ERGO SHIP 23

Maritime Research—Maritime Human Factors

2-3 November 2023
Esbjerg - Denmark

SDU

Centre of Maritime Health and Society

Welcome & Introduction

The Centre of Maritime Health and Society is the host of this years' ErgoShip conference that provides a national and international arena for the dissemination and exchange of applied scientific knowledge in the field of human factors within a maritime context. The target audience is shipowners, operators, seafarers, researchers, maritime regulators, classification societies and other maritime stakeholders with a particular interest in maritime human factors.

The history of the ErgoShip conferences dates back to 2011 when the first ErgoShip was held on 14-16 September 2011 in Chalmers University of Technology, Göteborg, Sweden.

The second ErgoShip conference was held in Melbourne, Australia on 6-7 April 2016. It was jointly hosted by the Australian Maritime Safety Authority (AMSA) and the Australian Maritime College (Institute of the University of Tasmania).

ErgoShip 2019 was the third in the series and was held on September 24-25 in Haugesund, Norway. It was hosted by Western Norway University of Applied Sciences.

ErgoShip 2021 was organized by the Korea Institute of Maritime and Fisheries Technology in Busan, Republic of Korea.

ErgoShip 2023:

Centre for Maritime Health and Society, University of Southern Denmark, Degnevej 14, Esbjerg - DK-6705.

Useful Information – SDU

Conference Rooms

Day 1 08:00- 17:00	Day 1 08:00-17:00	Day 2 0800 - close
E-81113	E-81112	E-81103

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No fire drills are planned for the days of the ErgoShip conference. If you hear a fire alarm, please do not stop to collect your belongings, leave the building in a calm orderly manner, and assemble at the muster-points.
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Please ensure you keep an eye on all personal belongings and do not leave your valuables unattended.

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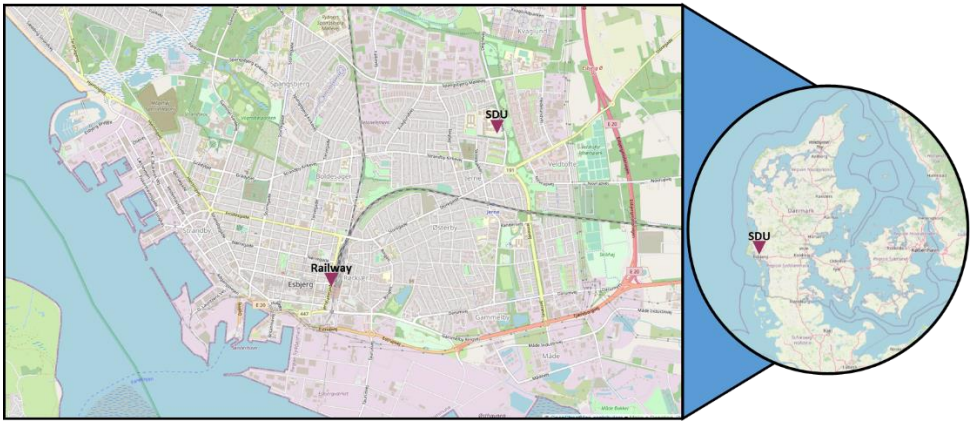

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Programme

Conference day 1 - November 2

09:15	Registration - Coffee, croissant, networking
10:15	Opening by Chair L.L. Froholdt
10:30	**Keynote:** The human factor, Rasmus Dahlberg, PhD, writer, and historian specializing in disasters and preparedness
11:15	Oral presentations - Category: Tech-driven support and innovation
14:00	Lunch
14:45	Oral presentations - Category: Risk reduction and human error prevention
16:45	Coffee and networking
18:00	Dinner

Conference day 2 - November 3

09:00	**Keynote:** From “learning from failure” to “learning from positive practice”, Thomas Koester, Psychologist, FORCE Technology
09:45	Oral presentations (2 sessions in parallel) - Category: Human-centred design - Category: Wellbeing, physical, and psychosocial health - Category: Laws and regulations: compliance and consequences of changes
11:30	Workshops in parallel
13:00	Closure
13:15	Light lunch

Workshops 3 November, 11:00 – 12:30

Workshop 1: Learning from accidents and incidents: Are current methods and practices efficient?

