

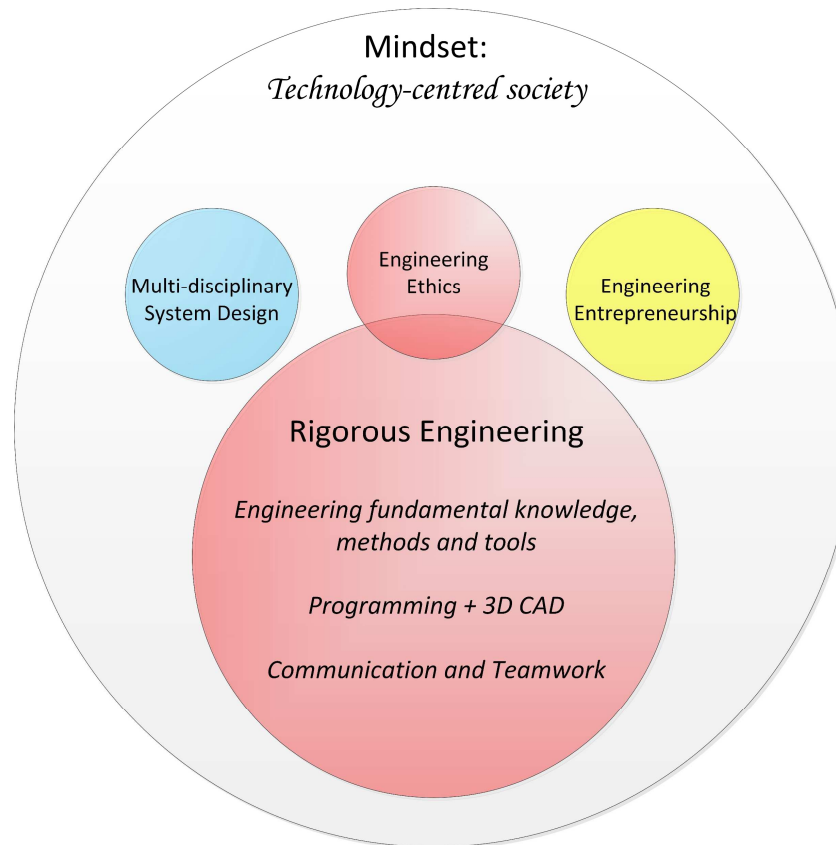
HOW ELSE CAN WE THINK ABOUT THE KEY ELEMENTS OF HIGHER ENGINEERING EDUCATION?

