SDPS 2023

TOWARDS A SUPRA-DISCIPLINARY DESIGN AND PROCESS SCIENCE

Workshop Session: Intellectualized Cyber-physical Systems

RESPONSIBLE" DEPLOYMENT OF TRUSTWORTHY CPS AS PART OF SOCIO-TECHNICAL SYSTEMS

Position statement by:

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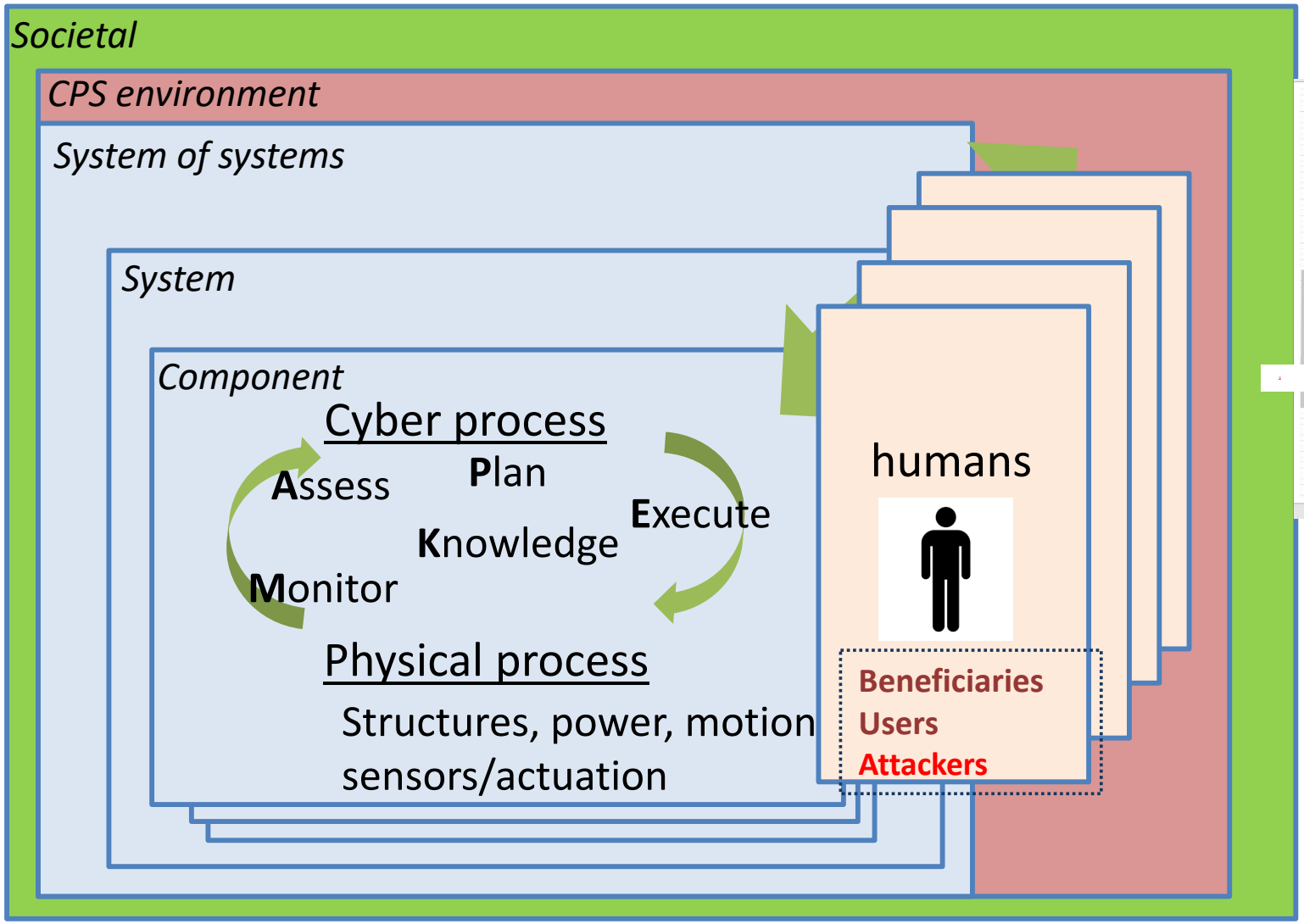
TECOSA
TRUSTWORTHY EDGE COMPUTING SYSTEMS & APPLICATIONS