Organised by SimTrans. Presenters and moderators: Thomas Koester, FORCE Technology, and Henning B. Andersen, Technical University of Denmark

The workshop will discuss methods and practices for reporting, analysing and disseminating lessons learned from accidents and incidents. The emphasis will be on weighing expected safety outcomes in relation to the considerable efforts in person-hours spent on documentation and analysis; and while the focus will be on the maritime and offshore sector, experiences and results from other industries (aviation, healthcare) will be briefly included. The workshop format will be interactive, and participants will be asked to discuss specific issues in small teams and subsequently share perceptions and insights. The ambition of the workshop organizers is to provide participants with an updated and critical overview of methods and practices for learning from failures and to inspire reflections on optimal ways of allocating scarce resources to safety enhancing activities.

Workshop 2: Energy efficiency and human factors

Organised by Hanna B. Rasmussen, CMSS, SDU

Energy efficiency plays an important role in the maritime industry and there are several research studies exploring how human factors have an influence on energy efficiency. However, even though human factors play an important role in energy efficiency there are also other factors such as the technical potential of vessels or stakeholders influencing ship's operation. The aim of this workshop is to explore some of the recent research about energy efficiency and human factors. The question is how much human factors influence energy efficiency? The workshop shall provide short presentations of chosen research and a mapping exercise exploring the different aspects of ship operations where human factors may have a direct impact on energy efficiency. If time allows, we can examine which parts have been explored in current state of the art research, and what gaps are left maybe creating some ideas for further projects.

Presentations

Tech-driven support and innovation (session1, day 1)

1	Seafarers, shorefarers, and cyberfarers: what we need to successfully coordinate with each other in a new era of ship navigation	J. Trygg Mansson M. Holtensdotter Lützhöft
2	Maritime safety and work environment in the fog of digitalization	M. Lundh S.N. MacKinnon C. Palmén J. Hüffmeier
3	What lies behind? Thoughts of underlying assumptions affecting design in automatization and technology development	N. Thit
4	Democratic intervention in blue Denmark's green tech development	R.G. Kristensen T. Børsen
5	Tech-driven organizational learning in shipping - a real world, full scale, "experiment"	M.R. Nielsen

Risk reduction & human error prevention (session 2, day 1)

1	You don't know what you don't know: identifying human factors training needs for marine accident investigators	W. Tutton A. Moll
2	Identification of cognitive error types and human-machine interface problems in ship navigation	J.R. Taylor I. Kozin
3	Another ECDIS induced accident: after all these years, why can't we get it right?	T. Porathe E.S. Petersen M. Lützhöft
4	Human reliability analysis for maintenance main ships engines with existing and alternative fueling	J.R.Taylor

Human-centred design (session 1, day 2)

1	Investigating challenges in decision support systems for energy-efficient route-planning: a transdisciplinary design research approach	B. Schwarz M. Zoubir J. Heidinger M. Gruner H-C Jetter T. Franke
2	Organisational challenges and opportunities for human-centred design integration in the maritime domain	D. Oakley
3	A user-centred exploration of virtual reality for collaborative maritime design	E. Gernez K. Nordby S. Archer Dreyer T. Burås S. Mallam
4	HUMANE: maritime autonomy	M. Lutzhoft J. Earthy
5	A regulatory case study: applying human centred design for developing safety management system standards in maritime operations	M. Grech

Presentations

Wellbeing, physical, and psychosocial health

1	Right course: self-perceived psychosocial consequences of regulation changes in the fishing industry - an action research approach	S. Grøn N. Granild L.L. Froholdt
2	Seasickness among offshore windfarm workers	A. Fenn
3	Bridging social divides? Characteristics and antecedents of seafarers' personal support networks during the COVID-19 pandemic	B. Pauksztat M.R. Grech

Laws and regulations: compliance and consequences of changes

1	Assessing Norwegian maritime cadets: compliance with laws and regulations for competence evaluation	D. Sjøen M. Lutzhoft
2	A study on the analysis of navigators' understanding of COLREGS navigation rule interpretation and ship encounter situations	A. Deuk-Jin Park B. Hong-Tae Kim C. Jeong-Bin Yim Hwa-Sub Roh

Abstracts

Category: Tech-driven support and innovation | 1

Seafarers, shorefarers, and cyberfarers: what we need to successfully coordinate with each other in a new era of ship navigation

J. Trygg Mansson
Paris, France
M. Holtensdotter Lützhöft
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Maritime professionals located ashore are becoming increasingly involved in the most critical tasks of ship navigation. Furthermore, so-called Robotic, Intelligent, Autonomous (RIA) technology is anticipated to take on an increasingly important role in ship navigation in the not-too-distant future. Despite these progressive changes, seafarers working onboard are nowhere near extinction. Hence, a new era of ship navigation is looming where a range of different actors, located both onboard and ashore, human, and non-human, must work together - in coordination with each other - to successfully provide the transportation that the world is relying upon.