Aldert Kamp | NTNU Campus, Trondheim | March 24, 2023

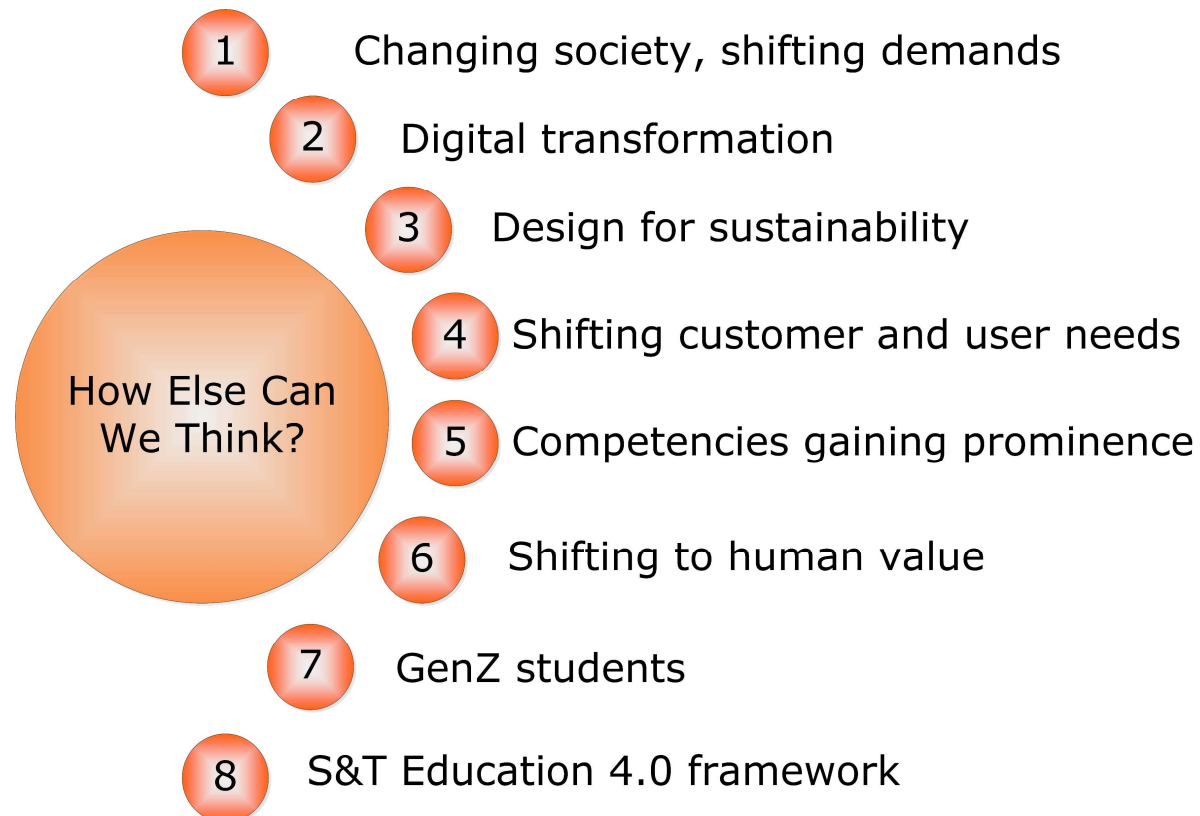


Conventional S&T

Body of Knowledge and Skills



Agenda



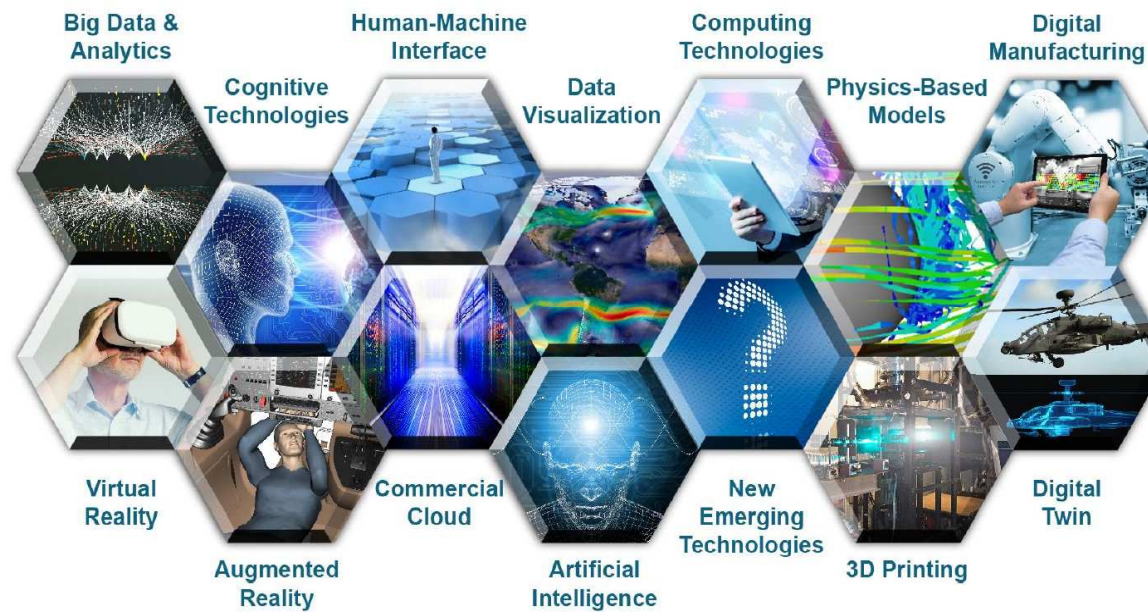
Stuck in a rut?

