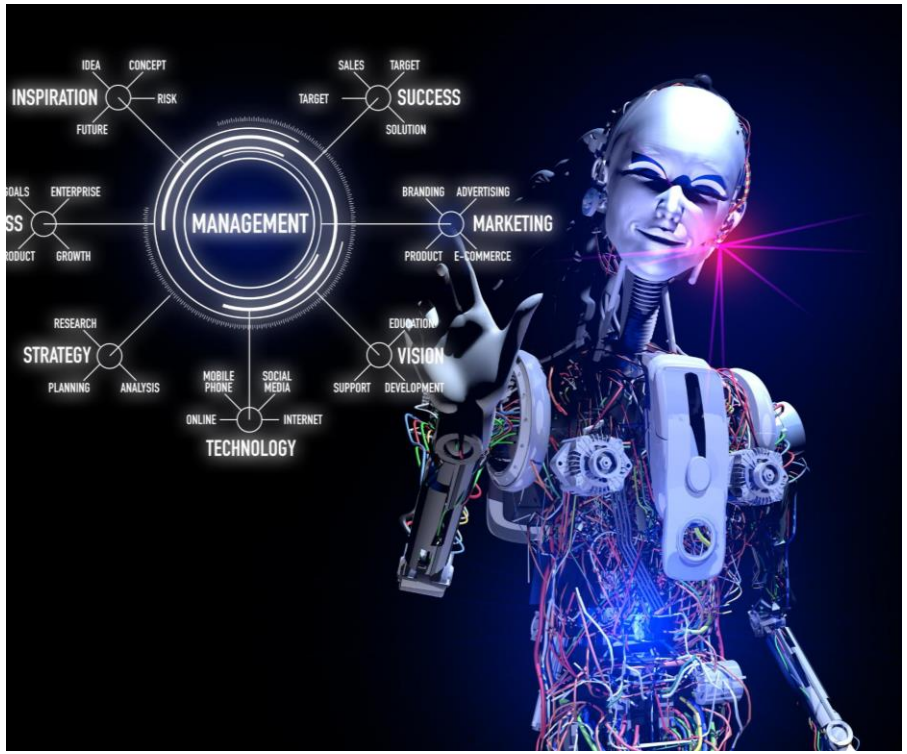


Removing humans from the decision loop, will all accidents disappear?

TRANSFORMING COMMUNICATION BETWEEN PEOPLE AND TECHNOLOGY

Overview of Human-Machine Interaction Evolution



Pre-Industrial Interaction

Early human-machine interaction involved rudimentary tools that relied entirely on human physical effort and manual labour.

Mechanisation to Automation

The evolution moved through mechanisation and mass production, enabling increased productivity and reduced manual input.

Digitalisation and Control

Digital technologies introduced new modes of control, shifting interaction from physical to digital interfaces.

Industry 5.0 Paradigm

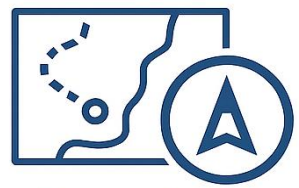
The current paradigm emphasises cognitive collaboration between humans and intelligent machines for enhanced well-being.

Humans controlled the loop





HOW Industry 3.0 CHANGED THE MARITIME WORLD

	ENGINE ROOM	BRIDGE
BEFORE INDUSTRY 3.0	 Manual controls, analog gauges	 Paper charts, manual navigation
AFTER INDUSTRY 3.0	 Automated systems, digital monitoring	 ECDIS, GPS, integrated systems

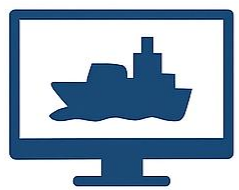
HOW Industry 4.0 changes the maritime world.

