Pragmatic Decision Making

SE PRACTICAL 6th and 7th October 2025

Delivered by Mike Johnson

SE-Training GmbH

https://www.linkedin.com/in/mikejohnson1981/

About SE-Training

Systems Engineering experts for the development and support of technically complex systems.

INCOSEUK

ENDORSED TRAINING PROVIDER

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INCOSE ASEP
Systems Engineering Professional™

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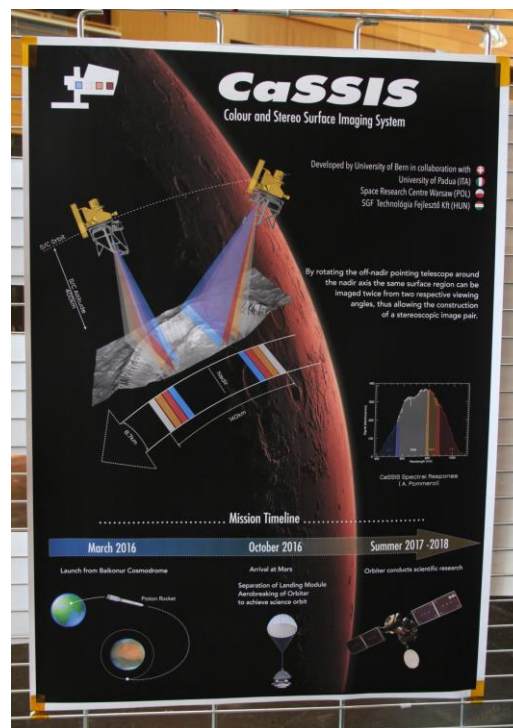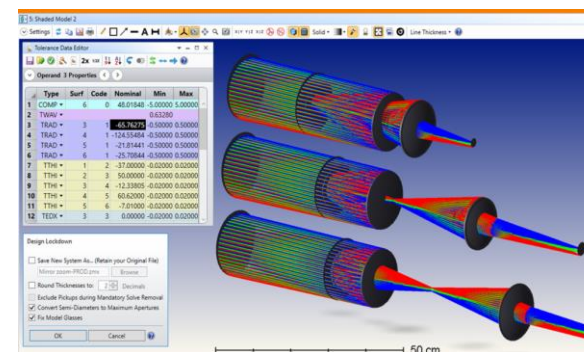# SE-Training Co-Founder

Mr. Mike Johnson (CSEP, CEng)

Mike is a Systems Engineering Manager, Consultant, Trainer and Coach with extensive experience in delivering complex systems and establishing Systems Engineering in the Defence, Space and Medical sectors.

Experience:

- Established Systems Engineering in the Molecular Division of Roche Diagnostics and led many Organisational Systems Engineering initiatives
- Head of Systems Engineering, RUAG Space
- Systems Engineer for the CaSSIS Telescope, orbiting Mars since 2017
- Systems Engineer for Thales Optronics, UK
- MSc in Optics and Optoelectronics, The University of St Andrews