*It is so much easier to educate students for our past
than for their future*

Changing society, changing demands

- Accelerating change
- Blurring of boundaries
- Infinite speed access to infinite amounts of data
- Complex interdisciplinary societal problems
- Digital transformation in engineering
- Impact of AI on engineering profession
- Generation-Z students' traits and behaviours
- Broader student population
- Learner-led education at scale

The digital transformation ...massive and intense...



Source: DoD Digital Engineering Strategy, 2017

Big Data and Analytics – Cognitive Technologies – Computing Technologies - Digital-to-Physical Fusion Technologies

Data Engineers or Data Scientists

hype vs need

*'There are **70% more open roles** at companies in data engineering as compared to data sciences. As we train the next generation of data and machine learning practitioners, let's place more emphasis on engineering skills'*

- Scientific engineering curricula tend to prepare mainly for machine learning, deep learning, and making Bayesian simulations (modelling data)
- *Data engineering* is about annotating, cleaning and shaping data, moving it from place to place, and doing this as quickly as possible

UN Sustainable Development Goals



Key competencies for sustainability

- INDEPENDENT CRITICAL THINKING
- VALUES THINKING
- RANGE (interdisciplinary, holistic, systems thinking)
- COLLABORATION AND PARTNERING
- SELF-LEADERSHIP
- FUTURES THINKING
- DESIGN SKILLS FOR SUSTAINABILITY

Shift in stakeholder's wishes and needs

- Systems, product and services to be:

Simple

Safe

Secure

Smart

Stable & predictable

Maintainable

Socially acceptable/sustainable

Affordable

Scalable

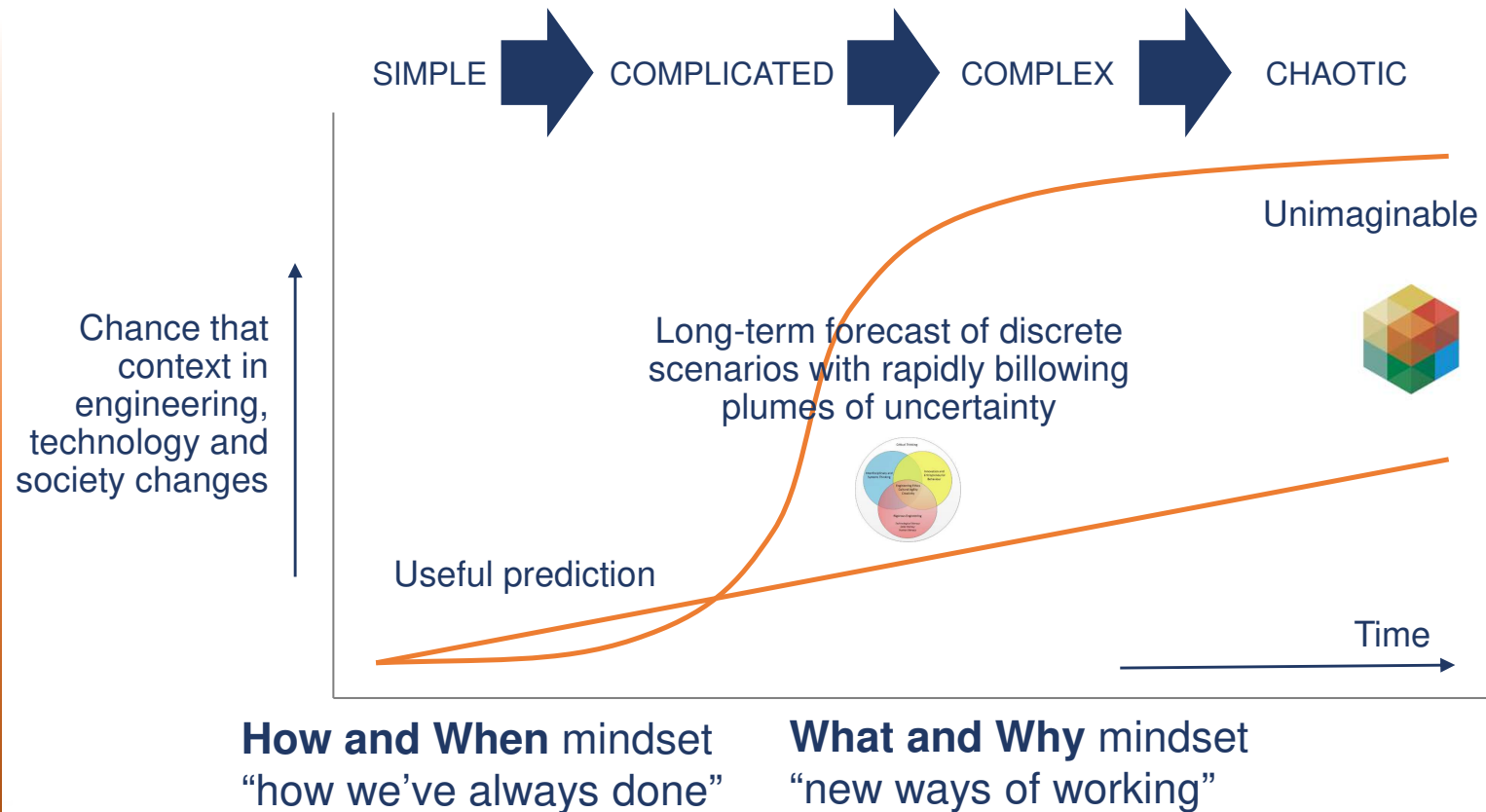
Adaptable

Gaining prominence

- agility and adaptability
- creativity and imagination
- developing relationships
(empathy, trust, humility, ...)
- digital literacy
- entrepreneurial behaviour
- ethical responsibility
- goals achievement
(ownership, ability to learn, coping with uncertainty, ...)
- interdisciplinary systems thinking
- self-awareness and self-management
(self-confidence, motivation, integrity, ...)
- teamwork effectiveness

