

# ModuleSEFS Cross Cutting Topics

by *Gerrit Muller* University of South-Eastern Norway

e-mail: `gaudisite@gmail.com`

`www.gaudisite.nl`

## Abstract

Various topics, such as Trends and Future and Value of Systems Engineering, and Human Factors.

### Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

March 25, 2021

status: preliminary

draft

version: 0



# SEFS Future and Trends

by *Gerrit Muller* USN-SE

e-mail: `gaudisite@gmail.com`

`www.gaudisite.nl`

## Abstract

In the previous century, the military and aerospace domain developed systems engineering to support the development of complicated systems. The functionality and services that we are using depend on the interaction of many systems and organizations. We call this complex rather than complicated. When developing complex systems, the developers cope with more uncertainties, and unknowns, and the inherent complexity of the dynamics between many systems and humans. Digitalization facilitates the development of interconnected systems. We view models as a means to help us coping with the complexity

### Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

March 25, 2021

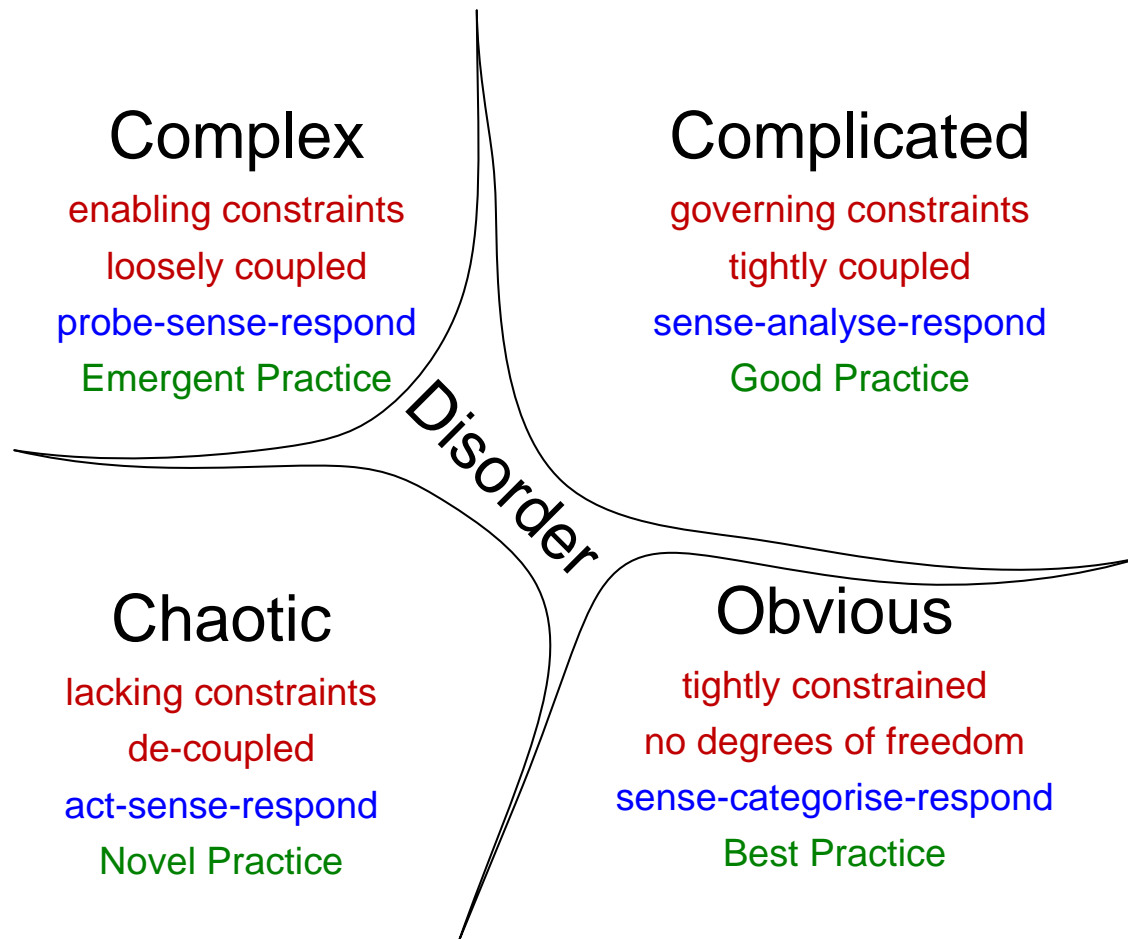
status: preliminary

draft

version: 0.1



# SE in Cynefin; Moving into Complex



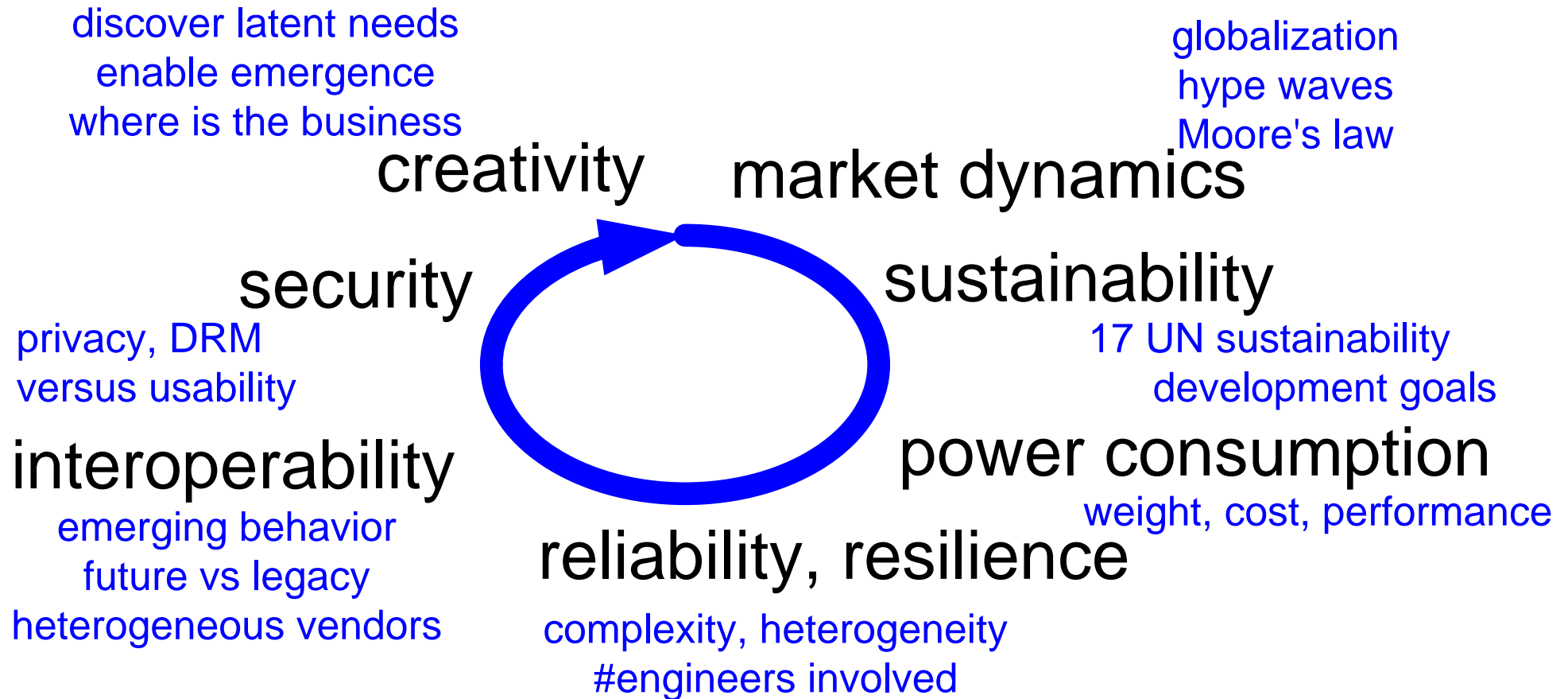
Systems Engineering  
originates in Complicated

Many problems move  
into Complex

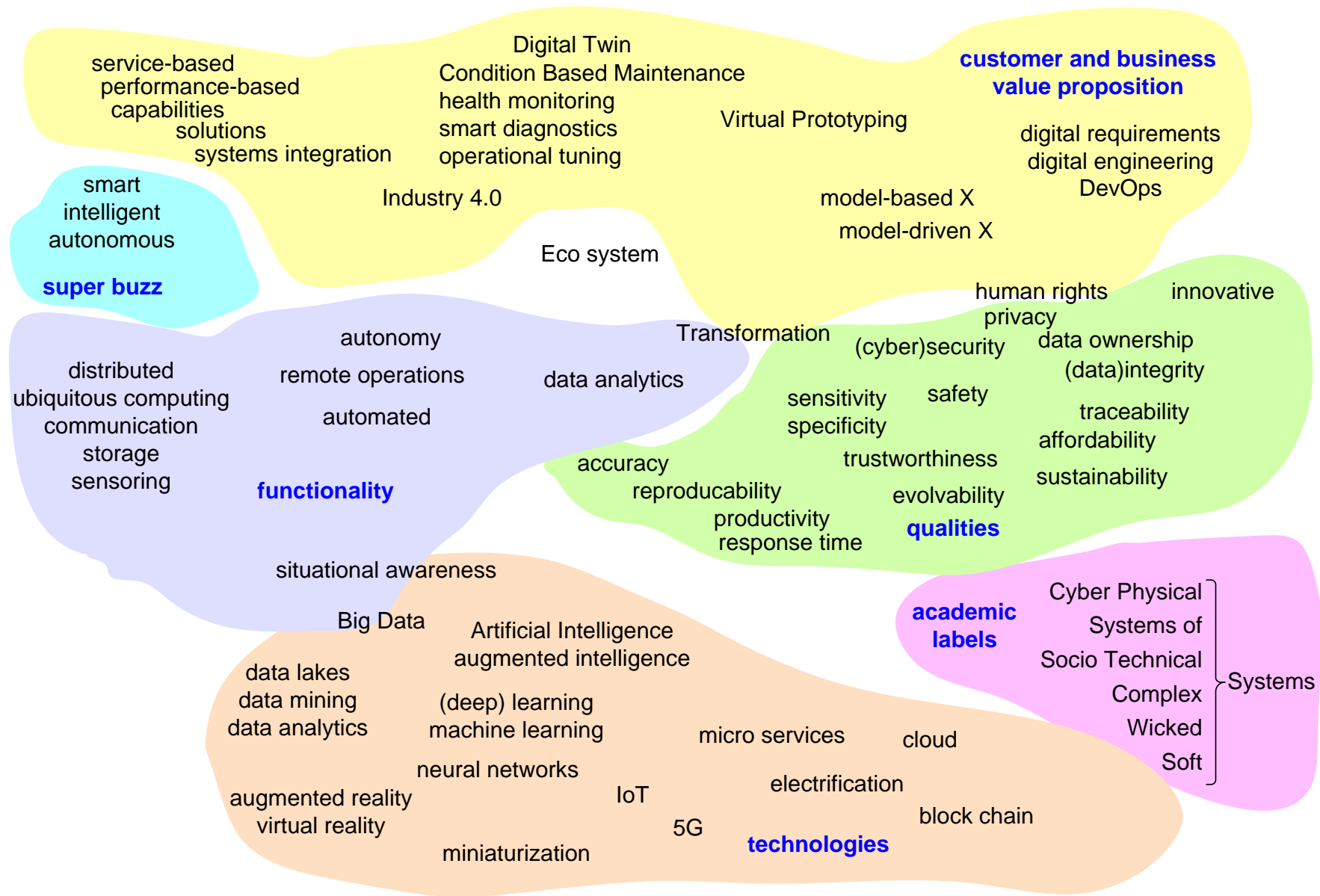
after: Dave Snowden, a.o. [https://en.wikipedia.org/wiki/Cynefin\\_framework](https://en.wikipedia.org/wiki/Cynefin_framework)