www.linkedin.com/in/mikejohnson1981

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Agenda

- **Context & Key definition**

- Decision-making Challenges
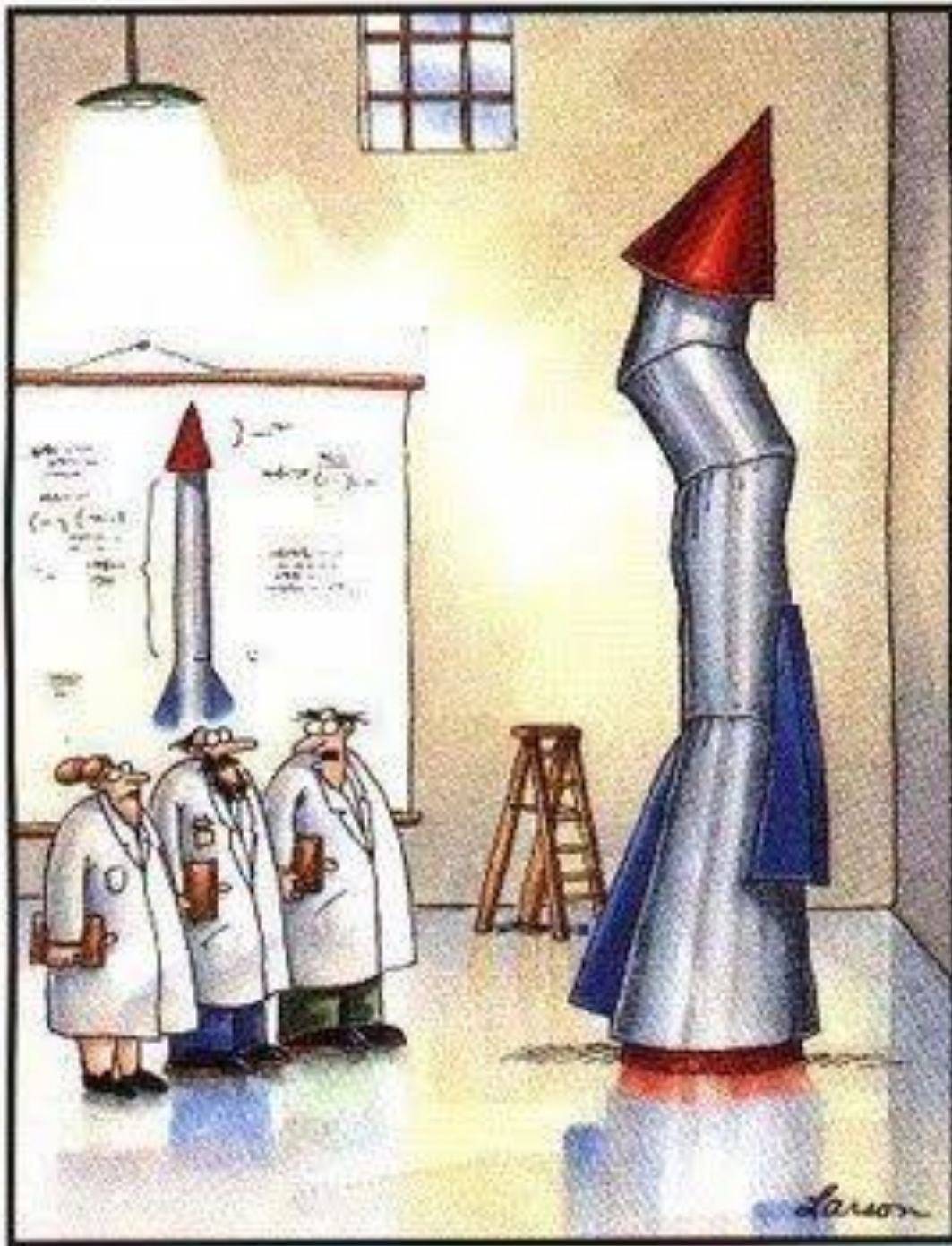
- Theory & Methods

- Activities

- Summary & Q&A

Context

The fundamental value of the Systems Engineer / Technical Lead is in taking accountability for making and enabling effective decisions on the development of complex technical systems / products.

Many of the most challenging technical decisions relate to low levels of certainty. Do you do something, or do you wait?! Doing a poll of your colleagues will not increase this certainty, as they will likely have opposing views. This area of engineering is not an exact science.

The Systems Engineer over many years to decades working on multiple projects, needs to develop effective methods for making informed decisions, especially knowing when to reverse a decision if some new information comes to light.

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Key Definitions

- **Pragmatic** (Merriam-Webster): ..*"relating to matters of fact or practical affairs often to the exclusion of intellectual or artistic matters : practical as opposed to idealistic."*

- **Decision-making** (Merriam-Webster): ...*"the act or process of deciding something especially with a group of people."*

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Poll!!

What makes it difficult to make a decision?