IN ALPHABETICAL
ORDER

Future as linear extension Accelerating change

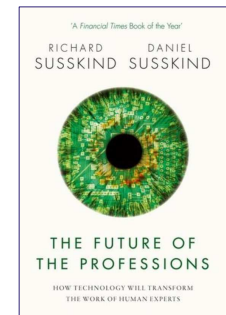
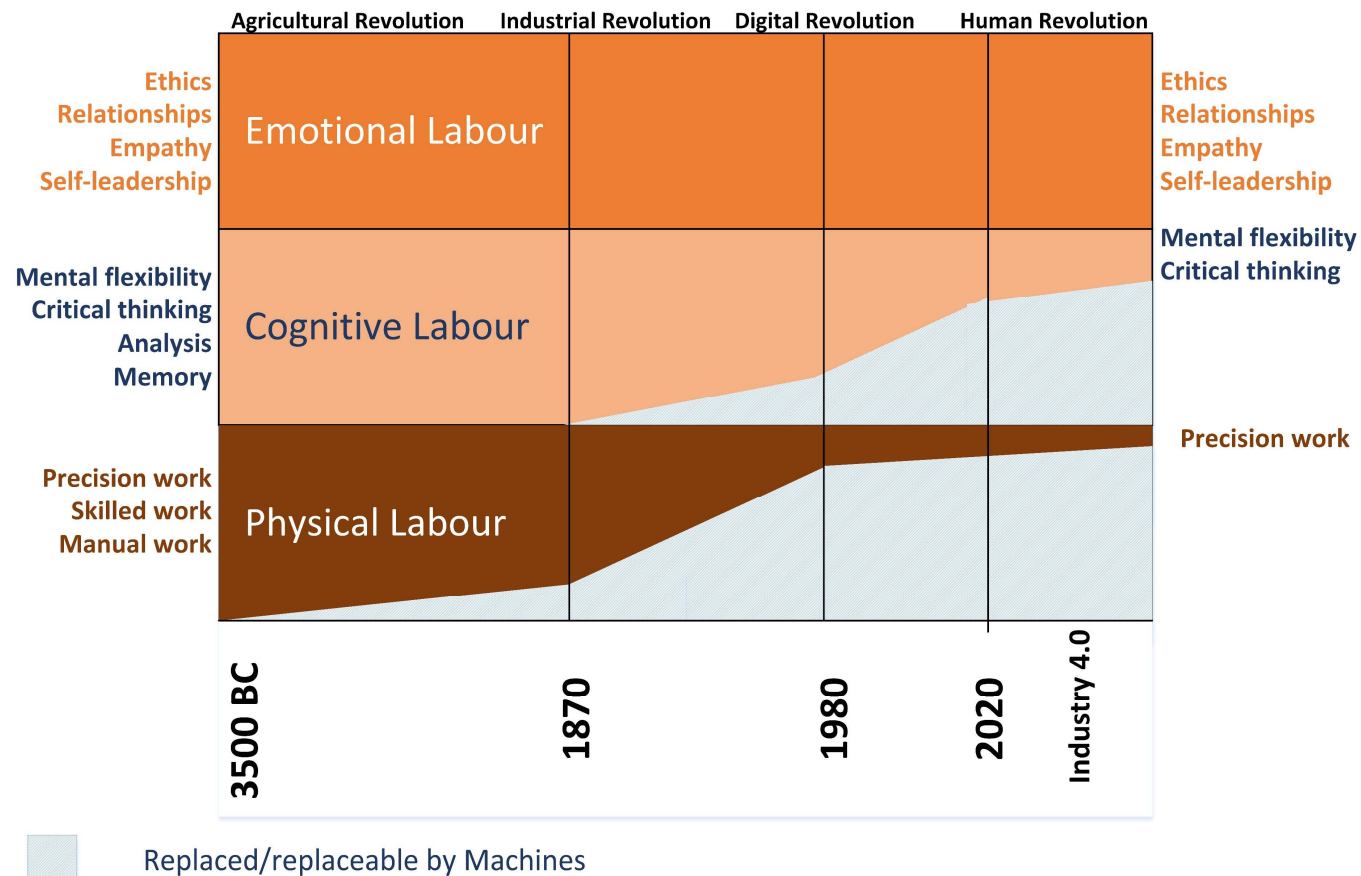