In this paper, the concept of Common Ground is used to explore what it takes to successfully coordinate in a new era of ship navigation. What information must be shared amongst those involved, what tools and techniques can be used, and what are some of the most pressing challenges that lie ahead, are all topics which are discussed here. It is concluded in the paper that a new era of ship navigation likely will require far greater explication, formalization, and continuous updating of the different actors' goals, and of how these are valued and prioritized against other competing goals (e.g., how the trade-offs between efficiency and safety of navigation are made when unexpected events arise). However, achieving such a greater degree of transparency amongst actors also has the potential to become one of the most pressing challenges in a new era of ship navigation.

Category: Tech-driven support and innovation | 2

Maritime safety and work environment in the fog of digitalization

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The 4th Industrial Revolution has foreseen the direct and indirect disruptions within the shipping industry. The greatest manifestation is how technology has disrupted how work and its application to make work safer and more efficient and reduce the workload on operators and other stakeholders. The International Maritime Administration (IMO) has provided guidance to support the implementation of digital solutions and highlights several emergent problems [1]. Among the issues are the risk of information overload, complex interfaces, and a risk of over reliance by the operator.

Apart from being regarded as a potential stressor in modern work life, digitalization also partly depends on a connectivity to internet, which exposes the system to risk of cyber-attacks and the emergence of ¨wicked problems" [2-3]. Recent research [4-6] have also identified gaps highlighting that the exploitation of these new technologies is fragmented and, facing a ¨square peg into a round hole¨ barrier. The same research also identified a discrepancy between Work as Imagined (WAI) and Work as Done (WAD) which emphasize the need to understand how the operators use the technology before it is introduced onboard [4,7].

The purpose of this research was to identify the scope, nature and consequences of incidents and problems associated with the application of digitalization. Participant stakeholder groups within the shipping industry were interviewed and identified many of the problems associated with the digitalisation on board. Among the results, evidence was given of several areas in need of improvement e.g. systems being too complex, not fit for purposes, providing too much information, the crew need to "work around" and adjust work and procedures together with not having sufficient support when needing it, interference of programmers to update software during operation; the issue of ¨lack of support¨ was a consistently recurring theme. The ¨support¨ problem has many dimensions such as the crew members don't understand (a) what went wrong (b) how it was fixed and (c) what can be learnt from the event. Furthermore, support to handle these issues were not always available 24/7 which in some cases disrupted the operation of the ship and/or prevented it from leaving port.

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Category: Tech-driven support and innovation | 3

What lies behind? Thoughts of underlying assumptions affecting design in automatization and technology development

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The shipping industry is defined by a strong allegiance to a bureaucratic ethos and structures and practices that emphasize rule-following and stress formalized processes [1,2]. Some even argue that conditions have become worse and that the shipping industry has seen increased bureaucratization and surveillance and is defined by a deep-seated culture of distrust- and that part of the problem is due to technology and the way it has been implemented and used [1-3]. New technologies enable automatization and enhanced surveillance and have generally shifted the responsibility and decision-making towards shore [1,4-6]. When designing such new technologies and automated processes, the designs, carry implicit assumptions and attitudes about the end users and the context in which the technology is to be used [7]. Consequently, it becomes clear which values and norms shape the workspace and the technology implemented (or installed), often carrying a dissonance between actual- and imagined use [7-10]. Through this PhD-project we wish to understand the underlying assumptions in shipping affecting decisions within innovation, technology development and implementation.

References

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Category: Tech-driven support and innovation | 4

Democratic intervention in Blue Denmark's green tech development

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DFDS
T. Børsen
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Blue Denmark releases huge quantities of human-generated gasses into the atmosphere. To achieve the criteria set for resolving the climate crisis, Blue Denmark must reduce greenhouse gasses. In this paper, we describe how the shipping industry is planning to do that and how a key element is lacking focus. To comprehend the technological development in Blue Denmark relevant actors were followed, mapped, and placed in a chain of development (Fig 1).