INDUSTRY 4.0

ENGINE ROOM

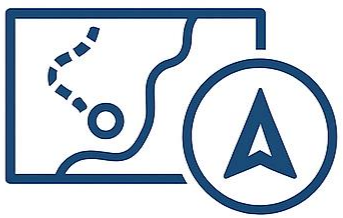


Automated systems



Remote monitoring

BRIDGE



Digital navigation



AI and data analytics

Understanding Human-Machine Interaction Models

Human-in-the-Loop Model

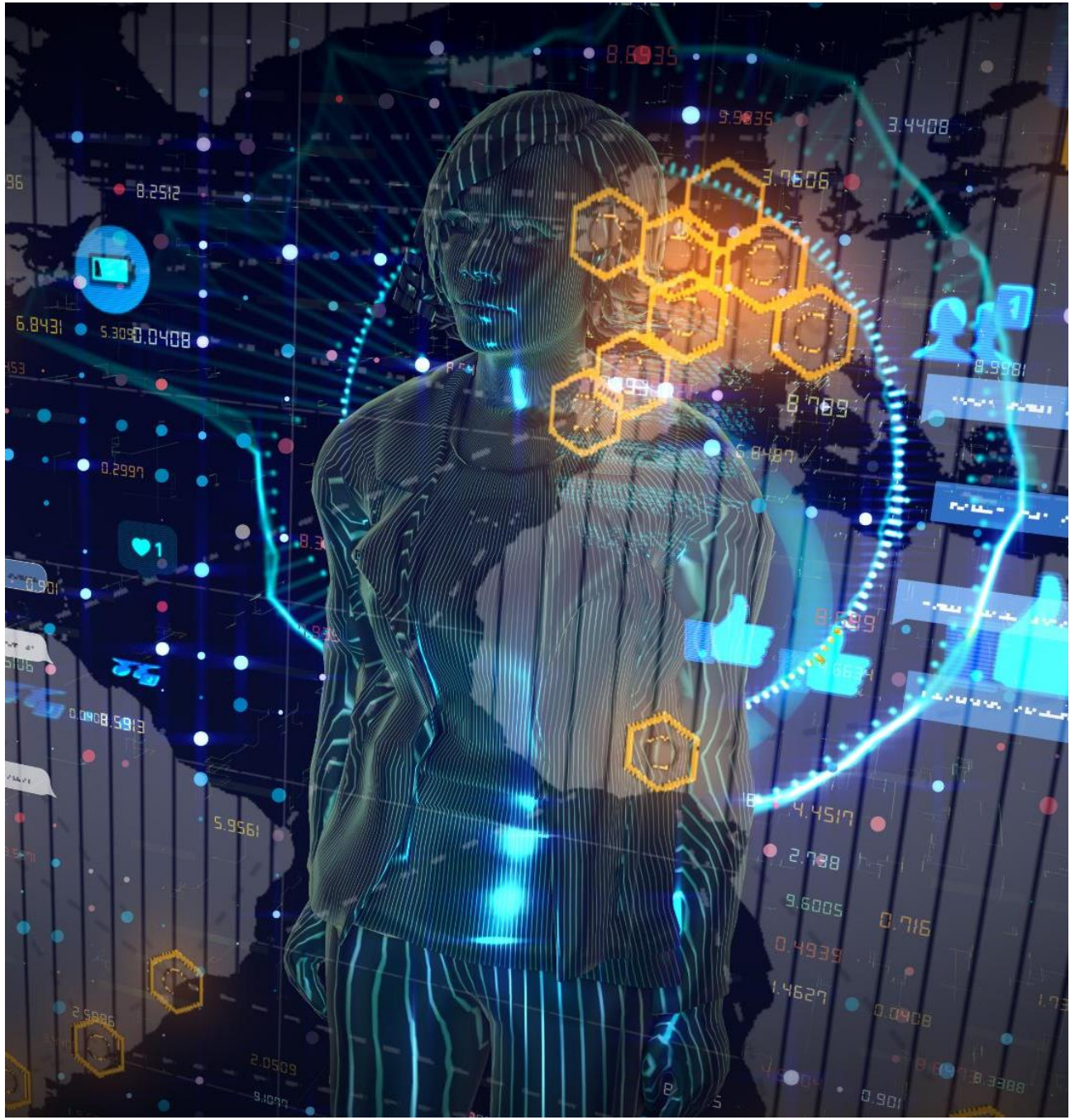
Humans are actively involved in real-time decision-making and control within the automated system.

Human-on-the-Loop Model

Humans supervise and oversee automated system operations, intervening only when necessary.

Human-out-of-the-Loop Model

Automated systems operate independently without human intervention during their operation cycle.



Some practical challenges with automation



ARTICLE

Observation and assessment of crossing situations between pleasure craft and a small passenger ferry

Kjell Ivar Øvergård[1] · Marius Stian Tannum[2] · Per Haavardtun[3]



tb.no

The challenge when humans are bending or breaking the rules

3152 CROSSINGS OBSERVED WITH OTHER VESSELS PRESENT.

Risk category	No. vessels	Deviation	Dangerous	Critical	Total
OV did not give way	2.66	205	30	9	244
OV had too high speed	1.50	–	5	1	6
OV lack of attention	2.11	4	3	2	9
OV on wrong side of fairway	4.00	1	1	–	2
Other	2.40	3	–	–	3
High traffic density	5.24	15	–	–	15
Total		228	39	12	279

OV, other vessels; *No. vessels*, average number of vessels on a conflicting course with Ole III for each situation

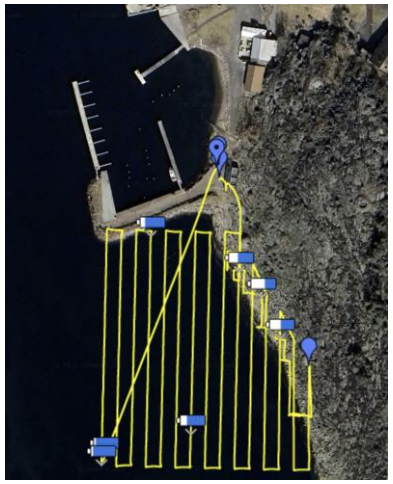
Situation	Control strategies of the captain of Ole III						
	Kept course and speed	Waited	Sailed aft of OV	Reduced speed or deviated	Com.	Used horn	Total
OV did not give way	15	103	48	32	5	2	205
OV had too high speed	–	–	–	–	–	–	–
OV lacked attention	1	2	1	–	–	–	4
OV on wrong side of fairway	1	–	–	–	–	–	1
Other	–	3	–	–	–	–	3
High traffic density	–	14	1	–	–	–	15
Total	17	122	50	32	5	2	228

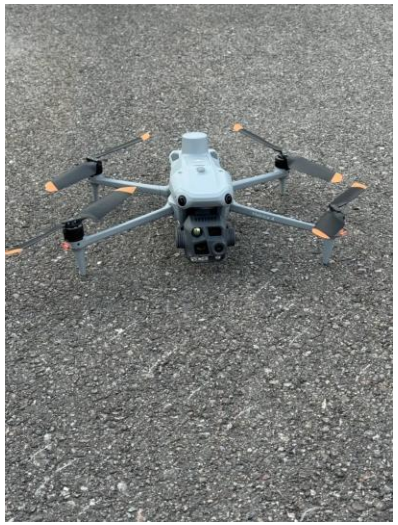
The first risk category ‘deviation’ was defined as a deviation from the COLREGS where Ole III waited for the other vessels to pass or passed at the aft of the other vessels even though Ole III had the right of way.
This risk category occurred 228 times (4.8% of the total, 7.3% of crossings with other vessels present).