# Challenges in Systems Engineering

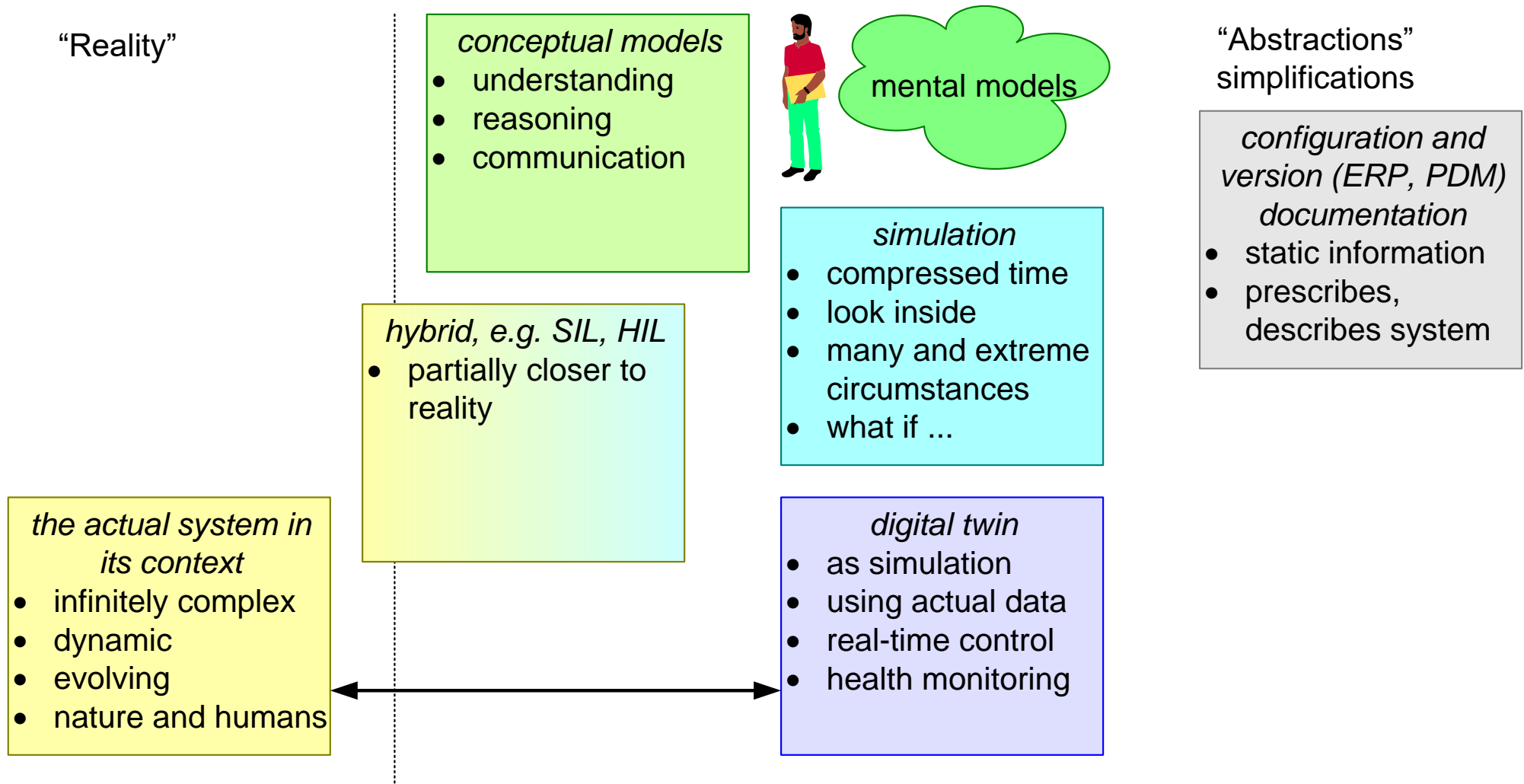
---



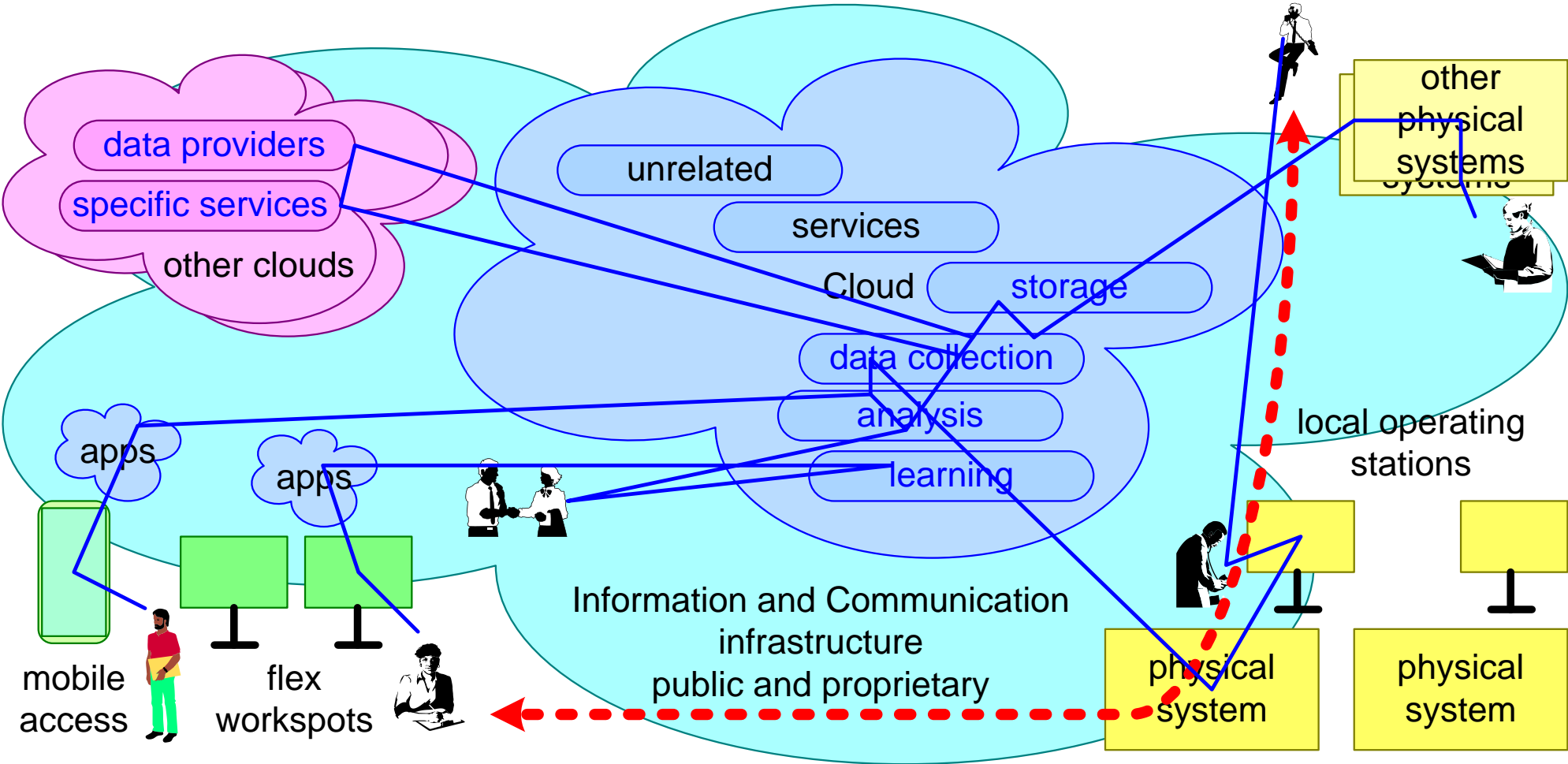
# Digitalization Cloud



# Digital Twins



# Systems of Systems



# SEFS Value of Systems Engineering

by *Gerrit Muller* USN-SE

e-mail: [gaudisite@gmail.com](mailto:gaudisite@gmail.com)

[www.gaudisite.nl](http://www.gaudisite.nl)

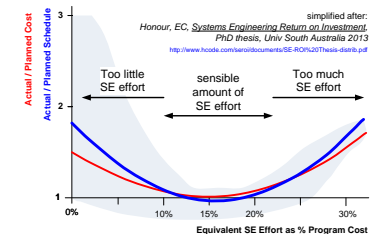
## Abstract

How can we explain to managers, customers, or colleagues what the value is of applying systems engineering? This nugget uses Eric Honour's work to explain the value of systems engineering.

### Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

March 25, 2021  
status: preliminary  
draft  
version: 0.1

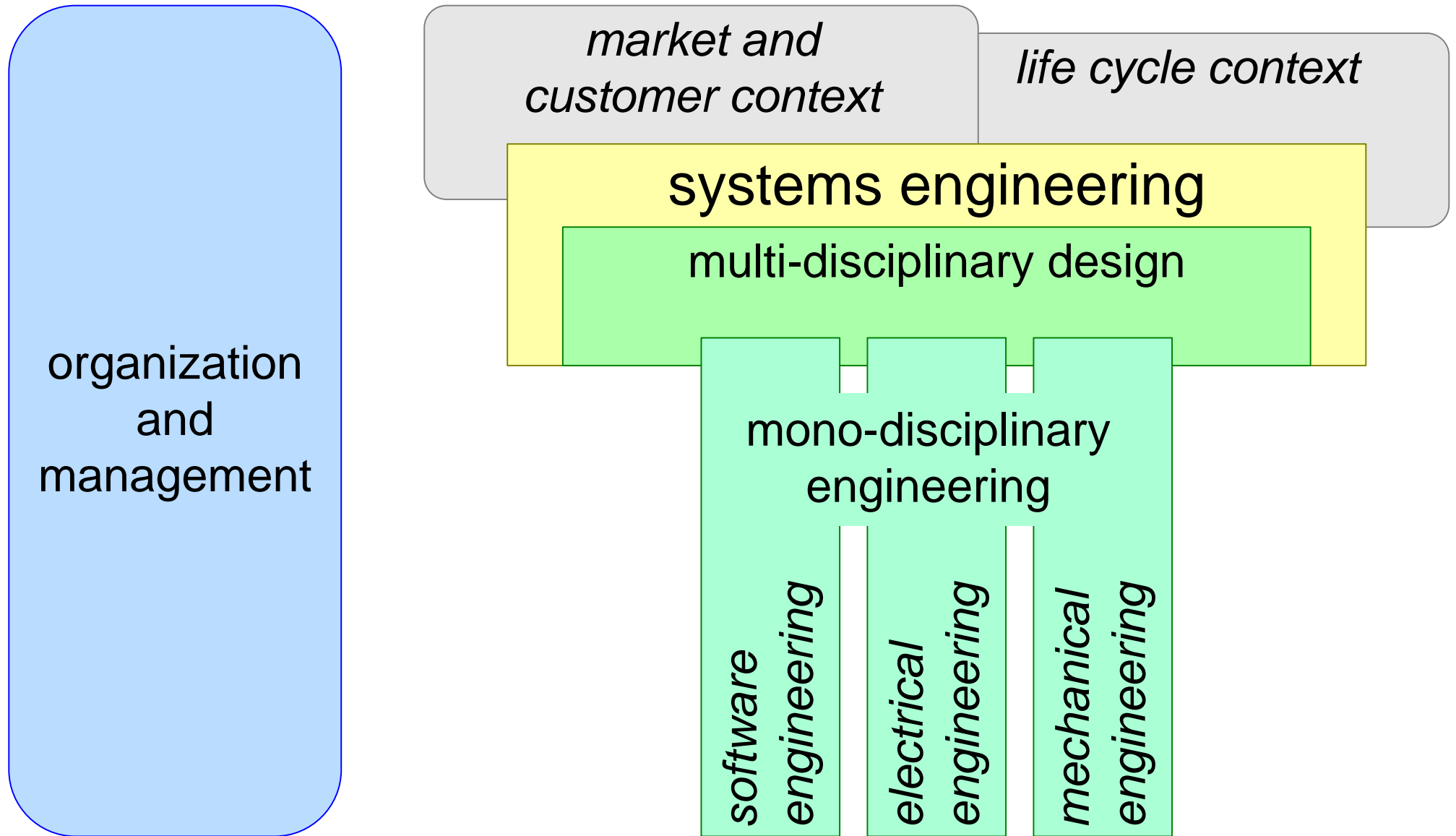




Why is it so difficult to convince people (managers, customers, colleagues) to use systems engineering?

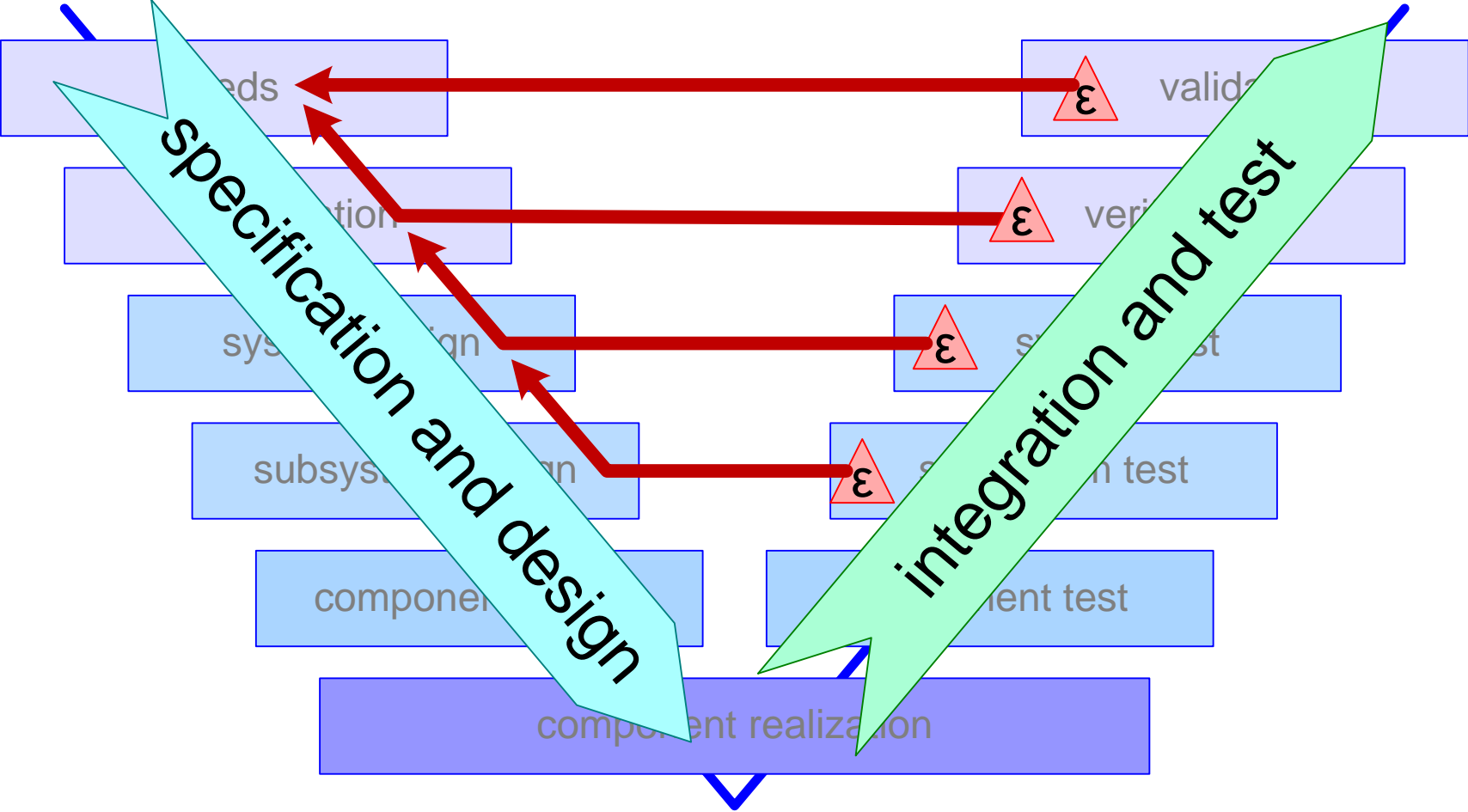
- Many of them see only a **part of problem** and **solution** space
- and are **unaware** of the **relations** between the parts
- Consequences of **lacking a systems view** become visible **at the end** of development or in the field
- when repairing them is **costly** and **time consuming**
- **Introducing systems engineering** is a change, requiring **change management**