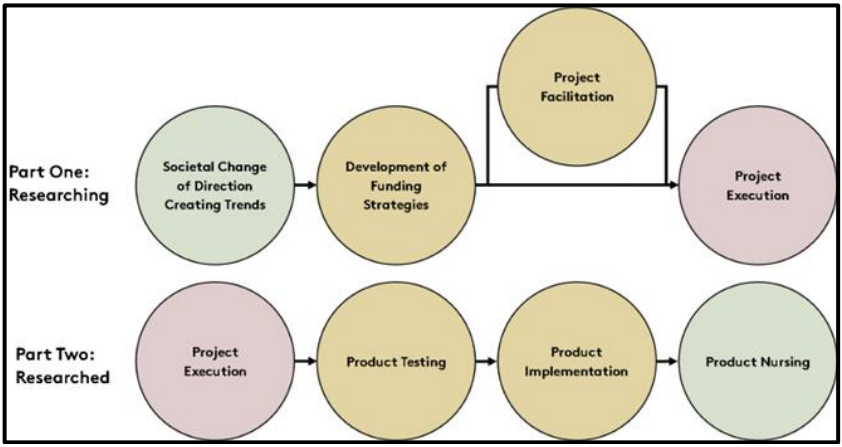

Fig 1: Blue Denmark's system of technological development

Processes of the system were observed as pursues. Trends in society are formed through various topics of possible technological solutions. As green tech starts trending, funds mainly going towards developing green technology. Funds are first distributed to those who claim to have a technical solution. Once funds are secured project execution can commence (arguably where actual user involvement should occur). The system ends in a potential implementation with a following nursing phase (where user involvement is mostly found to commence). The system can thus be divided into two parts – pre- and post-execution. This alleged system indicates that attention to user involvement appears late, if at all, after initial implementation attempts. As the complexity of the real world unfolds it becomes clear that user practices are not confined to

the restricted set of scenarios that engineers may imagine. User-technology interaction is dealt with reactively instead of proactively. We characterize this endeavour as a technical fix, as attempts to represent seafarers' working practices surrounding green technology do not hold primacy. Technology does. We argue that the reduction of greenhouse gasses cannot be reduced efficiently through technology alone and suggest Blue Denmark undertake a more balanced focus on both technological artifacts and the practices in which they will be situated. This balanced approach requires participatory observations or even active participation of the seafarer who, after all, are the ones who will operate the new technologies. We argue that seafarer participation in technology development requires interactional expertise and boundary spanners to ensure that the technology can actually support practitioners in their daily tasks. We will draft what a revised system of technological development in Blue Denmark can look like. The draft will be based on Critical Theory of Technology, arguing that the system, in its current version, provides an undemocratic setting for technological development.

Category: Tech-driven support and innovation | 5

Tech-driven organizational learning in shipping - a real world, full scale "experiment"

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Contextual background

Accident prevention has always been on both the political and research agenda, and over the years various theories and interventions to improve safety have been developed and tested. It is typically non-compliance with procedures and rules that is highlighted as the cause of accidents. In contrast to this, recent studies point out that the explanations for why accidents occur are often more complex. One branch of research and theorizing within safety and human factors that recognizes complexity as a factor, known as the Join Cognitive Systems school of safety, focuses on interactions between various agents in a work setting.

"Organizational Resilience", often presented as the ability to `stretch the system´ without collapsing [1], requires continuous anticipation, learning and follow-up actions. Rasmussen [2] argues that actions must be contained within certain operational boundaries and if any of the boundaries are exceeded, the system collapses. However, internal and external pressure will naturally push the operating point, towards the boundary of safe operations. One pillar of Resilience Engineering is the monitoring of this operating point, to allow pushback.

The project

Scoutbase was founded to address this need for predictive data and information feedback, relating to causative factors in accidents concerning the working environment on board ships as well as the crew members wellbeing within such environments. The aim was to provide various stakeholders with valuable information that could then be used in attempts to mitigate risk and prevent incidents and accidents from happening, and build a safer, more productive working environment with less `friction´.