An autonomous vessel cannot be programmed solely on the rules applicable to the incident.

VALKYRIES

Automatic detection and classification of objects



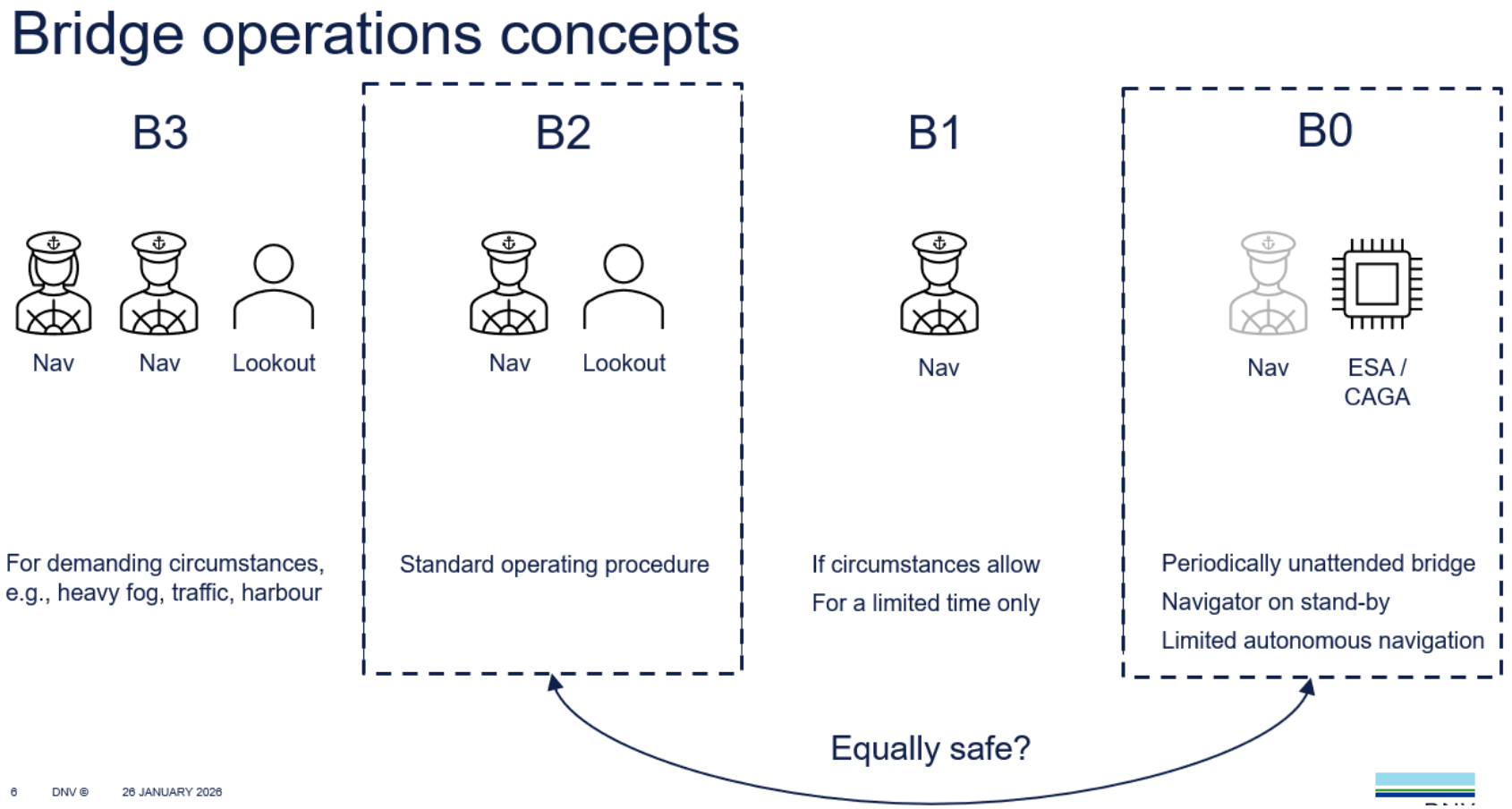




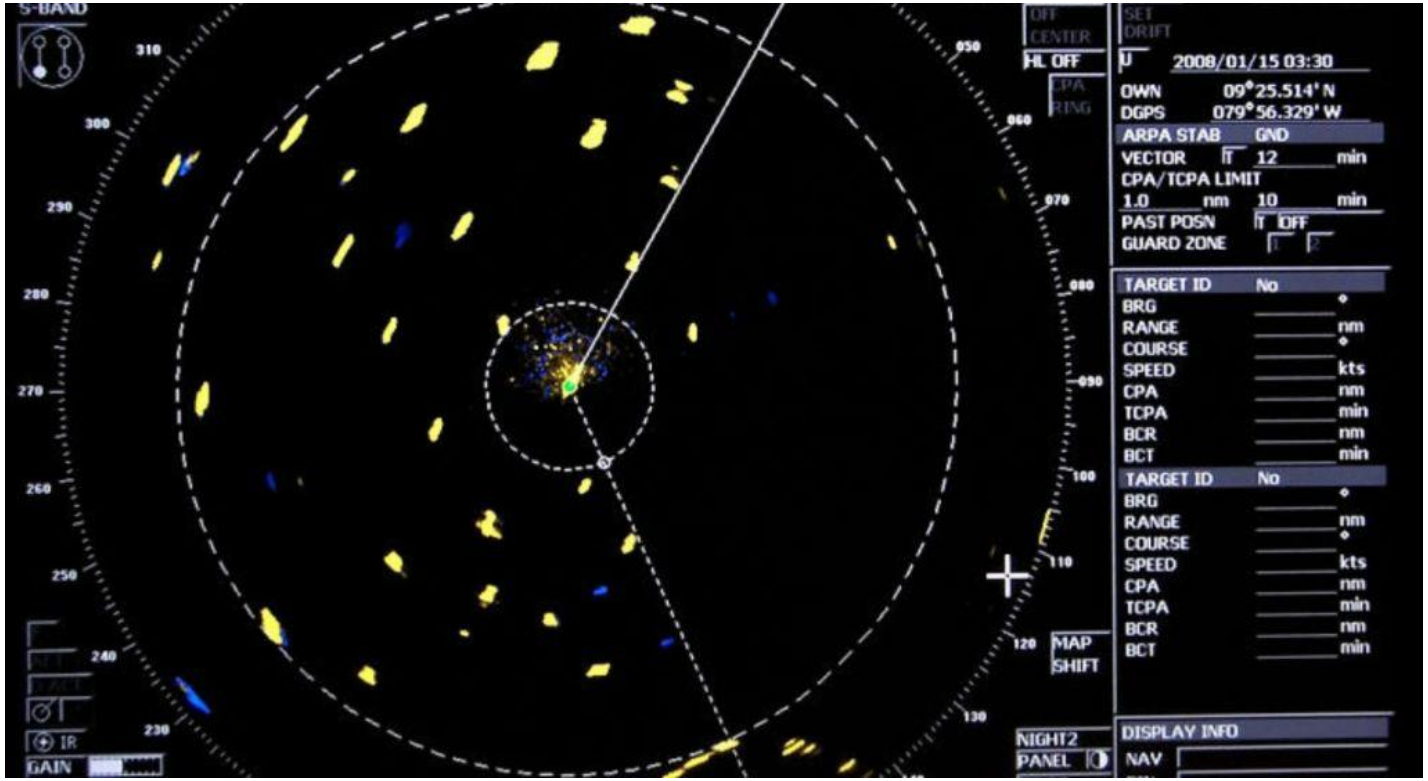
This mission didn’t yield the expected results because the actors' suits prevented the system from identifying