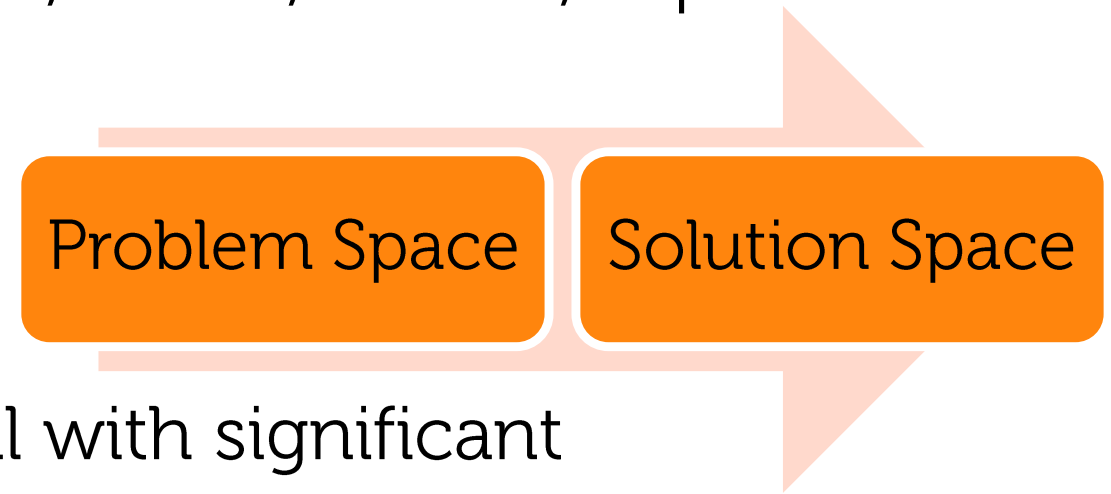
- INCOSE Technical Director (2019 – 2021)
- Project manager for translation of INCOSE SE Handbook v4
- Lead Co-Editor ISO 15288 next revision
- DIN representative in ISO JTC 1 / SC 07 / WG 07 (Software and systems engineering – Life cycle management)
- Accredited trainer for SE-ZERT® trainings
- Consultant to companies from various industries, including aerospace, renewable energies, automotive, maritime

Education:

- Dr. rer. nat. (Physics) – University of Hamburg

Typical Challenge in Every Project

- Transition from Problem Space to Solution Space
  - Conflicting stakeholder interests, needs, desires, expectations
  - Conflicting requirements



- Resulting issue:
  - Systems Engineers have to deal with significant amount of uncertainty in a complex environment
  - Behavior is partly unpredictable
  - Most common answer is: “Well, it depends…”

How Do People React to Complexity?

1. Ignore
   - Reproduction of the old system
   - Ignore the customer's needs and expectations
   - Convince the customer that the old system is the system they really need

2. Trial and Error
   - "Let's use an agile approach…"
   - Hope for a lucky punch

Adapted from: https://www.youtube.com/watch?v=m3QqDOeSahU

How Do People React to Complexity?

3. Dig in the Details
   - Try to understand and solve the problem in detail
   - War room jam-packed with charts
   - Analysis paralysis

4. Simplify
   - Optimize some parameters, ignore others
   - Treat the complex problem as if it was complicated
   - Leads to silo solutions

Source: https://www.pinterest.de/pin/446208275552972549/

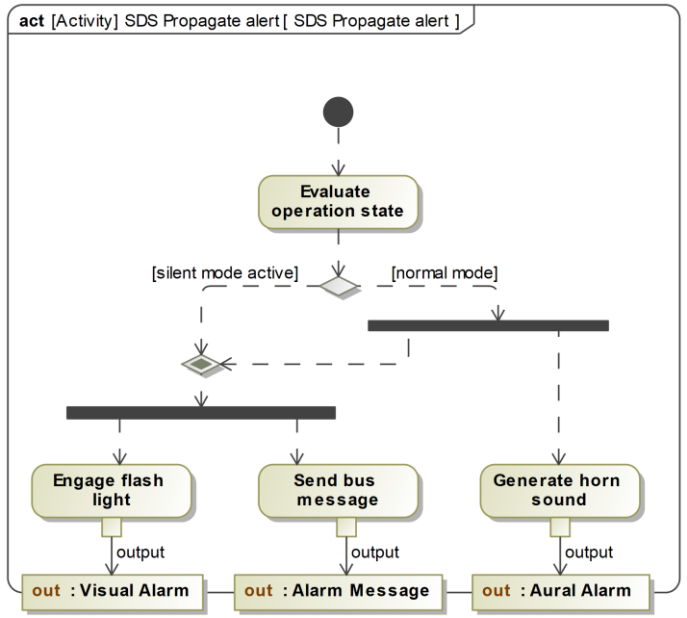
Adapted from: https://www.youtube.com/watch?v=m3QqDOeSahU

What to Do Instead?