Since launching of the project, Scoutbase has developed into an automated tech solution providing real-time, anonymous, and continuous data to shipping companies, and thereby enabling a proactive, rather than reactive, approach to risk identification and minimization. Additionally, interventions and recommendations based on the analysis of the data collected have expanded the solution into something that offers a clear identification of problem indicators as well as data-driven solutions to these, at an organizational and an individual level.

Project results

At the time of writing this abstract the project is ongoing. Further, real-world sample size is low. Therefore, any final conclusions as to the successes of the experiment, or opposites, are refrained from. However, part result examples can be presented here: For one shipping organization utilizing the Scoutbase platform on average 25 ships, numbers from a random quarter of a year's use comprises 64,261 total data points gathered on performance shaping indicators status, 80% average response rate across the fleet, and several trends spotted in the data. The perceived resulting experience working with Scoutbase is summarized in the following quote:

"The advantage that we have here is that we can get the sense of what's happening on board, how people are feeling, any stresses, any pressures that people are under, and we can then sense, well, let's have a conversation about that with the vessel and see if we can do something different there. It gives us a leading indicator to how people feel". Group Fleet Manager

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Category: Risk reduction & human error prevention | 1

You don't know what you don't know: Identifying human factors training needs for marine accident investigators

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There is wide acceptance that human actions account for 80-85% of marine accidents [1] with marine accident investigators required to receive formal training in all but the most specialized aspects of human factors (HF) investigation [2] and marine investigation reports to include human-related causal factors [3]. Accident investigators struggle to collect human factors evidence [3,4], and an internal survey at MAIB identified investigators felt they needed more training in this area. To date there has been no published review of training needs for marine accident investigators although training needs for air accident investigators have been [5]. MAIB have conducted a review of the HF training needs derived from international marine legislative requirements and guidance, as well as HF literature and best practice, involving investigators throughout. The project aimed to determine the HF training requirement for non-HF Inspectors to conduct basic HF Investigation without the need to involve HF specialists [2]. The scope of the project was to identify the skills and knowledge needed, measures of competence and the needs for ab-initio, refresher, and Continuing Professional Development (CPD) training. The approach used was a generic systems approach to training [7] using Anderson's skills framework [8] mapped to UK HF practice competence frameworks [9] to determine appropriate learning outcomes for marine accident investigators. This paper reports the findings from the project, highlighting the need to ensure HF skills and knowledge usable on deployment and focused on the operational issues encountered in marine accident investigation rather than all HF topics. This paper demonstrates that it is possible to address the practice gap between human factors and accident investigation using recognized human factors techniques and practice standards. The next phase of the project will determine training options, conduct a pilot study, and roll out the training with ongoing assurance.

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Category: Risk reduction & human error prevention 2

Identification of cognitive error types and human-machine interface problems in ship navigation

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Human machine interfaces (HMIs) for machinery monitoring and control in ships have improved in technology but have at the same time become more complex. It is well-known that HMI deficiencies have contributed to accidents in shipping [1,2], and methods have been developed to help improve the design of HMIs. Several design review approaches have been developed [3] that focus largely on the ergonomics and the functional design of alarm systems. To further improve HMIs, hazard analysis methods exist and provide a way of identifying hazards in human performance of operating and emergency procedures. These methods involve a step-by-step analysis of the individual actions to be taken in performing a procedure, and the error modes which can occur.

These two approaches, design review and potential error analysis, provide significant improvement in HMI design, but there is a group of problem types which are not susceptible to identification by these methods. These are the problems of operator cognition.

The issue of operator cognition is rooted in problems in using an HMI. A part of these problems can still be eliminated by comprehensive hazard analysis and assessing the ability of the HMI to properly display the hazard scenarios. However, causes of other problems in human-machine interaction can only be uncovered by observing the performance of operators in real environments or on simulators as well as by extracting the needed information from accident reports.

The paper will describe approaches to cognitive modelling of the navigation processes and to cognitive error identification. It will also describe the use of simulation to identify HMI weaknesses and cognitive error types, as well it will propose methods to reduce navigation risk. The paper will explain the new concept of hybrid simulator for the assessment of HMIs. These simulators are suggested for conducting human-machine interaction studies and they are conceptually different from training simulators.

Examples of cognitive modelling and cognitive error identification will be provided.

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Category: Risk reduction & human error prevention 3

Another ECDIS induced accident: After all these years, why can't we get it right?