them as humans. However, in the tests before the simulation, we could identify them in their normal clothes, as seen in the image.

An automated system must be as good or better than a human to detect and classify what it is looking for

Periodically unmanned bridge



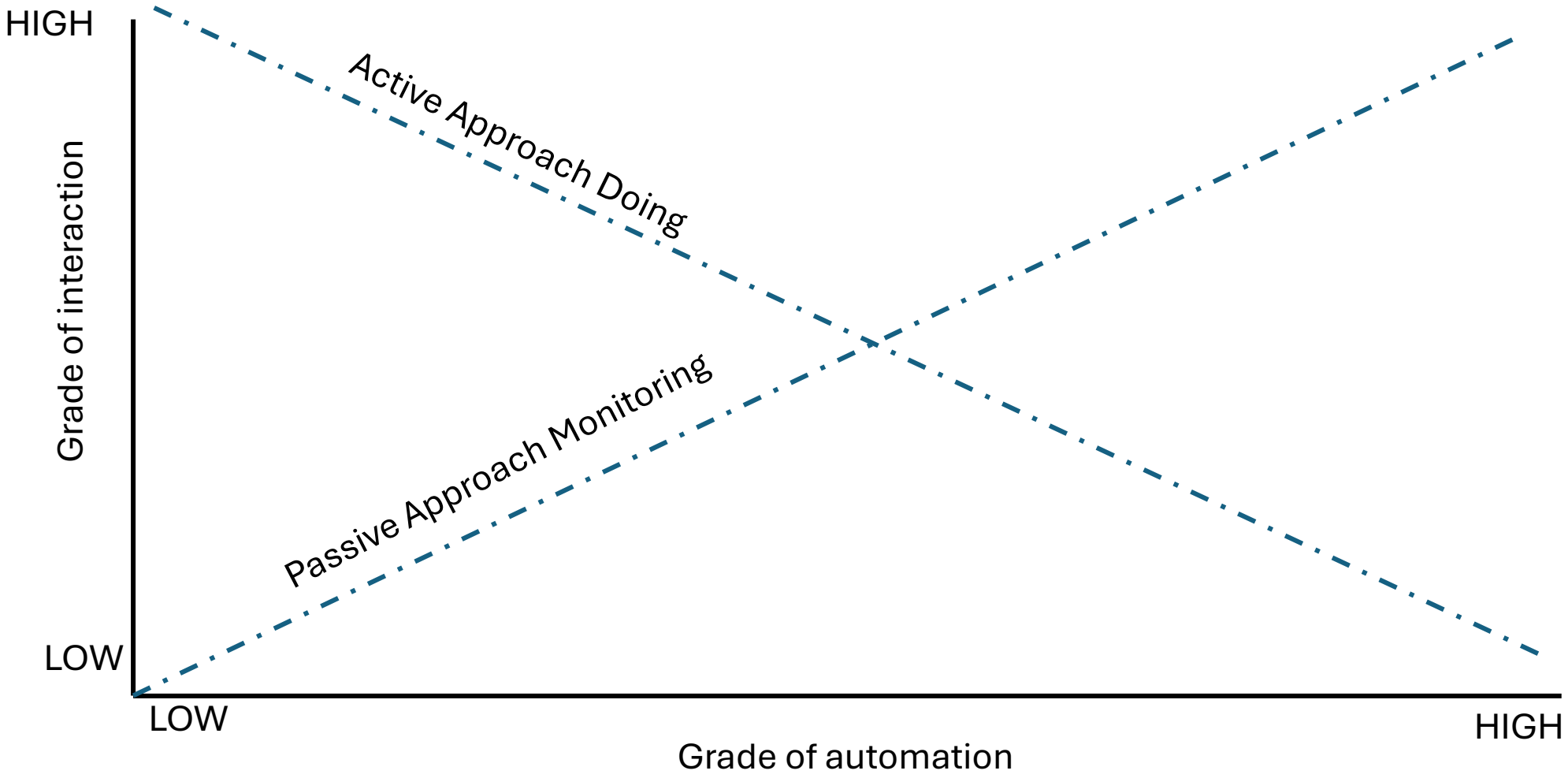
What if the control system stops?