Competence proficiency outcomes

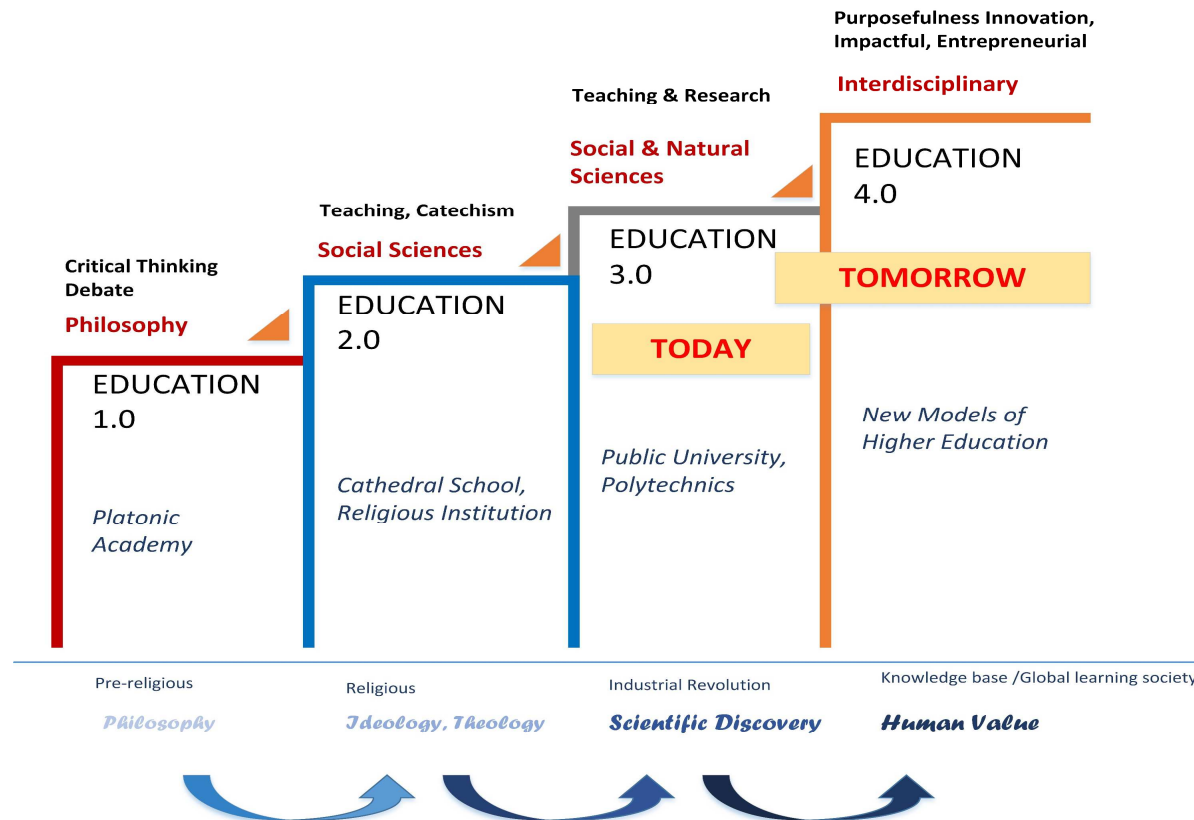


*Source: McKinsey (2021)
Future citizen skills*

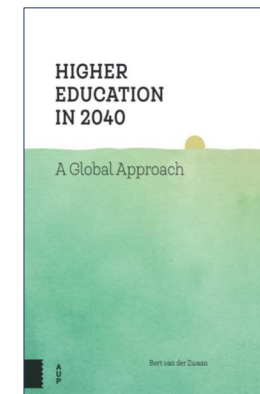
Shift in the division of labour



Paradigm shift in university education



Adapted from: CDIO
International Conference
2021 keynote Dr Pailin
Chuchottaworn
(VISTEC/KVIS)



In the age of AI

*We've known since Star Wars that intelligent machines can
easily do an engineer's work.*

'The droids are on the verge'

