



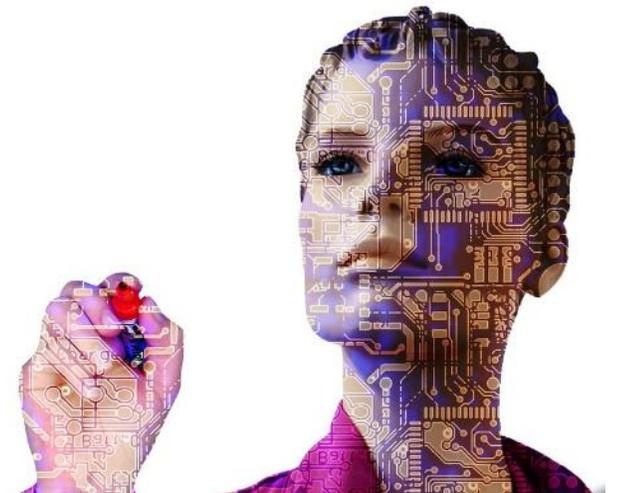
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A Human Perspective on Maritime Automation and Autonomy

Margareta Lützhöft & Tore Relling



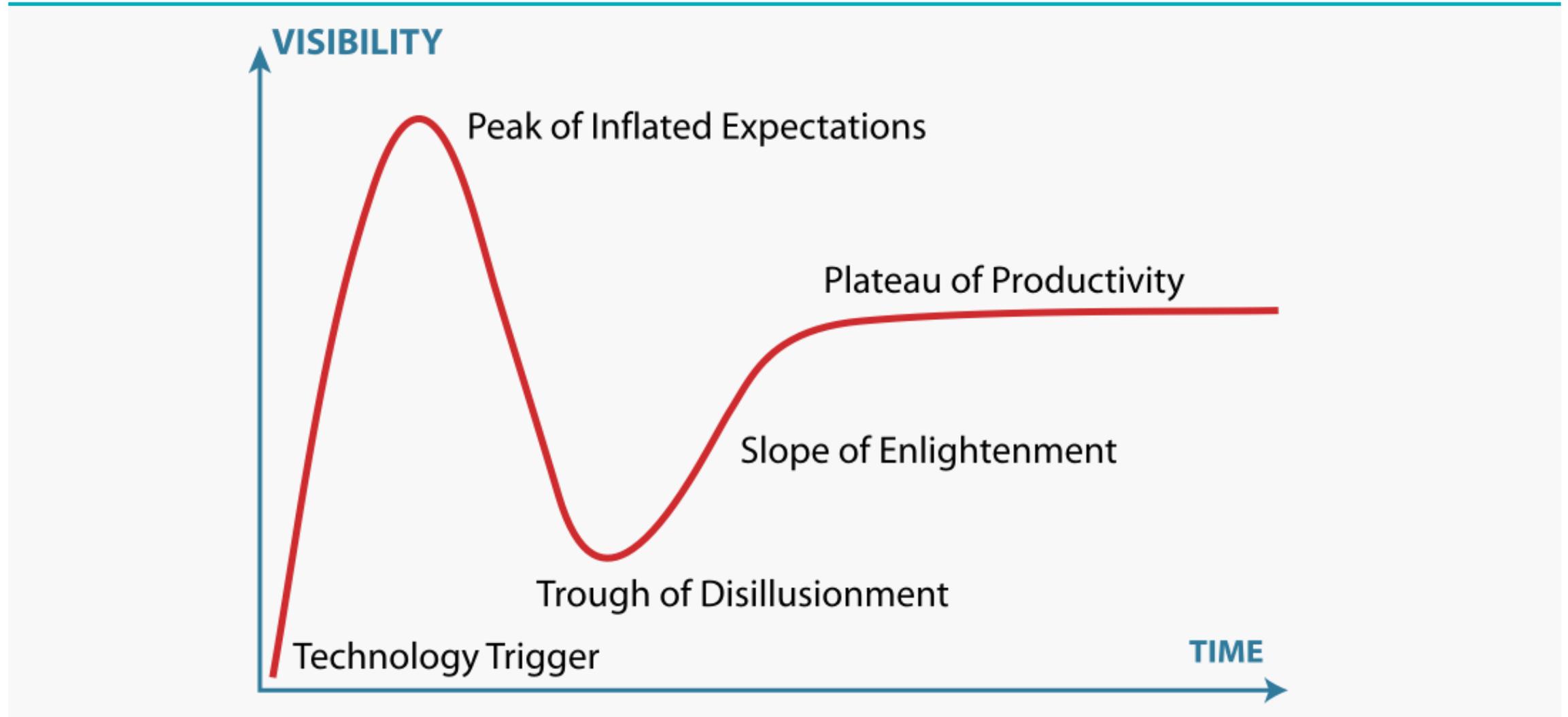
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Content