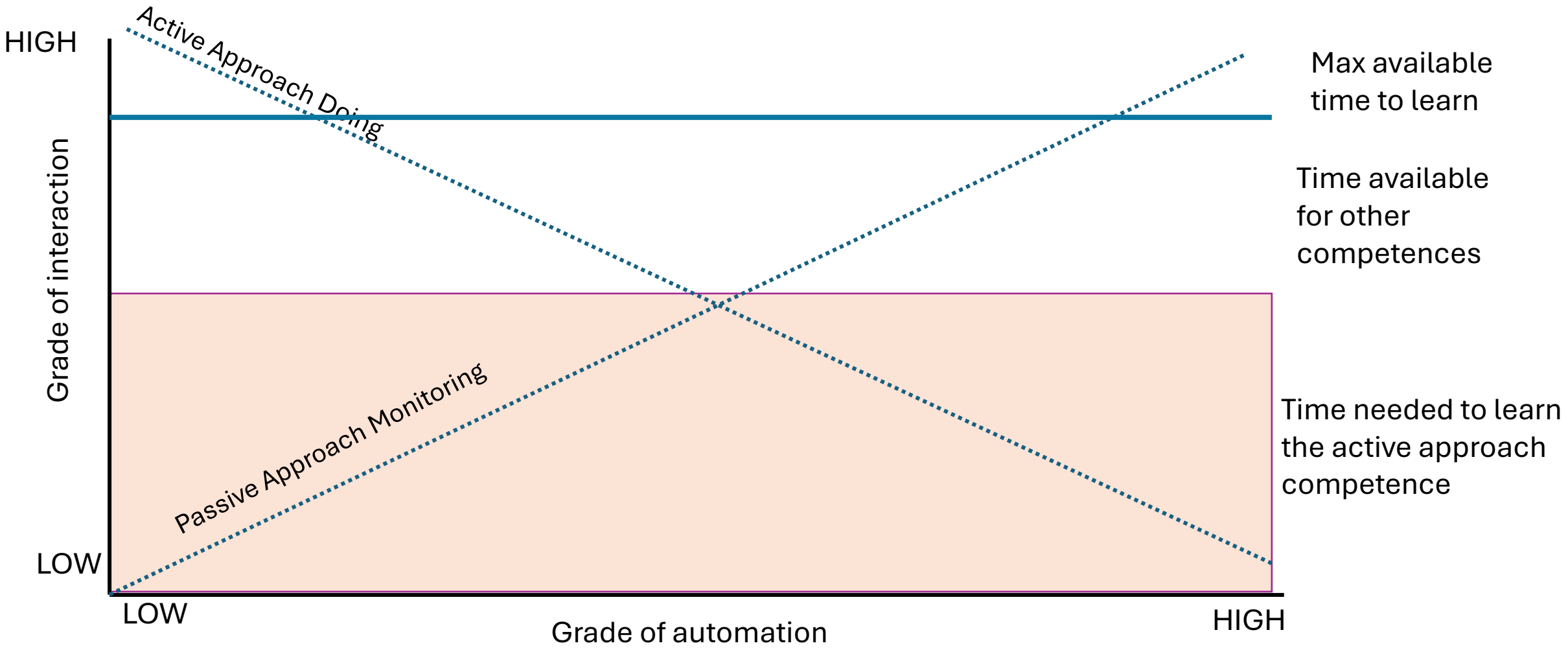
An automated system can handle more complex scenarios than humans, how can we take back control?