- Missing or ambiguous inputs

- Availability of key Stakeholders

- Knowledge of appropriate decision-making Methods
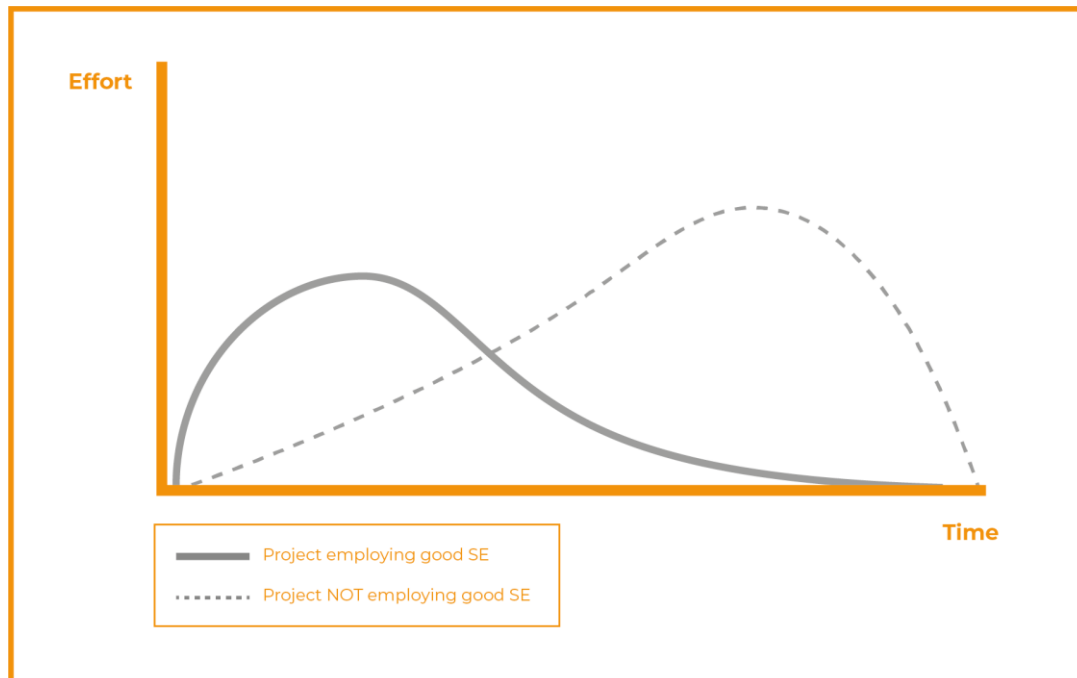
Poll!!

QUESTION 2

What are your experiences of the outcomes of poor decisions?

- Project issues, such as delays to Schedule, Cost overrun etc

- Non-compliance to technical scope

- Loss of morale in engineering development team

- Product / System issues post product launch, such as product recalls, field reliability issues etc

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SE Decision making Challenges