- › Autonomy and automation – what's the difference?
- › Humans and automation – what do we know?
- › Automation in maritime – what have been the problems?
- › Autonomy in maritime industry – what about the humans?
- › On-going projects
- › Summary



Autonomy – a hype or a paradigm shift?



Everyone is doing it...

- › YARA Birkeland will initially operate as a manned vessel, moving to remote operation in 2018, 2019, 2020
- › Japan's largest container line will test a remote-controlled vessel across the Pacific Ocean in 2019
- › Finnish Maritime Fully Autonomous by 2025
- › Maritime Unmanned Navigation through Intelligence in Networks
- › Kongsberg and Wilhelmsen join for autonomous ships – April 2018
- › BHP Billiton pushes for autonomous ships in the coming decade
- › MOL Expands Artificial Intelligence Research
- › Rolls-Royce, DNV GL, NTNU And SINTEF Ocean Simulation Platform For Creating Future Ships
- › Wärtsilä remote vessel control from 8,000 km

- › 22 March 2018 the Uber fatality
- › 3 April 2018 - Airports across Europe warned of disruptions "there has been a failure of the Enhanced Tactical Flow Management System", which compares traffic demand with local air traffic control regions.



– It looks like they are crashing, said Torbjørn Røe Isaksen, minister of Trade and Industry, when he took control of a so called autonomous ship in Trondheimsfjorden.