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How could a fully equipped modern ship, in good visibility and a properly manned bridge, plan a track away from the IMO recommended route and run aground on a charted rock? An easy take-away from the Kaami accident could be that, once again, the human operators failed to operate adequate, type approved equipment in a proper way. In other words, another occurrence of "Human Error", to add to a long list of similar accidents and incidents. In this paper we will retell the story of the small coaster Kaami that was lost in 2020 and compare it to several similar accidents from the last decade where the functions of the Electronic Chart Display and Information System (ECDIS) has been at focus, but instead of immediately arriving at "Human Error", we suggest to ask ourselves: does the design of the equipment have something to do with the failure of the human operator to do it 'right'? It is worthwhile to note that humans have limited capacity and are prone to make mistakes, take shortcuts, to be distracted, stressed, fatigued and forgetful. These traits are precisely those that makes us human, and which the equipment in the first place were designed to help us with – but the design needs to take these strengths and weaknesses duly into account, being mindful of the human shortcomings while enabling users to excel in the areas where human performance far surpasses that of equipment. In this paper we will discuss the gap between human capabilities and the support provided by standard navigational equipment.

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Category: Risk reduction & human error prevention 4

Human reliability analysis for maintenance main ships engines with existing and alternative fuelling

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CMSS University of Southern Denmark, Esbjerg, Denmark

With increasing sophistication and automation of ships systems and for the prospect of alternative fuels such as ammonia and small modular nuclear reactors, there is a need for increased attention to the procedures for engine maintenance. Human reliability analysis methods can be used to identify weaknesses in design and procedures, to support achievement of reliability and to ensure that written procedures and training cover problems and problem avoidance. There are many publications describing approaches to marine maintenance error analysis. However, hardly any of these provides methods which are sufficiently detailed to be able to support design, training, and maintenance work.

This paper is tended to describe methods which are fit for purpose, and which are compatible with existing research. In order to validate the methods, case studies have been undertaken for existing ships systems for which problem and incident data exist, with comparison between human error analyses and actual incidents aboard.

Category: Human-centred design

1

Investigating challenges in decision support systems for energy-efficient route-planning: a transdisciplinary design research approach

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To increase energy-efficiency and reduce CO2e emissions in shipping, Decision-Support Systems (DSS) can be leveraged. Specifically, in regard to reducing the greatest contributor to consumption, propulsion [1], by assisting seafarers in route planning, and timely and efficient re-planning, as well as general monitoring of ship's energy dynamics. However, the successful integration and acceptance of these systems into the seafarer's workflow pose significant challenges, such as goal conflicts, e.g., with safety or with the financial interests of different stakeholders, which require a deep understanding of interactions onboard and onshore.

This paper reflects on our implementation of a transdisciplinary design research approach for developing novel, human-centered AI-based tools for energy-efficient ship operations. Of our concurrent studies, we describe selected forms of inquiry that together resulted in a holistic understanding of the application domain, target audience, and typical tasks as well as an interactive prototype of a decision support system for energy-efficient ship navigation.

Research activities included a systematic review and thematic analysis [2] of literature on human factors concerning energy-efficient ship operations (N = 17), research through design in the sense of Jonas [3] in the field of DSS for CO2e emission mitigation in navigation and ship operation, and the formative evaluation of a DSS prototype in a ship simulator environment (N = 22). By viewing these research activities through the lens of design research, more specifically the theoretical foundation of MAPS [4], we systematically describe and discuss their individual contributions. MAPS specifically operationalized design research as "Matching Analysis, Projection and Synthesis", enabling integrative, systematic research processes across boundaries of disciplinary bodies of knowledge, domains, and actors.

As a primary contribution, we reflect on our lessons learned to identify generalizable challenges for similar future projects of the ErgoShip community. These include (1) context-sensitive integration of navigational and operational data; (2) calibration of users' expectations of the system's capabilities; and related to this (3) increasing transparency of how the DSS retrieves and processes data, and of how confident it is in its suggestions. By considering key human factors, such as workload, autonomy, and biases (e.g., automation bias) on the basis of our system, we demonstrate how these challenges can be addressed.

As a secondary contribution, we also share our resulting designs as examples of how AI-based decision support for optimizing energy efficiency can be visually and functionally integrated into onboard ship operation and navigation.