Cost/effort in the next week weighs heavier than cost/effort next year

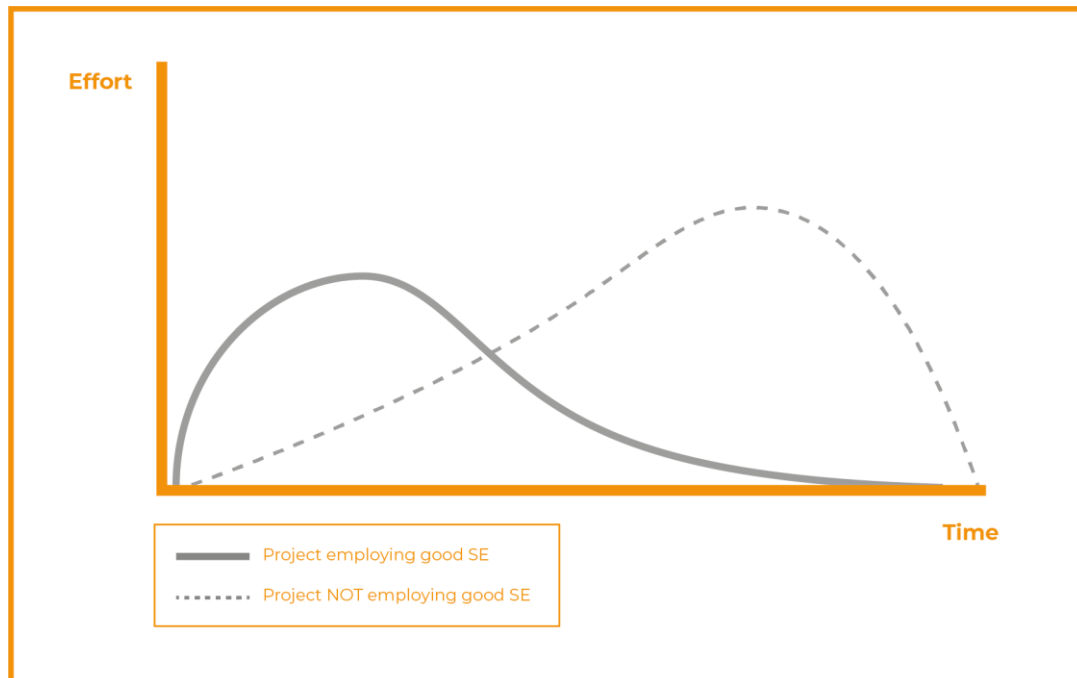### Challenges through the Vee

Problem

- Cost/effort that is due next week is certain.

- Cost/effort that is due next year can be perceived as as a minor problem.

- SE is not implemented => High cost/effort in the second half of the project.

SE Decision making Challenges

Cost/effort in the next week weighs heavier than cost/effort next year

Challenges through the Vee

Effort

Time

Project employing good SE

Project NOT employing good SE

Solution

- Effective risk management prevents to overlook/discard future costs and forces you to act mitigate

- Effective risk management motivates the organisation to «shift left» (apply SE)

Ineffective decision-making is often linked with an inability to make decisions on low levels certainty.

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3 key lessons from experience

The art of Decision Making is far more than a method!

Soft Skills

- Why are these skills called **SOFT**???
  - Objectivity
  - Negotiating
  - Resolving conflicts
  - Communicating sensitive and difficult subjects
- What about if I'm potentially to blame?
- How can I approach someone who thinks that they are potentially to blame?

Trading conclusions

- What was my answer after a 10 minute bus journey? *"Someone knocked on my door at 3am last night"*
- The issue is clearly with the FPGA.
- There's a bug in the latest software release.

Trade with descriptions of the behavior and observations.
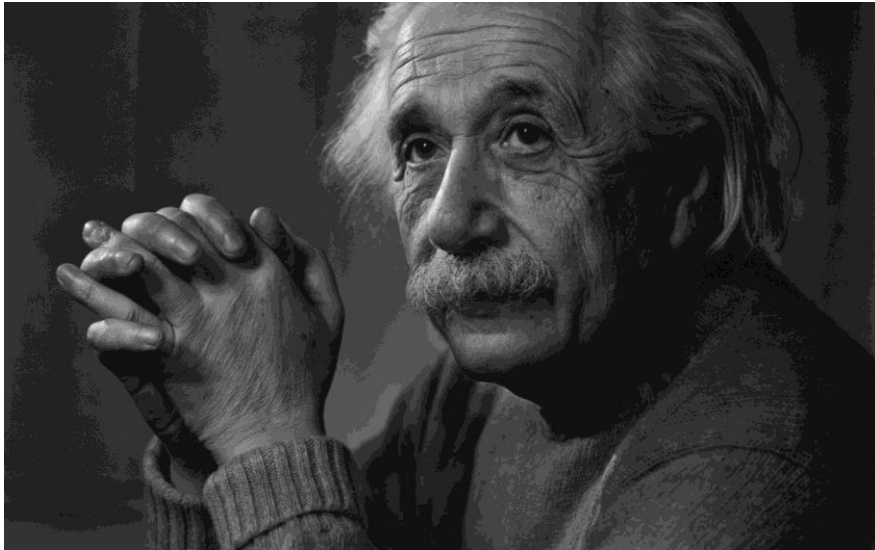
Doing something!

- The most difficult decision to make from my role as a Systems Engineer; when my solution was to do nothing about the problem!
- What would have happened if the pilot from Air France Flight 447 had done nothing when the aircraft autopilot disconnected?
- What would have happened if the UK hadn't gone into a lockdown?

You must have a control loop for your decision-making!