# Operational Scope

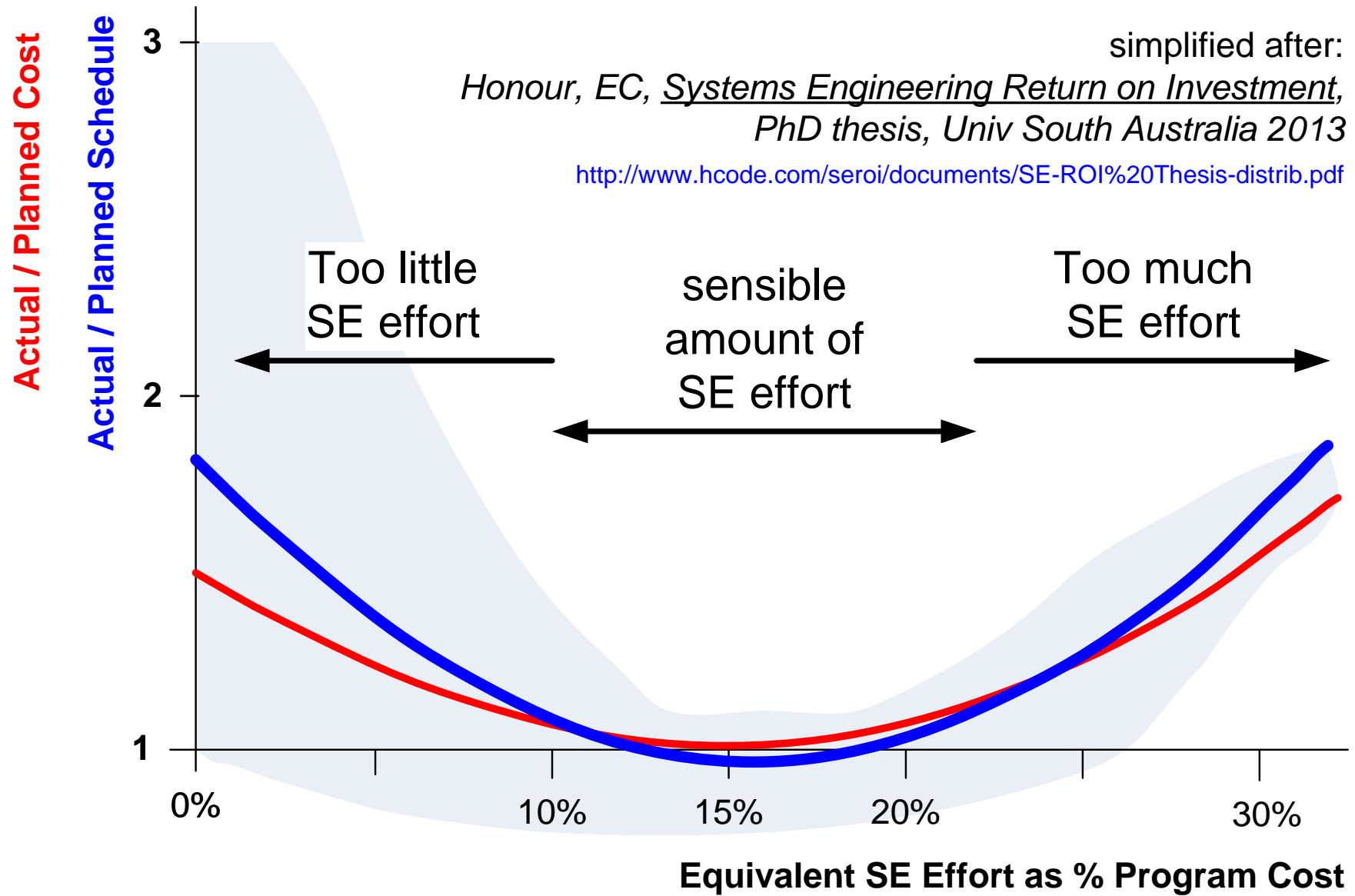


# Lacking Systems Engineering Results in Late Failures

failures found late in development  
can be traced back to *unknowns*,  
*unforeseens*, and *wrong assumptions*



# Eric Honour's Research



# SEFS Human Factors

by *Gerrit Muller* USN-SE

e-mail: `gaudisite@gmail.com`

`www.gaudisite.nl`

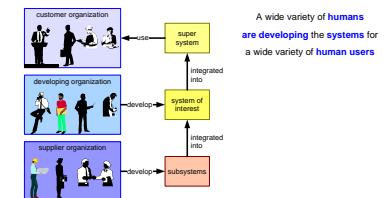
## Abstract

Humans interact with systems. Humans have behavior and properties that we do not control, nor can we predict them. The emotional and physical state of humans impacts their behavior and capabilities. Humans show group behavior, emerging from the interaction of the individuals in the group. Organizations show more complex behavior resulting from individuals, groups, and organizational processes. Legislation and standards are means to cope with human aspects when developing systems.