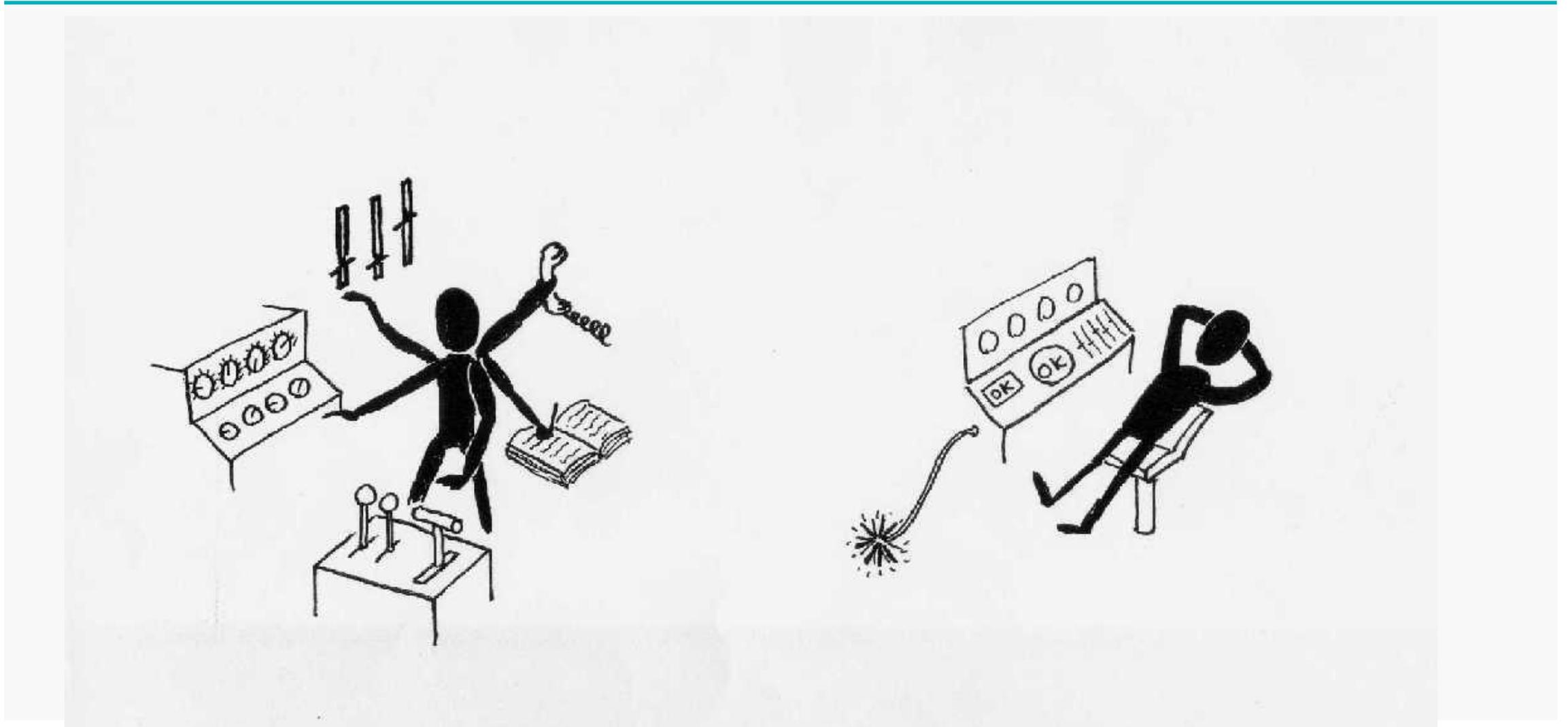
Autonomy – to bin or not to bin?

- › Society of Automotive Engineers (SAE) has abandoned the term autonomy since it:
 - › becomes synonymous with automated.
 - › obscures communication and/or cooperation with outside entities
 - › should be considered cooperative rather than autonomous

- › However the term autonomy is useful to discuss **significant** changes to a system such as
 - › Relocating the responsibility to a remote location
 - › The use of artificial intelligence
 - › A local reduction or removal of humans



What have we learned from human and technology interaction?



Automation

- › Promises
 - › Efficiency
 - › Safety
 - › Economy
 - › Less human error
- › Side effects
 - › Increased knowledge demands
 - › New risks
 - › New accident types

Strong and silent

- › Change is automatic
- › Future movements are not shown
- › More independence and authority
- › Difficult to supervise/control
- › The human has to know:
 - › when and where to look
 - › for what
- › Availability is not observability



The impossible task and the ironies of automation (Bainbridge, 1983)

- › Skills deteriorate when not used
- › Formerly experienced may now be inexperienced
- › Memory depends on frequency of use
- › Knowledge develops through use and feedback
- › Impossible to maintain attention for more than about half an hour.

It is humanly impossible to carry out the basic function of monitoring for unlikely abnormalities

- › The computer is being used to make the decisions because human judgement and intuitive reasoning are not adequate
- › Automation can do the job better but the operator is being asked to monitor it