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Focussing on the Problem

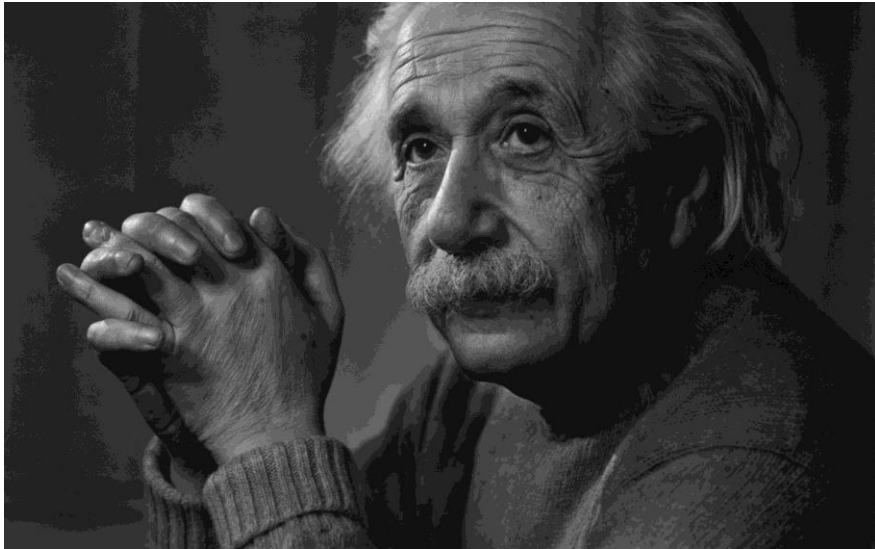## How much time to focus on understanding the problem?

If you have one hour to solve a problem, how would you split the time across the following steps:

- Define Problem: ## minutes

- Find a solution: ## minutes

- Check solution: ## minutes

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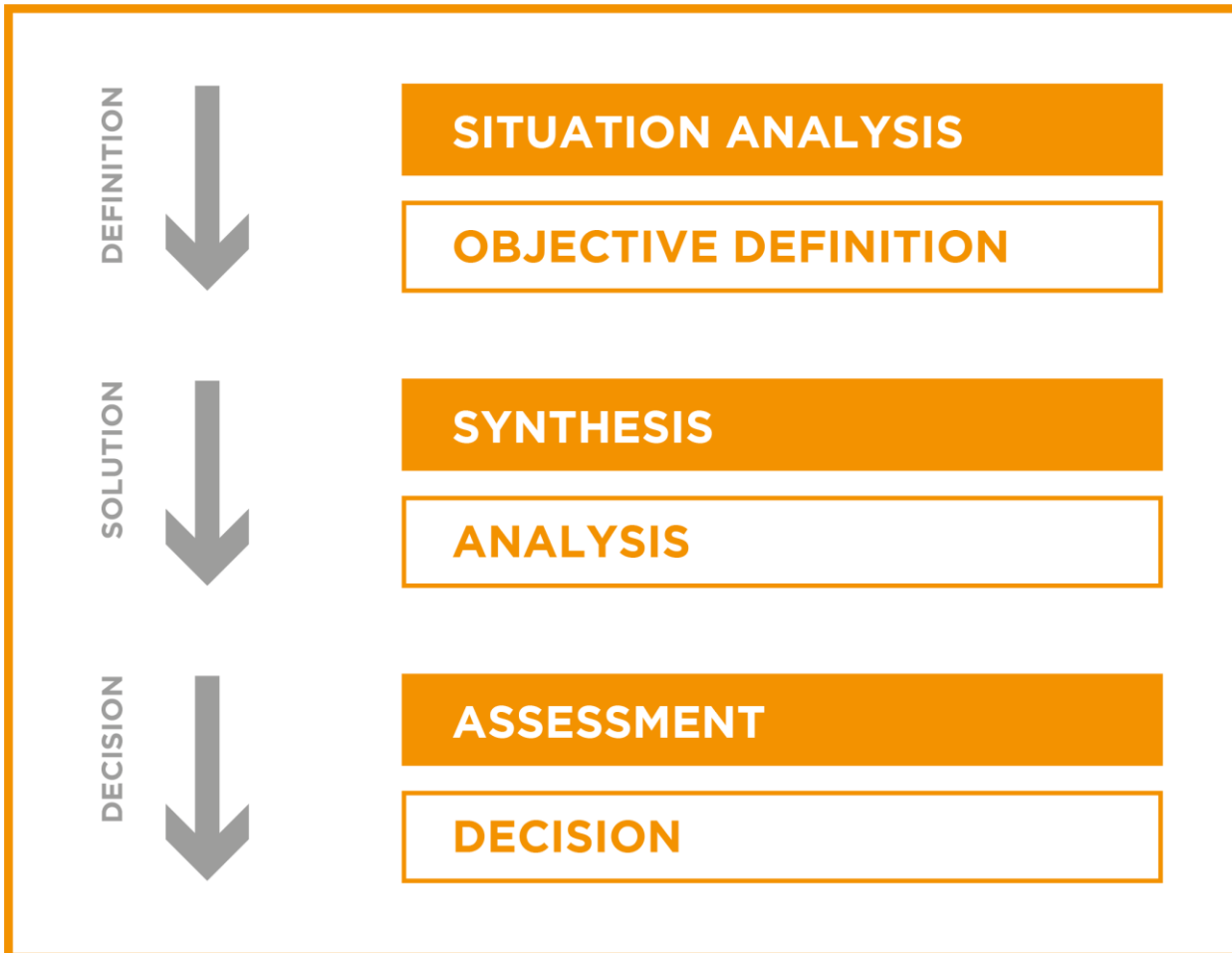
Focussing on the Problem