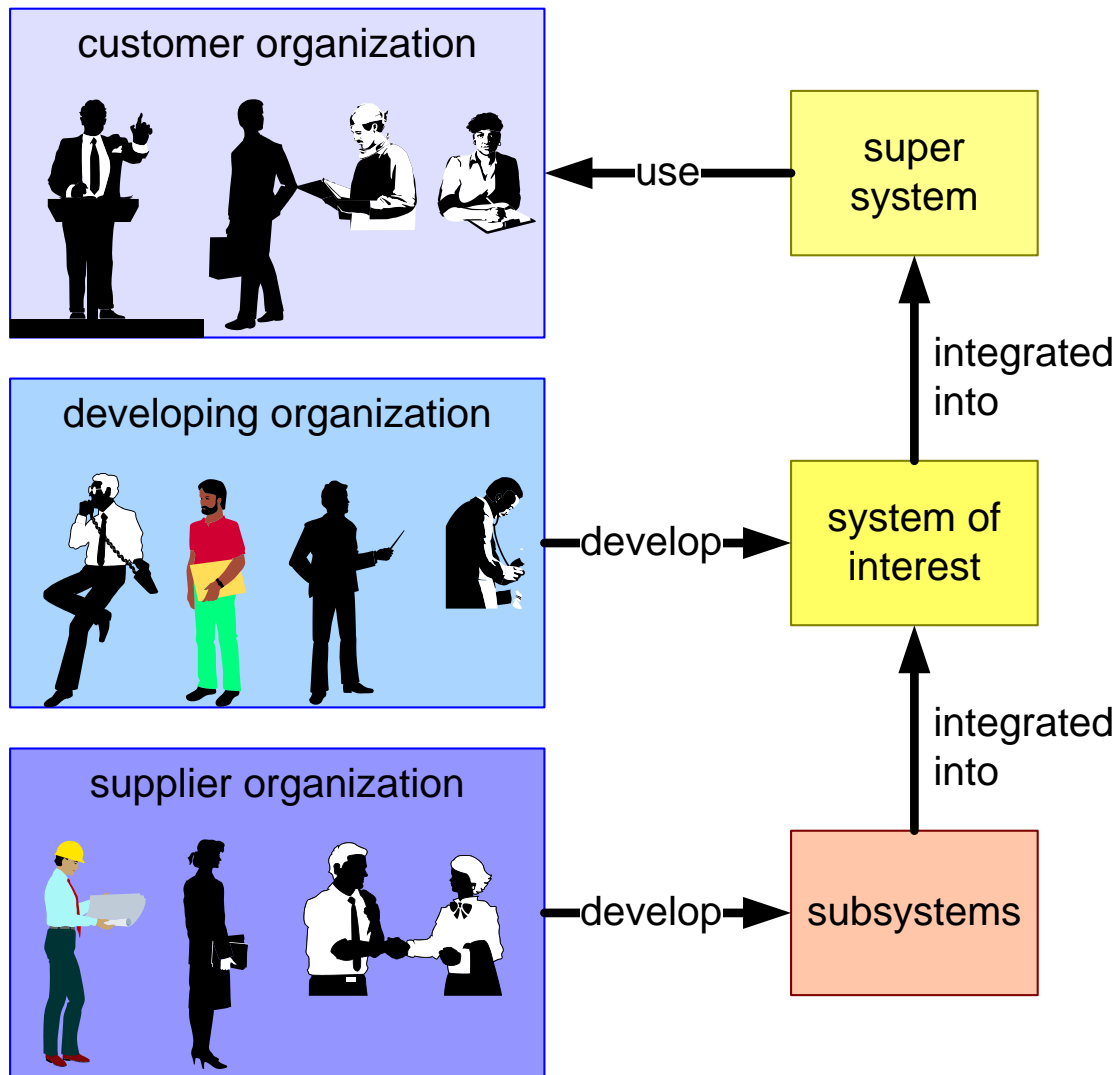
### Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