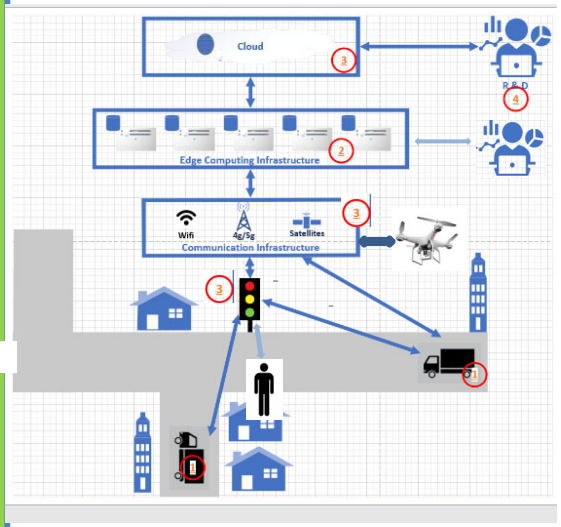
What are the deeper theoretical fundamentals and operational and implementation principles of a dependable intellectualization and socialization of next-generation cyber-physical systems?

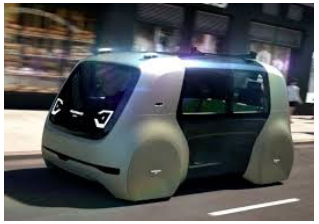
Perhaps we need to understand the question first?