Sheridans levels of autonomy	Expanded OODA loop							Criteria the Human must know and understand			
	Observe	Orient/ Sort	*Reccomend*	Decide	Act	*Veto*	*Cancel*	Tagged during observation	Selection	Decision	Mandatory to Inform
1. The computer offers no assistance; human must do it all.	Human	Human	Human	Human	Human	Human	Human				
2. The computer offers a complete set of action alternatives	PC	Human	Human	Human	Human	Human	Human	x			
3. nr 2 + narrows the selection down to a few,	AI	AI	Human	Human	Human	Human	Human	x	x		
4. nr 2 + suggests one	AI	AI	AI	Human	Human	Human	Human	x	x	x	
5.nr 4 + executes that suggestion if the human approves	AI	AI	AI	Human	AI	Human	Human	x	x	x	
6. nr 5+ allows the human a restricted time to veto before automatic execution	AI	AI	AI	AI	AI	Human	Human	x	x	x	
7 nr 5 + executes automatically, then necessarily informs the human	AI	AI	AI	AI	AI	Human	Human	x	x	x	
8 nr 5 +informs him after execution only if he asks	AI	AI	AI	AI	AI	Human	Human, if active	x	x	x	
9. informs him after execution if it, the computer, decides to	AI	AI	AI	AI	AI	Human	Human if observant	x	x	x	x
10. The computer decides everything and acts autonomously, ignoring the human.	AI	AI	AI	AI	AI	None	AI				

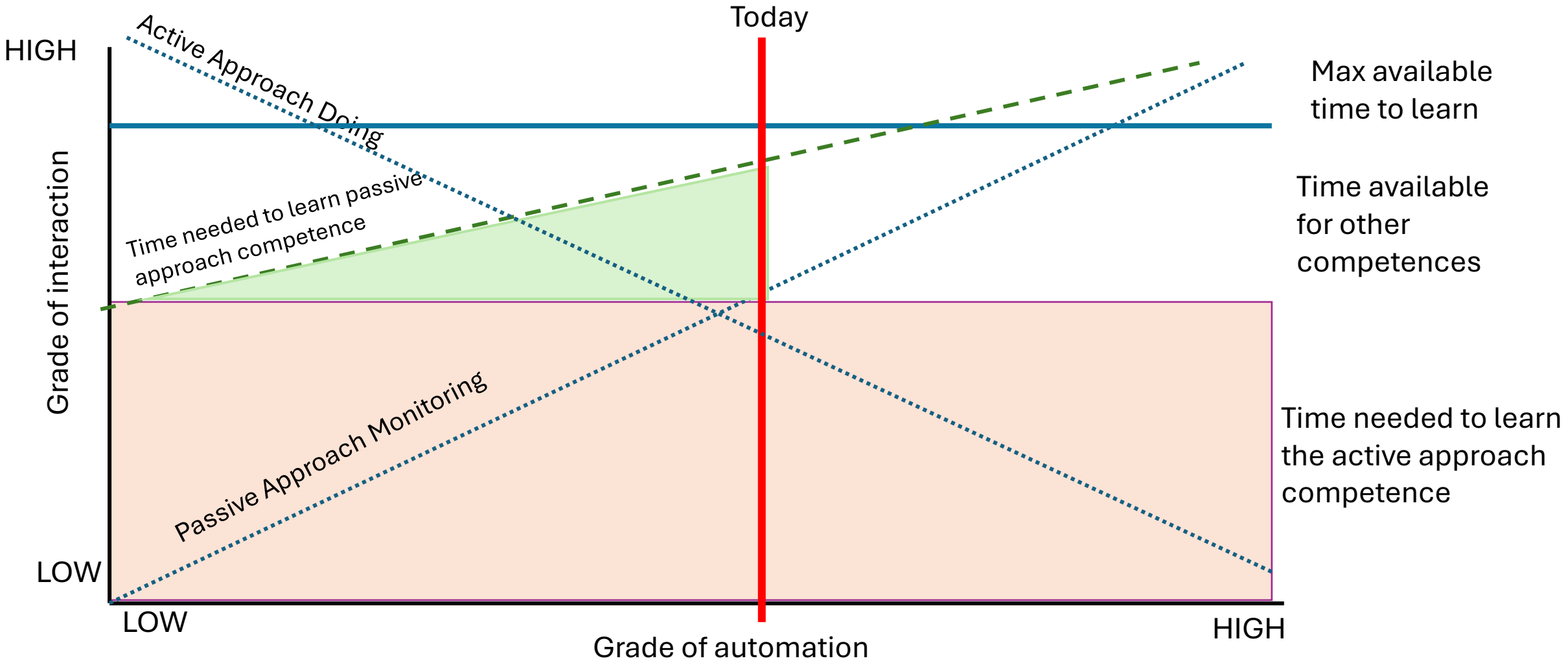
How is Industry 4.0 changing the work methods