March 25, 2021  
status: preliminary  
draft  
version: 0.1

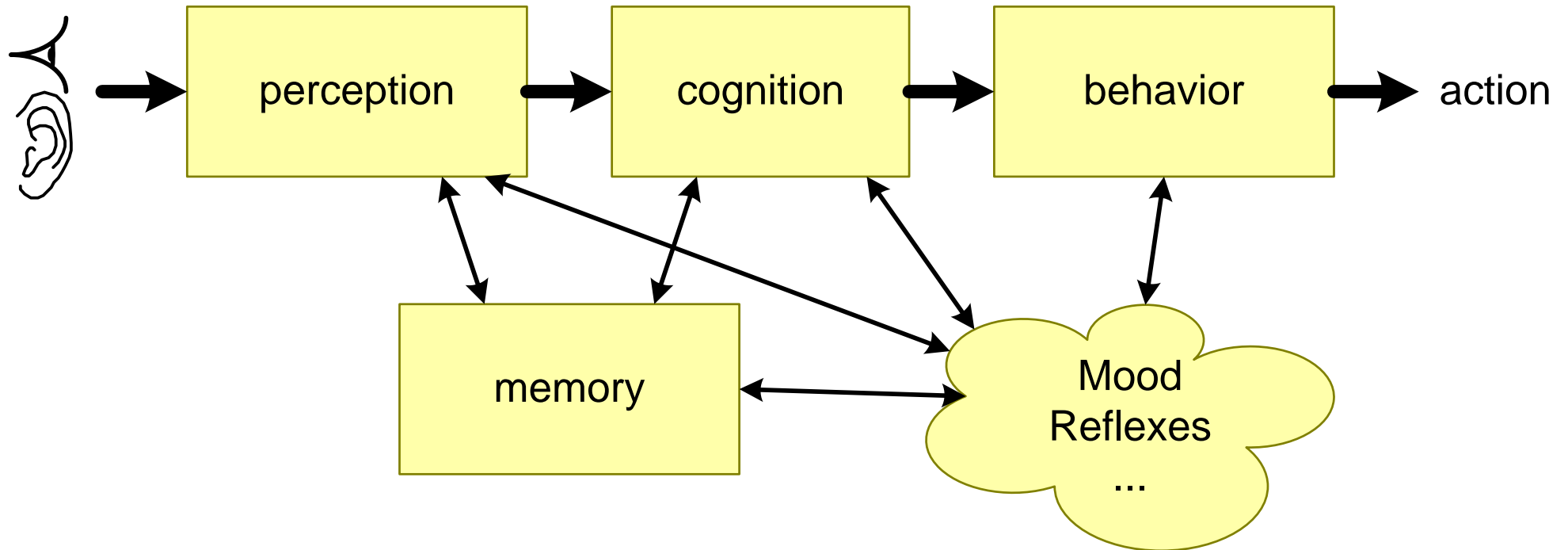


# For and By Humans



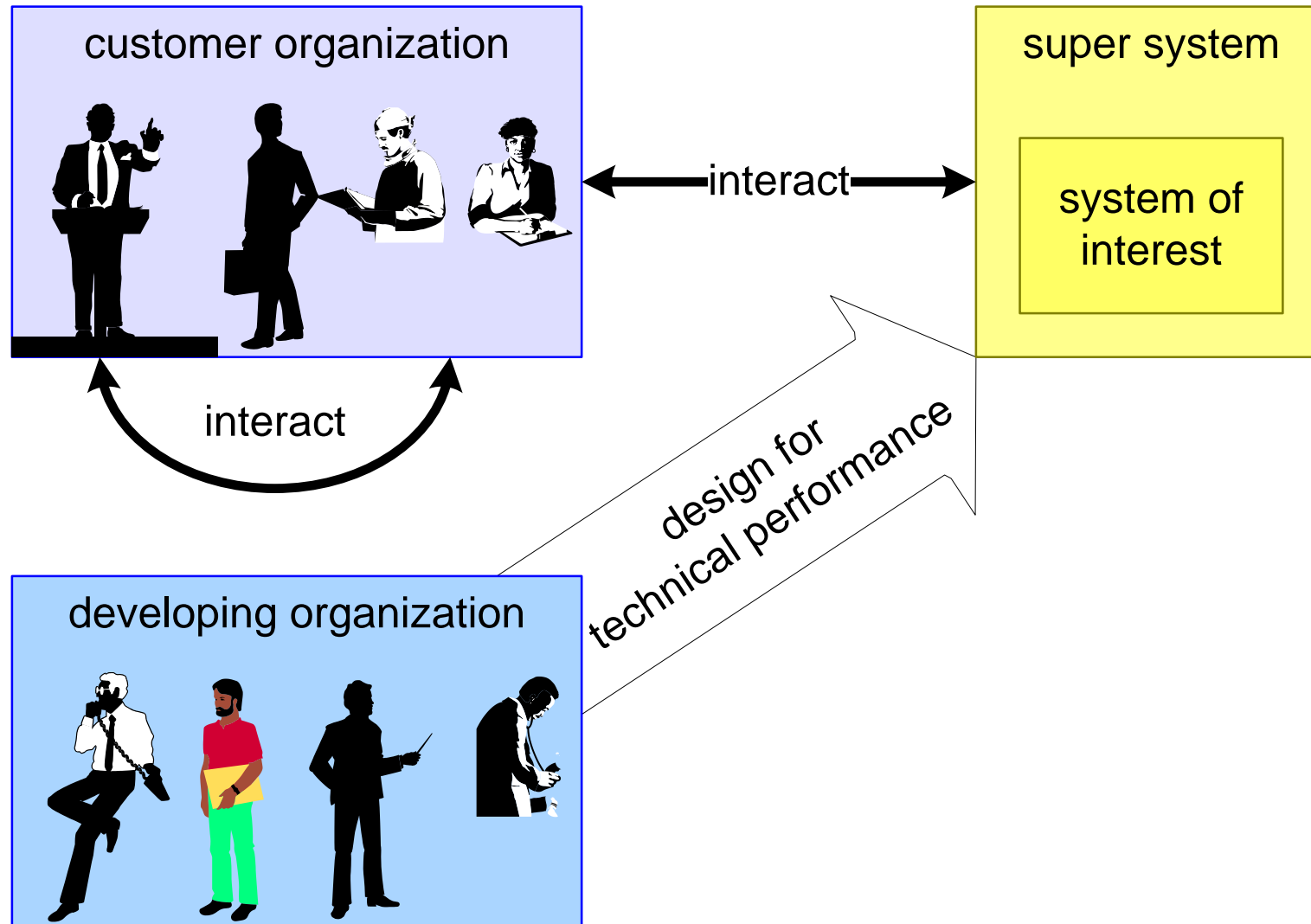
A wide variety of **humans**  
**are developing** the **systems** for  
a wide variety of **human users**

# Humans: Ratio + Emotion



# Risk of Engineer-Only Design

unexpected behavior causing **safety** and **usability** problems





# Many Human Factors Experts