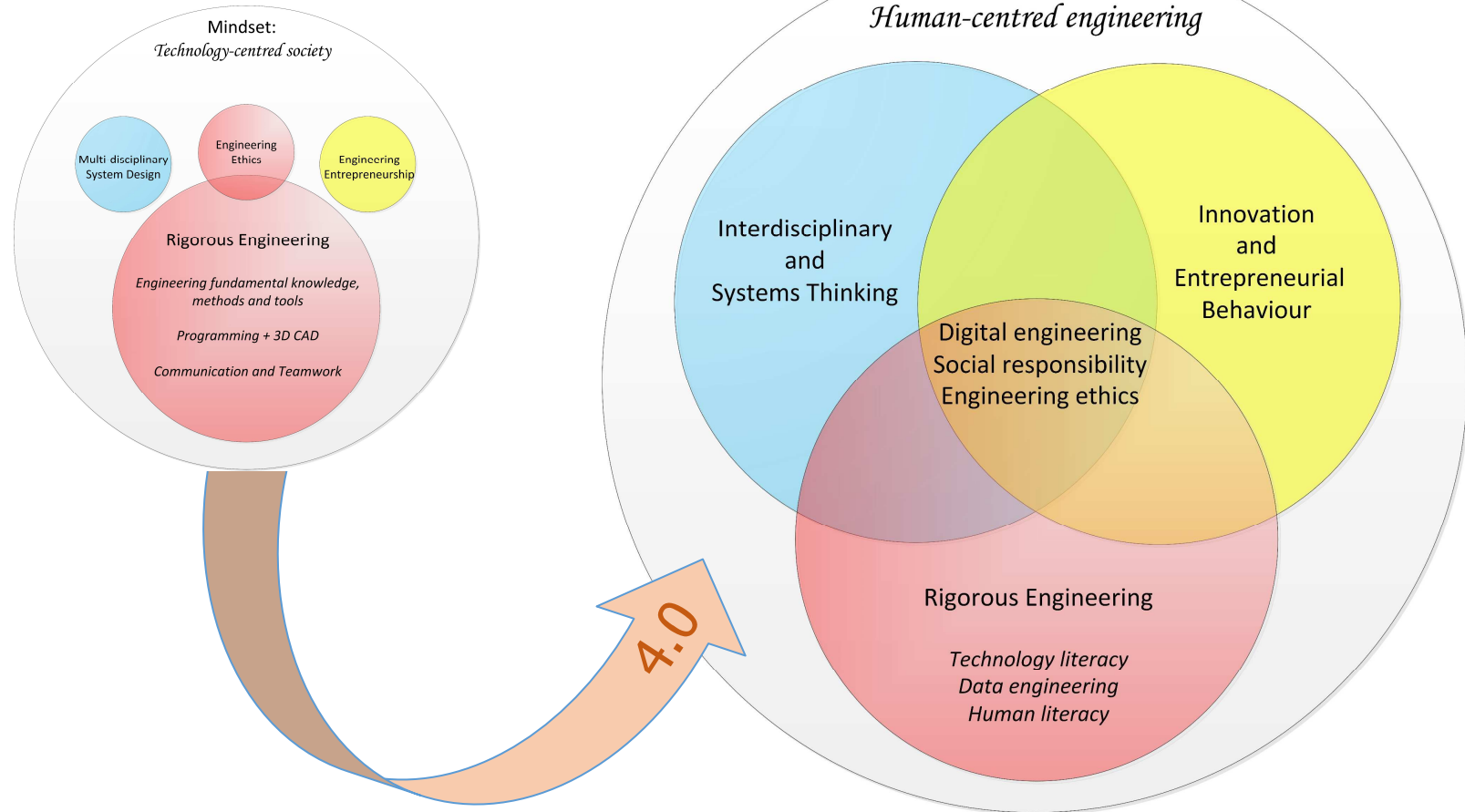
*It's time to focus our education on what human engineers
can do better than AI*

Breed of Gen-Z students

- *Digital natives*
- Technically connected, *disconnected* from human relationships
- *Younger*
 - Need more guidance and personal development
 - Take more time to grow up to adulthood
 - Less familiar with norms and expectations
- *Individual identity*
 - Distinctive CV
 - Build-it-yourself careers
 - Strong in purpose (relevance, real life)
- *Instant culture*