What can we do to define a problem?

- Follow a process (even a basic one)

- Talk to Stakeholders and SME's

- Review available information

- Write a problem statement!

  - When was the last time you did this?

- Assess the complexity of the problem (eg. Cynefin framework)

- Etc

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Decision Making Process

Systematic approach for generic problems

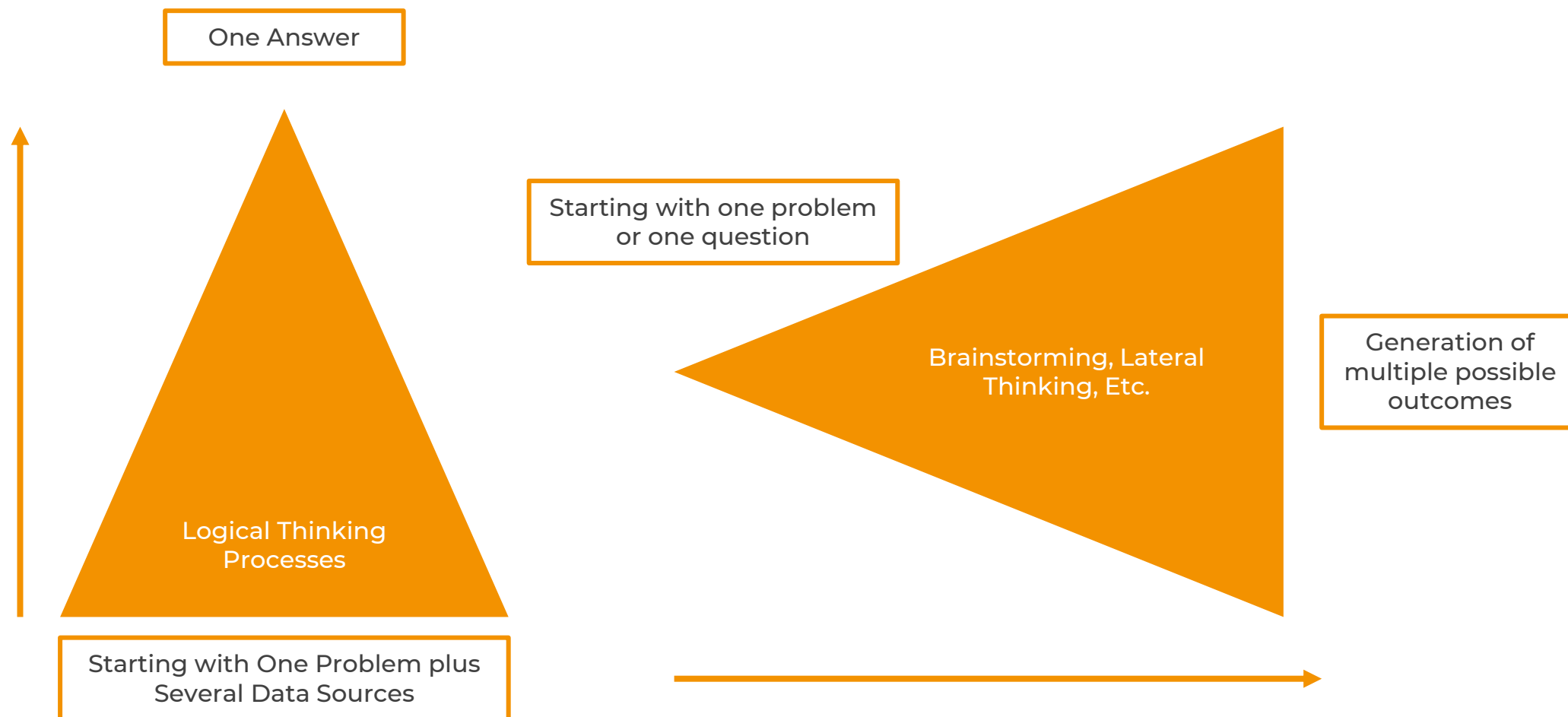|	
DEFINITION	SITUATION ANALYSIS
	OBJECTIVE DEFINITION
SOLUTION	SYNTHESIS
	ANALYSIS
DECISION	ASSESSMENT
	DECISION