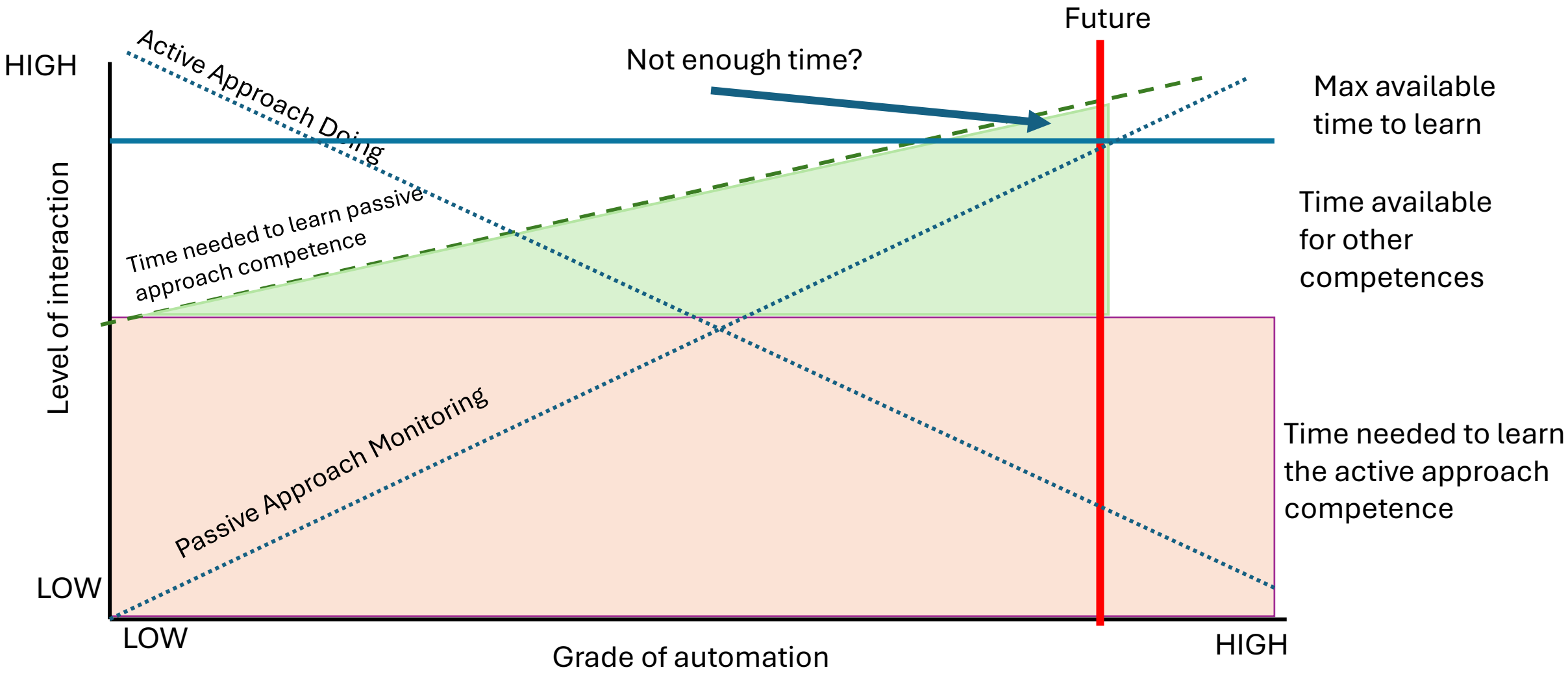
How will this development affect learning?



How will this development affect learning?



How will this development affect learning?



Based on Rieth M and Hagemann V "Veränderte Kompetenzanforderung and Mitarbeitende infolge zunehmender Automatisierung – Eine Arbietsfeldbetrachtung" 2021

The future Industry 5.0

Enhanced Safety Protocols

AI-driven systems provide real-time risk assessment and support safer navigation and decision-making onboard vessels.

Predictive Maintenance

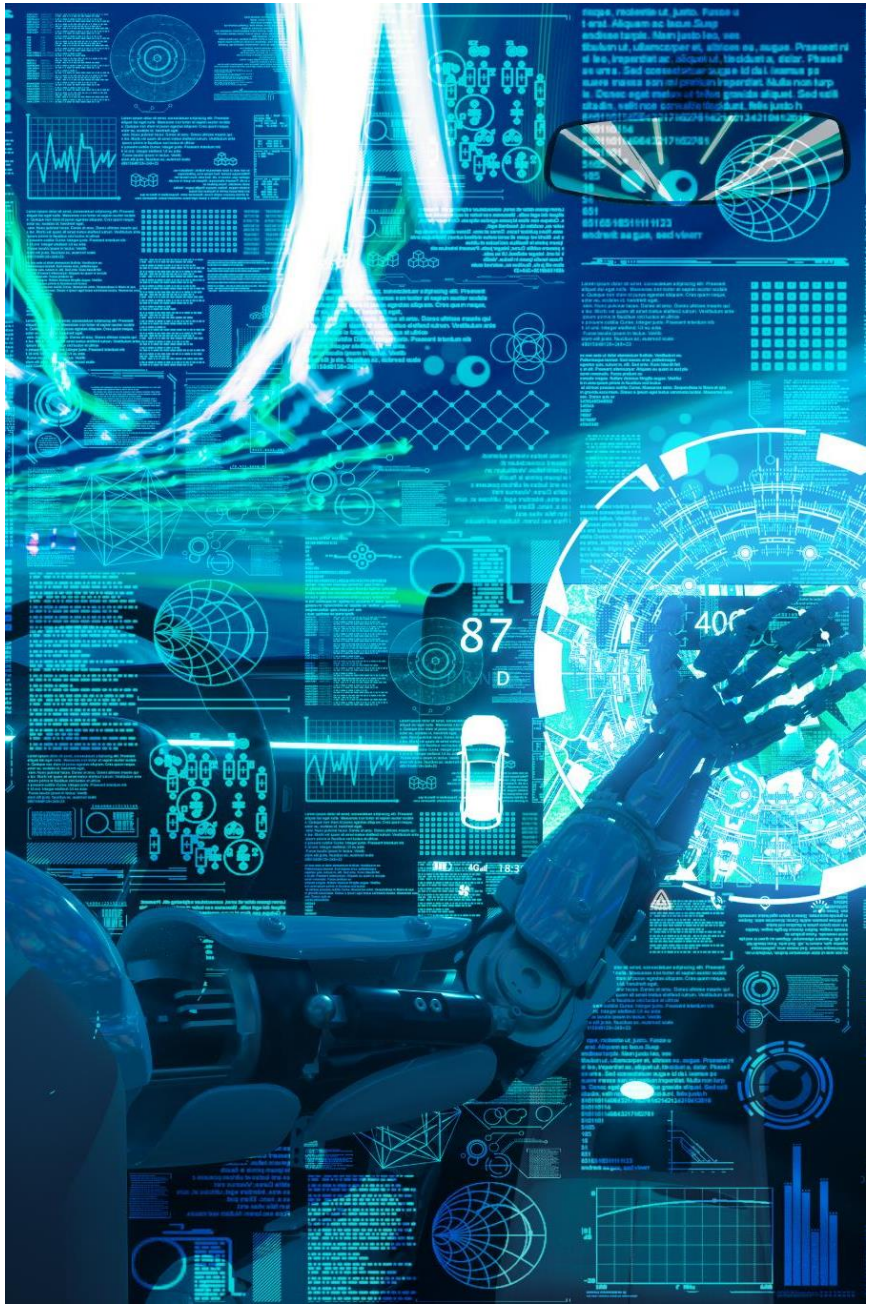
IoT sensors and big data analytics enable early detection of issues, reducing downtime and extending vessel component lifespan.