Cyber-physical systems

Public perception
Regulations, standards
Societal effects

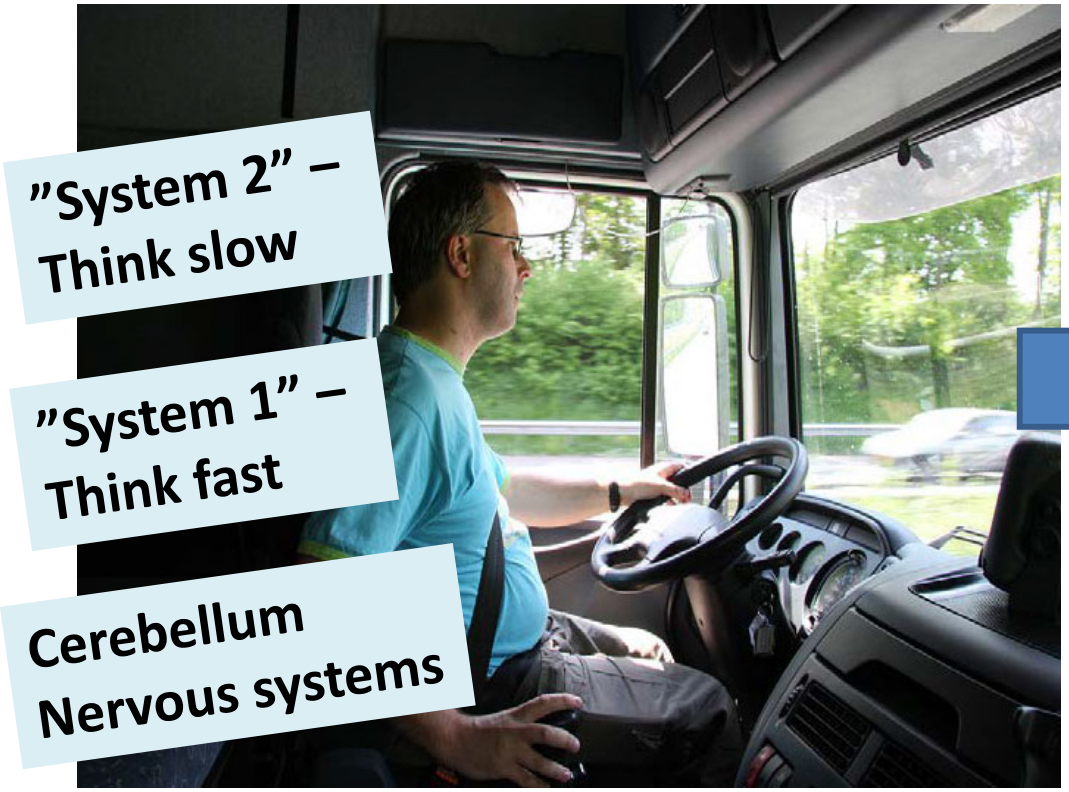






Human intelligence as a reference for automated CPS? Breaking new grounds

ADI – Autonomous Driving Intelligence



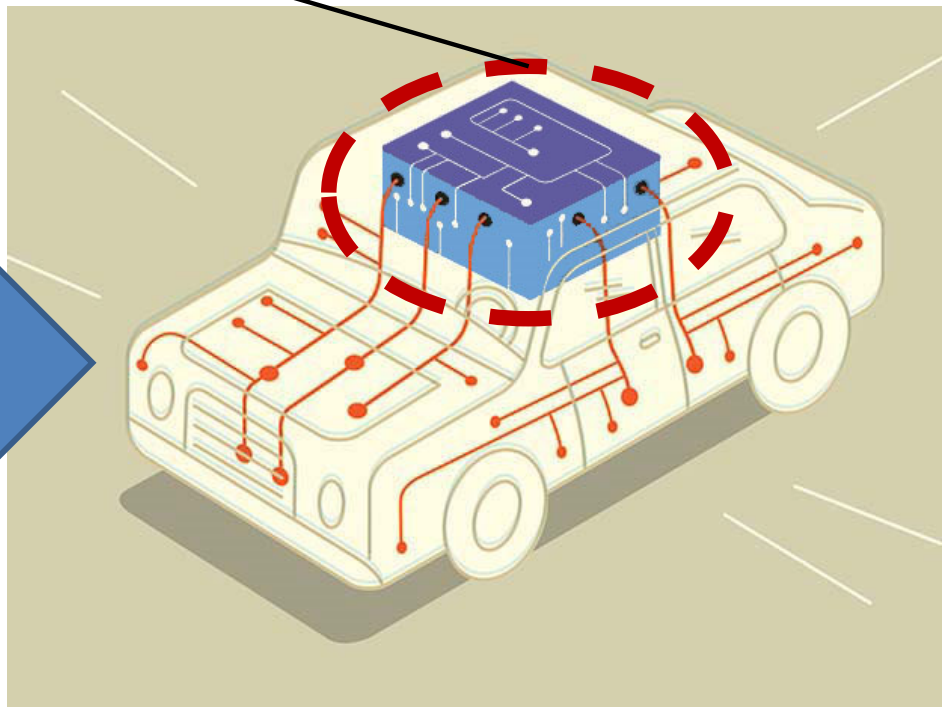
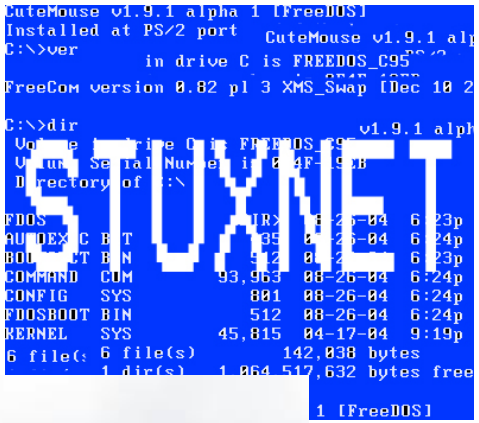