How long does this process need to take?

- 15 minutes?
- 4 hours?
- 5 days?
- 3 months?
- …It depends?

Can I iterate through this process?

- **YES!!!!**

Critical Thinking for complex decisions

Critical Thinking in Perpendicular Processes

One Answer

Starting with one problem or one question

Generation of multiple possible outcomes

Brainstorming, Lateral Thinking, Etc.

Logical Thinking Processes

Starting with One Problem plus Several Data Sources

Vertical vs. Horizontal Thinking

Which is appropriate for your problem?

Vertical Thinking

- Selecting idea is the goal

- Focuses on right or wrong

- Sequential

- Analytical

- Excludes irrelevant material

- Tries to finalize

Horizontal Thinking

- Generating ideas is the aim

- Not concerned with right and wrong

- Moves around

- Provocative

- Irrelevant material valued

- Always expanding possibilities

Vertical vs. Horizontal Thinking

Audience interaction!

Vertical Thinking

Good examples:

- Determining the appropriate car for me to buy.

- Realising I'm 5 minutes from my train stop.

- Checking algebra.

- Etc...

Horizontal Thinking

Good examples:

- Unloading cargo ships takes a long time.

- New, taller ships cannot enter the port in the city due to a bridge.

- A factory dumps pollution into a river.

- Etc...

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Activities!

Decision-making early in the Vee!

Early project phase

You role is the Technical lead of a novel medium complex product.

Your project has been running for a few weeks.

In a discussion over coffee, one of your colleagues working on a similar project, but much later in the life-cycle, informs you that her team regrets only making one development prototype. She lists multiple examples as to why the cost of an additional development prototype would have saved the project significantly more during the integration and verification phase.

You share her experience with the experienced team members in your project, they agree with her experience.

There is only one development prototype costed for your project. Your Project Manager is regularly mentioning his concerns about the cost of the project and how little project reserves are available.

What do you do?

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Summary

- It is impossible to avoid making decisions.
- The most challenging decisions to make, have a low-risk index.
- Experience is a key input for making decisions on complex matters.
- Focus on understanding and defining the problem, hence contextualise the problem!
- Practice different approaches for problem solving, dependent on the type of problem.
- Develop, test and mature decision-making skills beyond methods.
- Being self-aware of decision-making significantly lowers project risks.
- Systematic processes can be applied (without impacting schedule) enabling effective decision-making.
- Stay humble, especially so we can go back if something changes unexpectedly

Thank you for listening!

Q&A

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