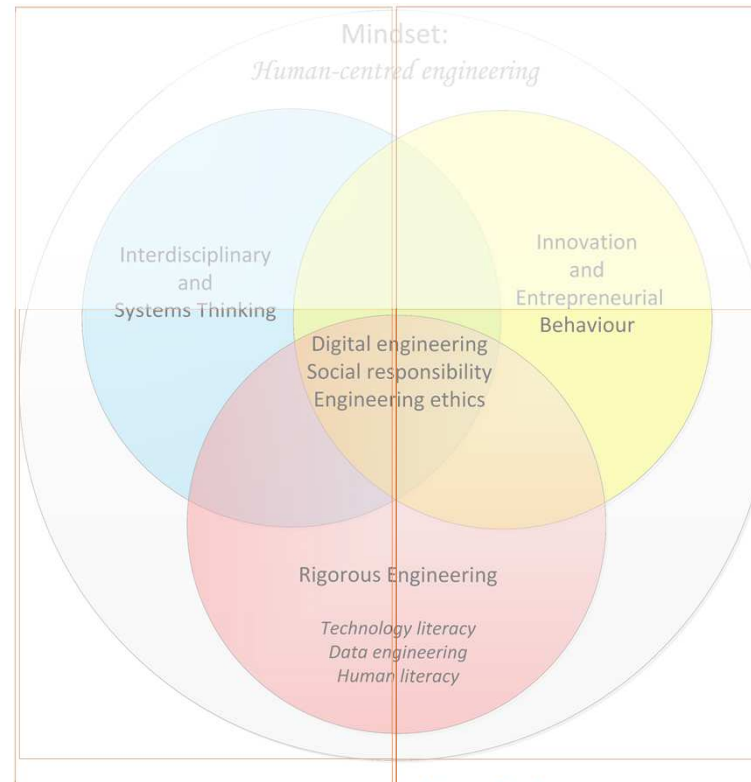


S&T Education 4.0



Most wanted professional roles in engineering 2030-2035

Systems
Integrator



Front-end
Innovator

Research Specialist 2.0

A plethora of changes in the air

1. RANGE

Job crafting *DESIGN LEARNING FOR HUMANS*
Coping with uncertainty
 Micro-credentials *Data literacy*
Society as the centre of engineering *Agility and adaptability*
Agile curricula *Responsible Engineering*
Multi- and interdisciplinary learning

2. AGILITY

Impact-focused education *NURTURING MINDSETS*
Student choice and flexibility
 DIGITAL ENGINEERING *On-demand learning* **PROFESSIONAL
ROLE MODELS**
 Systems Thinking *Upskilling staff* *Common Sense* *Empowering leadership*

3. UPSKILLING

Lifelong learning *Learning how to do what machines cannot do* *making as learning*
Data-driven innovation *UN Sustainable Design Goals* *Employability*
Self-confidence *Lifelong learning* *STEMpathy*

Takeaways

Engineering education on the verge of a major transformation
(digitalisation, sustainability, humanisation, acceleration)

How are you going to adapt to these changes?

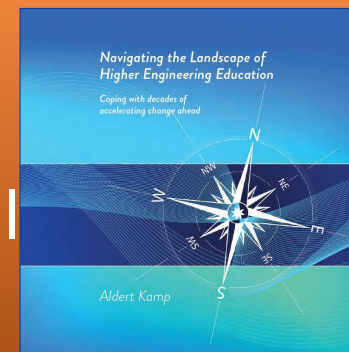
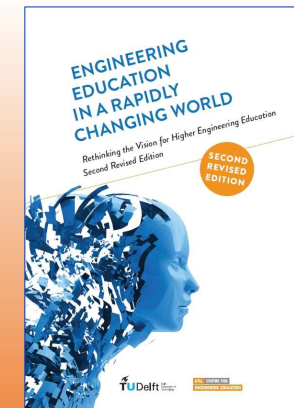
What role are you going to play in this?

What do you need?

Read more about future higher education

www.alderkamp.nl

- Free downloadable books
- Keynote video recordings
- PowerPoints (some with voice-over)
- Reports
- Papers
- Blogs



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