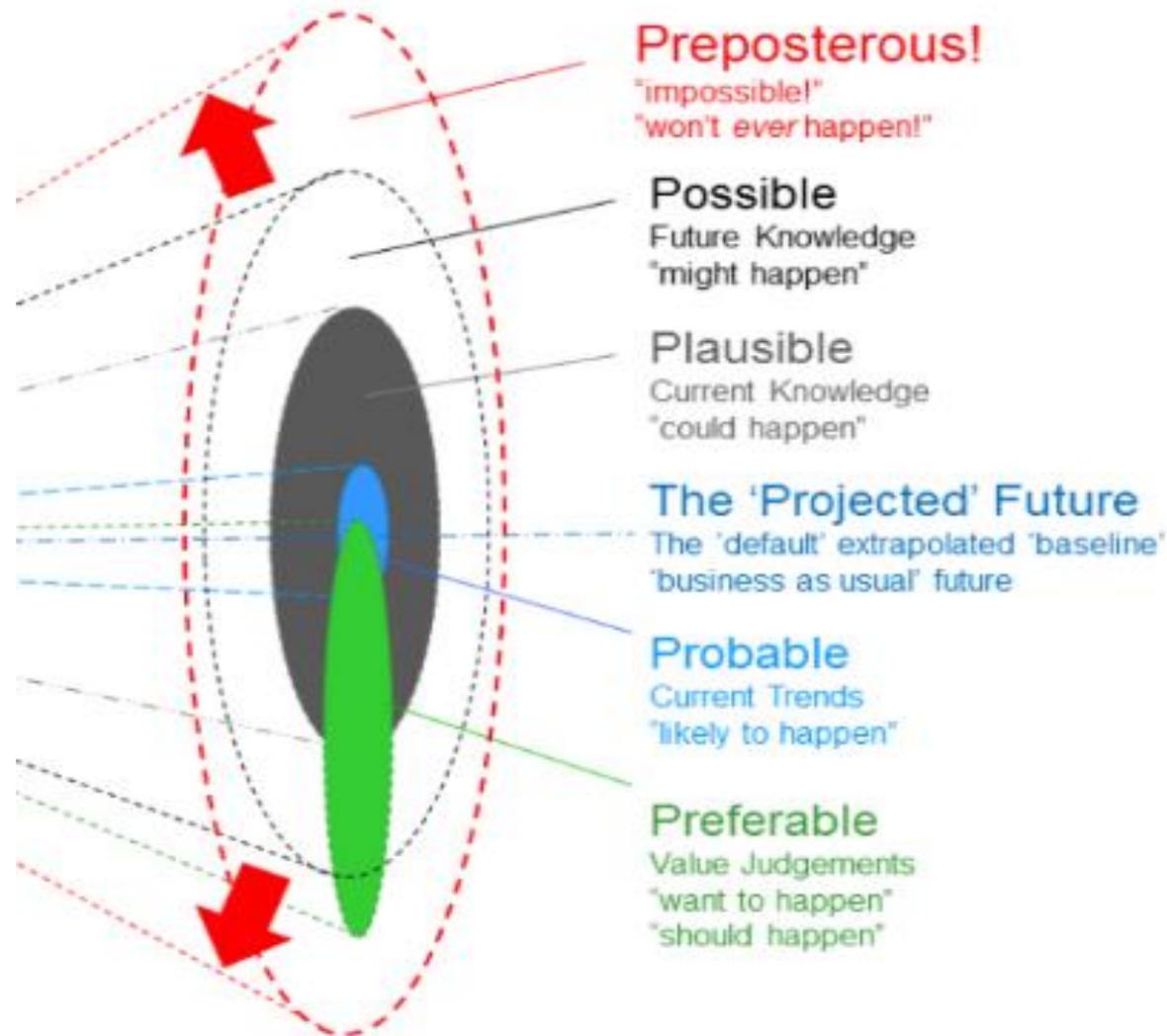
The human monitor has been given an impossible task.