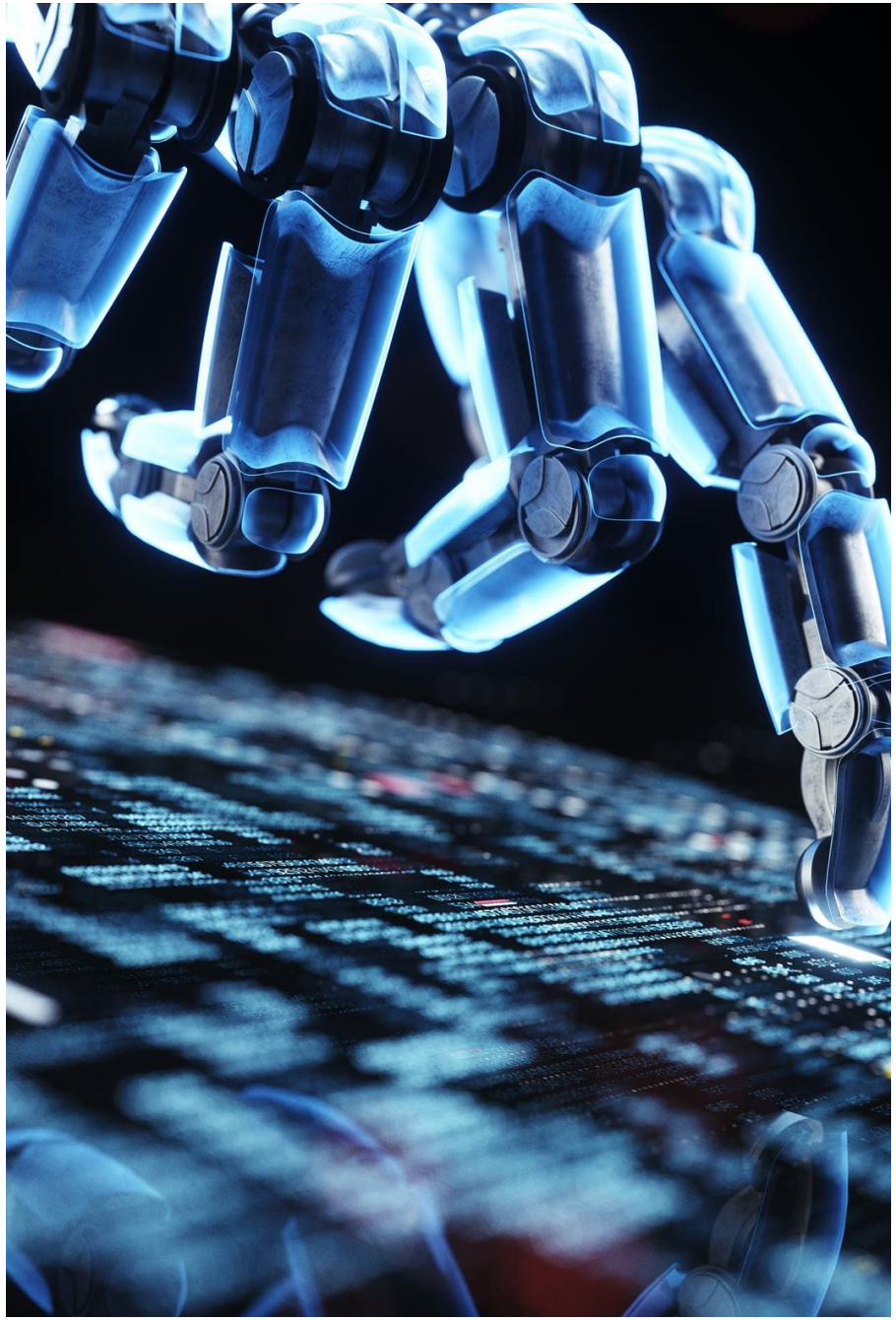
Evolving Crew Roles

Seafarers transition into digital system collaborators requiring reskilling and proficiency in advanced maritime technologies.

Integrated Ship-Shore Collaboration

Industry 5.0 promotes transparent, efficient data sharing and decision making between ship and shore operations.





Summary and Reflection

Evolution of Interaction

Human-machine interaction evolved from manual labor to intelligent and empathetic collaboration over time.

Industry 5.0 Focus

Industry 5.0 emphasizes human creativity, sustainability, and ethical integration in technology use.

Future Challenges and Opportunities

Understanding technology's evolution prepares us for future societal, educational, and work challenges and opportunities.

Technology as Partner

Technology is becoming a partner in human development, not just a tool for efficiency.



Thank you

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