- Apply proper Systems Engineering ☺
  - Consider the whole life cycle
  - Establish trade-off studies for balanced solutions
  - Apply interface, risk, and configuration management
  - Form Follows Function Follows Purpose
  - …
- These steps will reduce complexity
- Some complexity will remain in the system

Form Follows Function Follows Purpose

1. Start with an Operational Concept (OpsCon) to carve out the purpose
2. Model the system to better understand the behavior

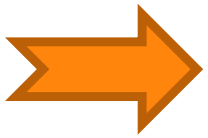


Form Follows Function Follows Purpose

3. Identify form

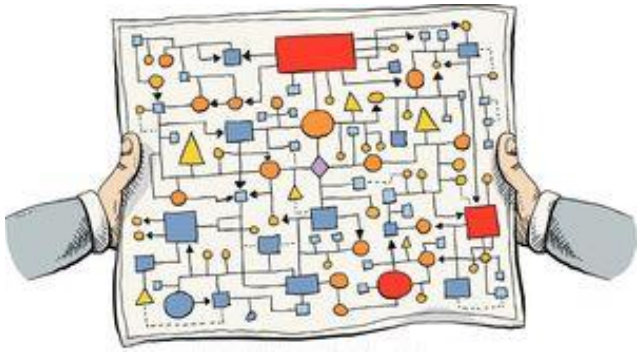
Function	Solution1	Solution2	Solution3	Solution4
Detect smoke	Light absorption	Ion beam	Nose	Bird
Report smoke	Horn	Flashlight	Indication	Smoke signs

F1		X			X			
	F2	X	X				X	
X		**F3**			X			
	X		**F4**	X			X	
	X			**F5**		X		X
X		X	X	X	**F6**			
				X		**F7**		X
	X		X				**F8**	
X				X		X		**F9**



F1	X	X						
X	**F3**	X						
X	X	**F6**		X		X		
			F2	X	X			
			X	**F4**	X	X		
			X	X	**F8**			
			X			**F5**	X	X
						X	**F7**	X
X						X	X	**F9**

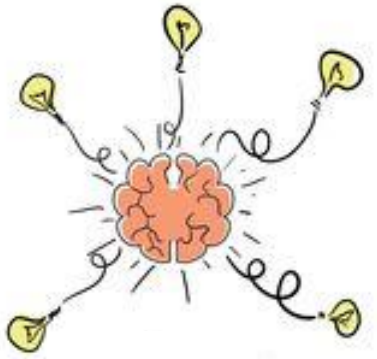
Some Complexity Will Remain



What to do?

How to Deal With Remaining Complexity?

- Teams need to rely on intuition
- Intuition
  - Unconscious pattern-recognition (gut feeling)
  - Is based on former experience
- Competency of the people involved is key
  - Needed to have the “right” patterns



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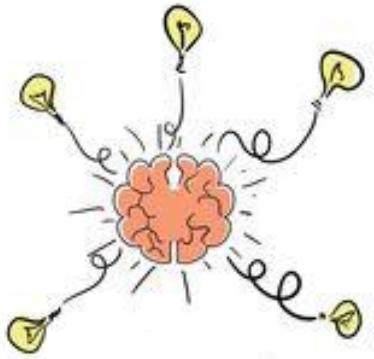
“Right” Patterns

- RELEVANT experience is mandatory
  - Success comes from wisdom
  - Wisdom comes from experiences
  - Experiences come from mistakes
- Issue
  - The patterns may be out of date
  - For person in charge, the patterns are still felt to be correct



Source: https://www.youtube.com/watch?v=m3QqDOeSahU

“Right” Patterns Not Available?

- Agree on values
- Team with collective intuition (swarm intelligence)
- Managers and decision makers need to ask the right questions

Adapted from: https://www.youtube.com/watch?v=m3QqDOeSahU

Summary

- Structured approach is a key success factor
- Support pattern building
- Competency has a direct impact on decision quality
- Needs to be understood by both Systems Engineers and Managers