Human-Technology interaction in the maritime industry



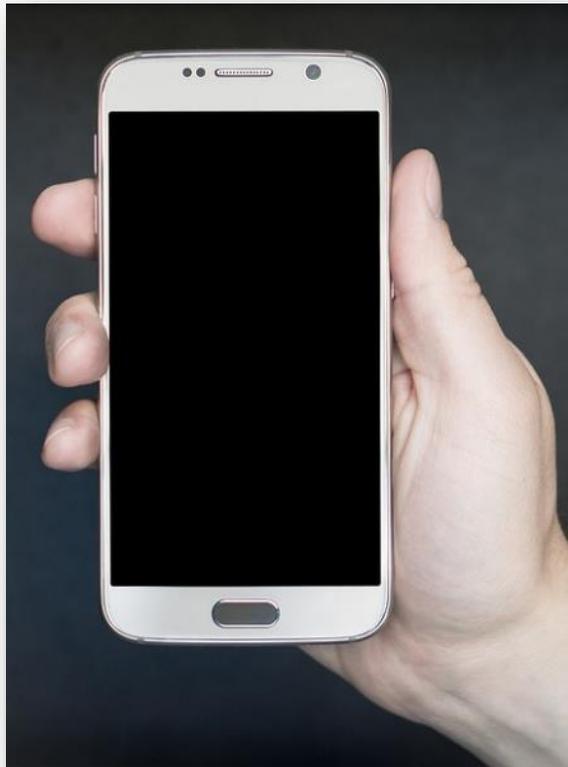
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A projected future of maritime autonomy