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Category: Human-centred design | 2

Organisational challenges and opportunities for human-centred design integration in the maritime domain

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There is a well-documented link between human error and design in the maritime domain [1-4], but there is a growing body of evidence to suggest that adopting a human-centred approach in the design of ships is as a viable solution for mitigating design-induced error and improving safety outcomes at sea.

The presentation investigates the current role of human-centred design (HCD) in the ship design process. HCD is a mature process and is validated by over 30 years of application in industrial and software design across a number of safety-critical domains [5]. However, it remains underutilised in the maritime sector, with isolated examples of successful HCD adoption unable to exert sufficient impact or influence on common ship design practices [6]. It asserts that successful HCD integration requires significant process capability and organisational change [7] and finds that adopting a systems perspective of HCD merits further investigation. This perspective represents a shift in focus from the consideration of the capabilities, limitations, and needs of the end-user in the design of the ship, to a broader consideration of the diverse capabilities, limitations, needs, and aspirations of all the stakeholders that influence and are influenced by the design, development, operations, and management of a ship across its lifecycle.

The presentation illustrates an empirical case study, conducted in partnership with a large shipping organisation, which acts as the ship owner, operator, and/or charterer in different capacities across its operational fleet. HCD is explored within the context of the case company, with design and organisational processes considered as interdependent parts of a complex system. It summarises the results of the author's doctoral research conducted to date, which represents a body of evidence that supports a deeper understanding of 1) how human-centred design is perceived within shipping organisations, including knowledge, attitudes, and behaviours; and 2) the extent to which a human-centred design is currently applied within across design, operation, and management activities; and reveals key opportunities and challenges for the integration of human-centred design at the organisational level. The presentation concludes with an outlook on how these challenges could be addressed within the organisation and across the wider maritime industry.

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Category: Human-centred design

3

A user-centred exploration of virtual reality for collaborative maritime design

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Virtual reality (VR) has gained traction in supporting maritime user-centered design with the development of low-cost and standalone head-mounted displays. As its use grows there is a need to develop best practice processes and methods for VR-mediated, user-centered maritime design. In this paper we report on work where we implemented an iterative user-centered design process to establish and evaluate a multi-user online VR tool supporting ship design activities. We address two questions: What are the needs of ship designers when using VR in their design activities? What requirements do those needs apply for VR experiences to support collaborative maritime design activities? We explored these questions by developing a VR demonstrator supporting user-centered design processes. The demonstrator was introduced to six expert users. The experts were monitored during their tests, and we interviewed them about its possible application in their work. The users commented on design activities that may benefit from the use of VR, human representations and avatars in VR, lighting, visual resolution, and texturing. They also indicated current challenges for adopting VR in their workflow. We summarise the user needs and requirements and propose a framework for what components of a VR experience should be considered for beneficial impact to the design process.

Category: Human-centred design | 4

HUMANE: maritime autonomy

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In 2018 Rolls Royce released an informative video that demonstrated the operation of a ship remote control centre. This caught the imagination of the maritime sector and many conferences, presentations, projects and demonstrations of "autonomous shipping" ensued. All of this interested had a focus on technical capability and the benefits associated with removing humans from ships. The Norwegian Research Council (NFR) established the HUMANE project to balance this technical push and investigate a human-centred development of autonomous technology.

Five years later the implications, impact and governance of autonomous shipping are still being discussed by the maritime sector. And the HUMANE project has been tracking the evolution of thought regarding the relationship between this technology and seafarers. Our presentation will revisit the Rolls-Royce video with the benefit of hindsight, asking what did it really show, what were the underlying assumptions at that time? And what is now being assumed about autonomous and remote operation? We will draw on the developing beliefs that adoption will proceed at very different rates depending on ship type, that people will still be needed (somewhere), that human-autonomy teaming may be a better approach than replacement. We will present the HUMANE project findings about what the job to be done will be in the future if people are still needed. How do we make the job sufficiently attractive to recruit the seafarers that it will require? How do we specify its safe behaviour? How will the technology request and allow assistance and what in what scenarios of use will it be required to demonstrate safe behaviour?

Category: Human-centred design | 5

A regulatory case study: applying human centred design for developing safety management system standards in maritime operations

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This presentation will provide an overview of a human centered design approach used to re-design regulatory standards with the success of this applied research hopefully guiding future development of regulatory outcomes.