Illustration: Harry Campbell, IEEE Spectrum
http://spectrum.ieee.org/cars-that-think/transportation/self-driving/nxps-bluebox-bids-to-be-the-brains-of-your-car

Challenges in building, operating and maintaining "smart" CPS

- **The world of software and bugs**
  - Industry average code ~ 15– 50 errors /KLOC
  - Safety critical systems may reach 0.1 error/KLOC at very high cost
- **Deep learning: breakthroughs but brittleness**
  - Prediction machines with domain specific super-human capability but without explainability and contextualization beyond training data
- **Cyber-security threats and attacks**
  - Dynamic threat landscape; imbalance
- **Complexity**
  - Billions of transistors, LOC's and 100's of billions of parameters
- **Automation surprises and pitfalls**



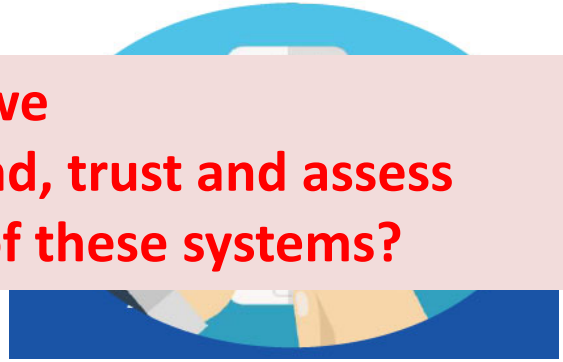
Societal reliance on CPS

Boeing
737 Max

Human-centered Cyber-physical systems?

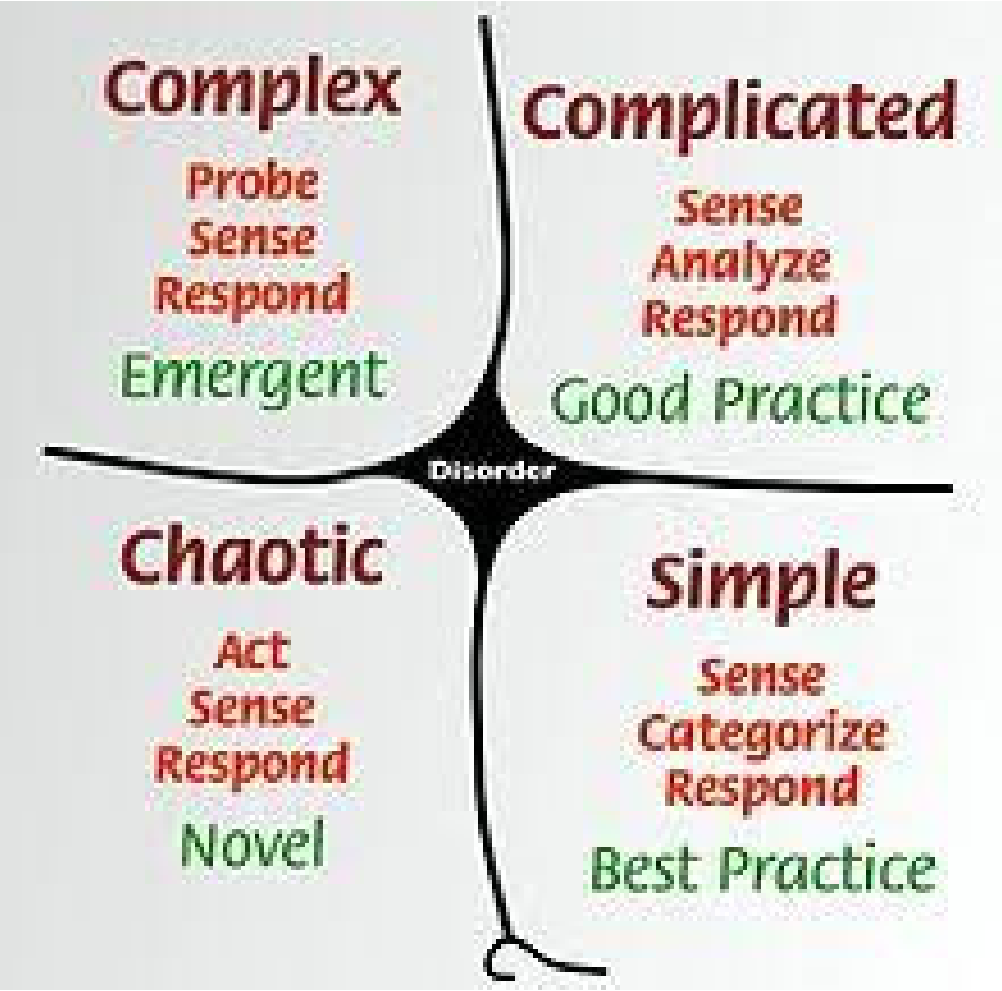
Arthur C. Clarke:

Any sufficiently advanced technology is indistinguishable from magic



How can we
Understand, trust and assess
the risks of these systems?

Needs and tools when going into the "complex domain"

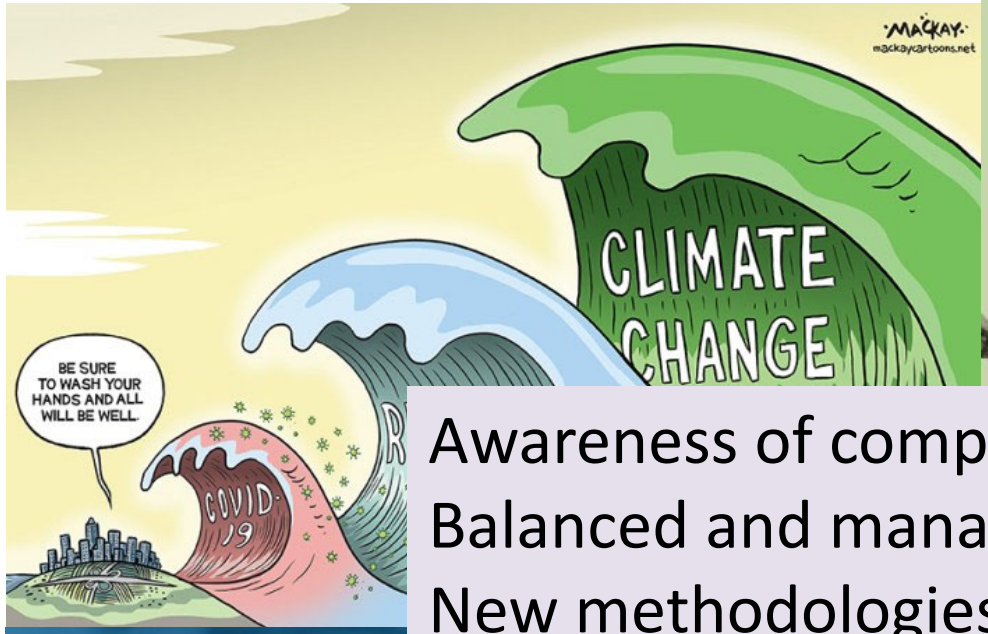


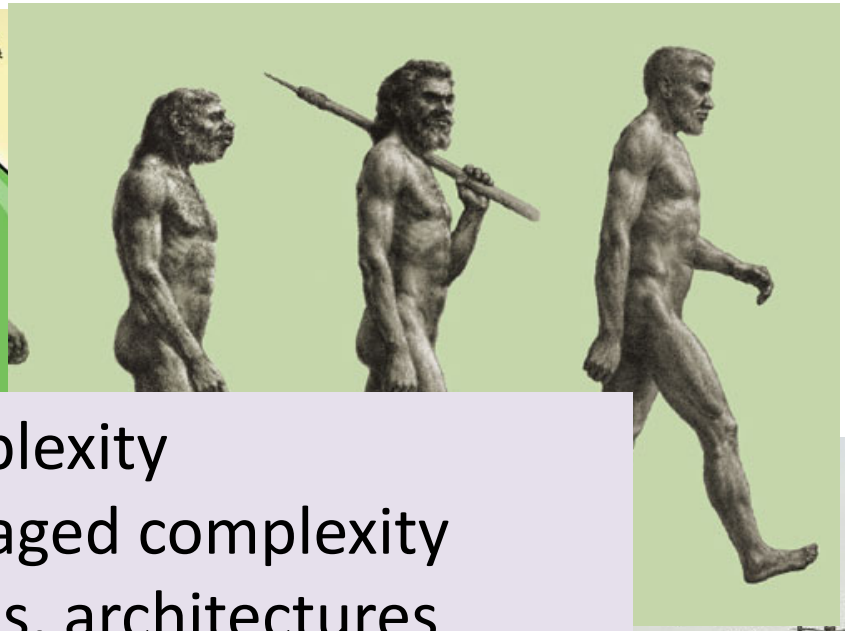
Cynefin model (Snowden, 1999)

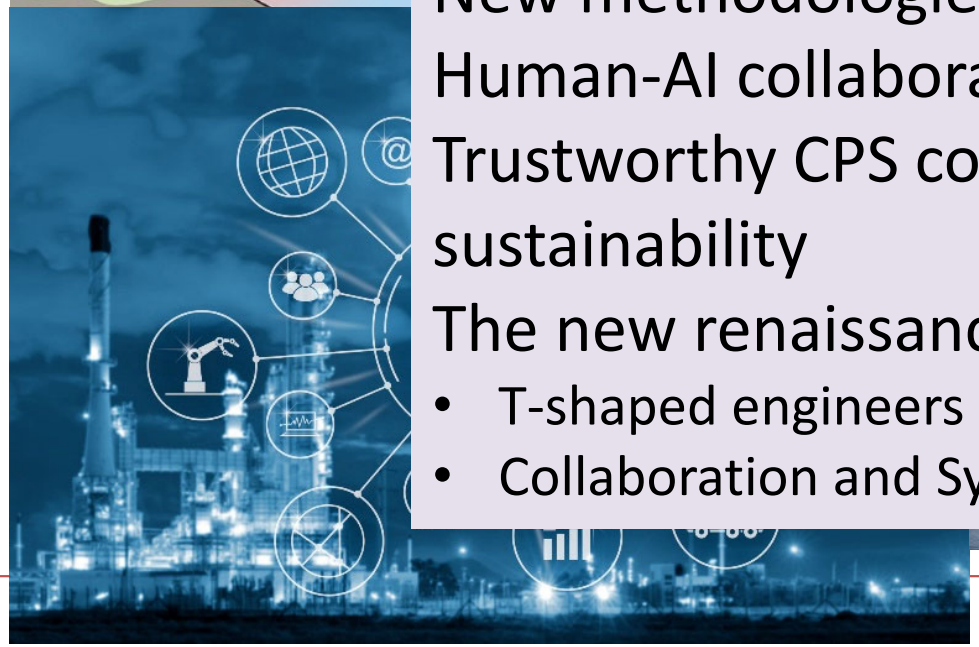
- Learning and developing new methodologies and architectures
  - Sharing of data, incidents, failures, …
  - Testbeds and controlled experiments!
- New sociotechnical frameworks, legislation, and agreeing on risks
- New innovation eco-systems
- Forums for debate!

Tech-driven vs. Societal involvement
Cautionary vs. Innovation principles

Towards human-centered CPS







Awareness of complexity
Balanced and managed complexity
New methodologies, architectures
Human-AI collaboration
Trustworthy CPS contributing to sustainability
The new renaissance human!

- T-shaped engineers
- Collaboration and Systems thinking