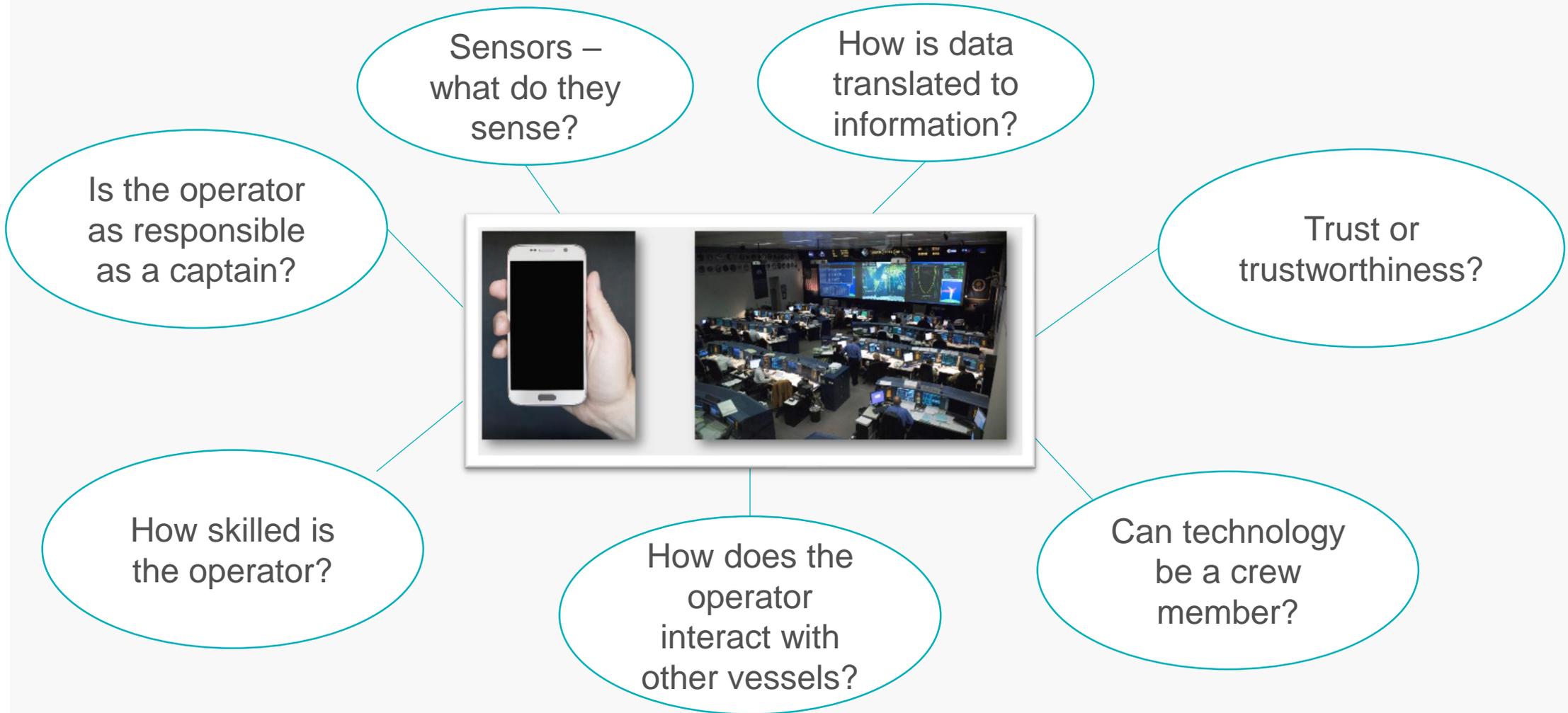


- › Vessels with no or significant reduced manning
- › 'Autonomous', remote and conventional vessels will co-exist
- › The captain is no longer on the vessel
- › 'Someone' is responsible from a remote location
- › A few autonomous concepts in territorial waters initially

Remote and responsible



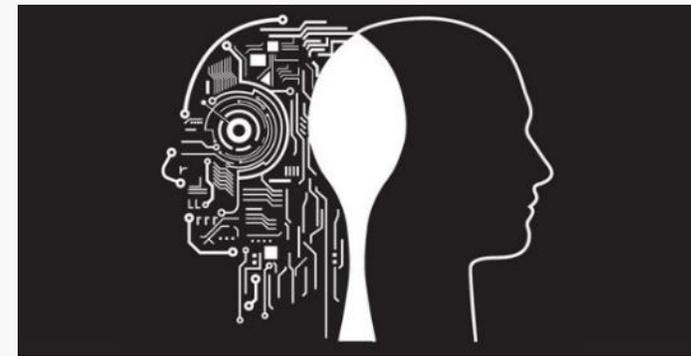
The tool becomes the job



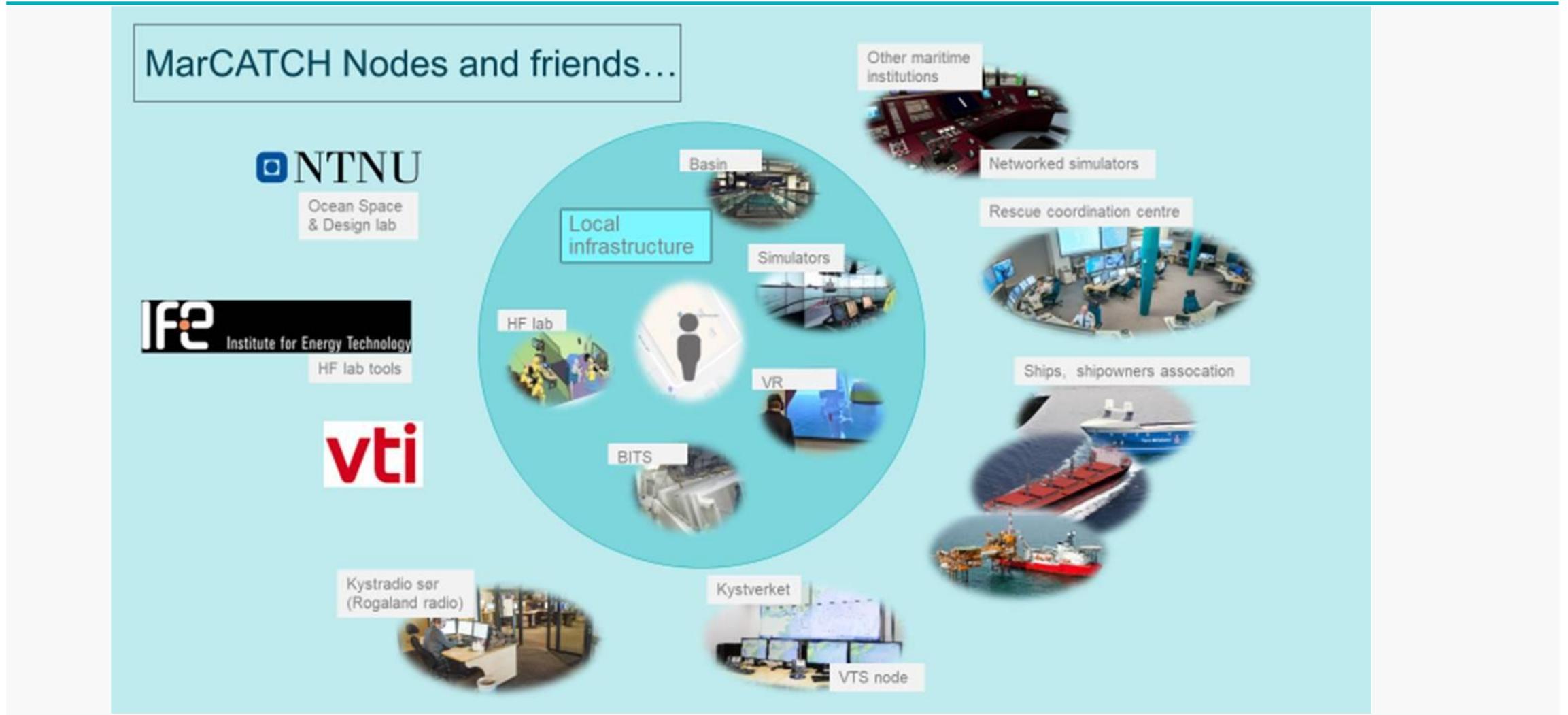
HUMANE project

- › Hardware reliability & cyber security
- › Skill sets, competence and knowledge
- › Legal implications
- › Organisational & job design issues

- › Why?
 - › Most of the technology is in place...?
 - › Some bits are missing
 - › What can we do to support and enable?
 - › Everyone wants safe and efficient shipping

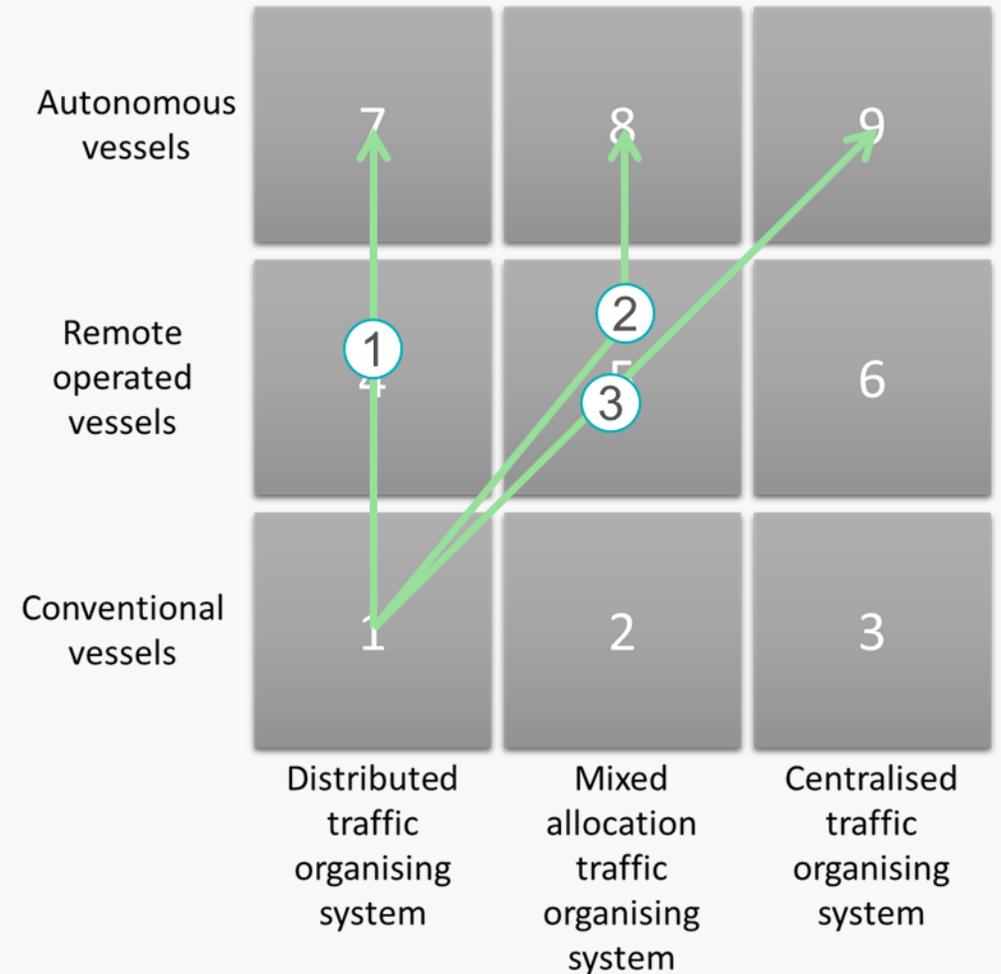


Maritime competence and test cluster Haugesund



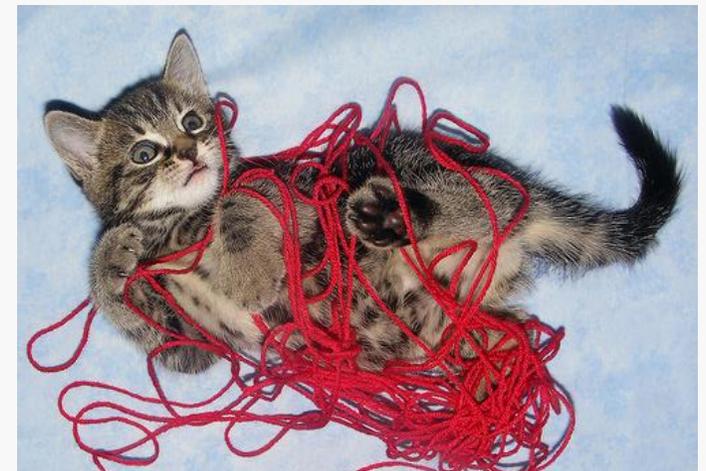
Disruptive approach – centralise responsibility to reduce complexity

- > What if the SCC is not best fit for taking the navigation responsibility?
- > Could responsibility be allocated elsewhere?
- > What if the governmental authorities is allocated responsibility in some geographical areas?



Summary

- › Automation and autonomy – many similarities, but also need to understand the difference
- › Humans and automation – consider known human-technology interaction in future design
- › Automation in maritime – rapid development, but end-users are not considered enough (rewrite)
- › Autonomy in maritime industry – some old challenges, but also some new. Responsibility is a key factor for future system design
- › Work is in progress





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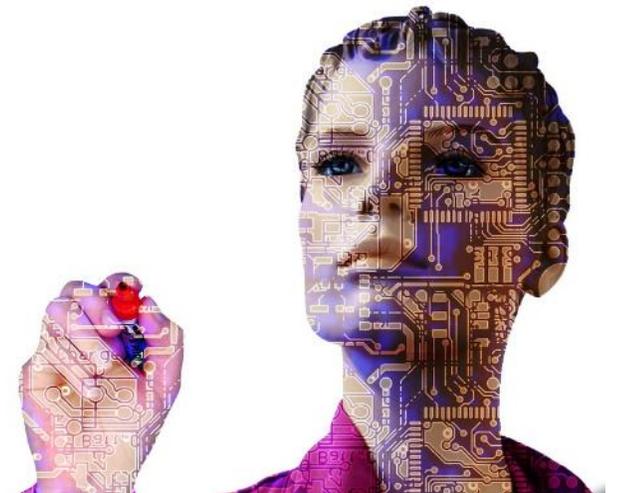


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