An initial analysis through one-on-one interviews of small domestic commercial vessels in Australia carried out during COVID, identified that many of these operations struggle to implement safety management systems effectively. These operations tended to outsource their safety management system or cut-and-paste their details onto other safety management systems, thereby resulting in a static and ineffective document that "ticks a regulatory box" instead of a dynamic and effective way of managing safety in the context of these operations.

As a response to this issue, we applied a human centred design approach to re-design safety management systems standard requirements. The focus was on understanding the perspective of the owners/operators and whether the safety management solutions designed will truly meet their needs effectively. Our aim was to achieve three key success indicators of simplicity, safety and usability of the simplified safety management requirements for smaller operations.

Surveys and focus groups with relevant parts of industry formed part of the data collection process. The survey which included 890 responses from industry validated our concern. Although the majority (94%) indicated they have a safety management system in place 48.5% indicated that they only do so for compliance purposes with 26% indicating that they found current requirements too complicated. Findings from the surveys allowed the development of an initial prototype to further test with users through a pilot. Focus groups are currently underway which will refine the designed prototype, and these will be tested with a small group of select operators to finalise the design. The intent is to make it into regulations early next year, demonstrating the success of applying human centred design to regulatory outcomes.

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Category: Wellbeing, physical, and psychosocial health

1

Right course: self-perceived psychosocial consequences of regulation changes in the fishing industry – an action research approach

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The fishing industry in Denmark has been subject to a lot of regulation changes in the last ten years; for example, the reduction of fishing quotas, different kinds of bans, electronic monitoring of trawlers in the Kattegat and landing obligation.

This project focuses on fishermen's psychosocial work environment and investigates how it has been affected by the changes.

Research shows that frequent changes and little control leads to job uncertainty [1-3], which is associated with negative health effects [4,5]. But we do not have empirically supported knowledge about the content or the extend of the psychosocial impact among fishermen. This project will fill this knowledge gap and seek to improve the fishermen's sense of job uncertainty at the same time, using an action research design [6].

To learn about fishermen's experiences, we conducted 4 chronicle workshops [7] with a broad scope of fishermen, representing different kinds of fishing methods, boats, and communities. The workshops also provided us with personal stories and perspectives on their lives as fishermen and their working conditions. We conducted interviews as well with a diverse group of fishermen. These two data sources form the basis for 4-5 ethnographic stories [8] that illustrate fishermen's current work lives and psychosocial work environment issues.

The ethnographic stories and the themes from the chronicle workshops, will inform the work of a group of industry partners, policy makers and stakeholders. In three workshops we will facilitate the work from this group and co-create a set of recommendations to safeguard fishermen's psychosocial work environment moving forward.

A preliminary result from the chronicle workshops and the interviews is that there is a lack of dialogue between the authorities and the industry. Our aim is that these three workshops will create a dialogue, and that the developed recommendations will improve fishermen's psychosocial work environment.

In the presentation we will present preliminary results and experiences from the project.

We wish to present preliminary results and experiences from the project.

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Category: Wellbeing, physical, and psychosocial health

2

Seasickness among offshore windfarm workers.

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Windfarm workers must adapt to different motions as they swap between shore, vessel, and wind turbine. While adaptation to motion is thought to reduce the prevalence of vomiting, it is not necessarily the case for other motion sickness symptoms - of which there are many. Frequent changing motion stimuli may hinder the process of adaptation and negatively affect worker health.

The general effects of motion sickness are transitory and known, occurring in the presence of, or shortly after exposure to motion; however, it does not necessarily follow that the effects upon worker health are also limited.

Experiences of motion sickness are subjective, with susceptibility and tolerance differing greatly. Sufferers may have few outward symptoms yet may be suffering from motion sickness or associated effects. Those who experience motion sickness, with few visible symptoms cannot be considered as being suffering to a lesser extent than those who vomit, yet they may still be expected to go to work in a reduced functional state. This may have adverse physical and psychological effects.

While negative effects from motion sickness are assumed to occur among offshore windfarm workers, it is unclear as to what those effects are, particularly in the long-term, or their prevalence. The health impacts of motion sickness among offshore wind farm personnel have not been widely studied.

Understanding motion sickness among offshore wind farm workers is of relevance, not only for current wind farm operations, but also for the potential growth in floating offshore wind farms, where motions are potential amplified by the movement of the turbines themself.

This presentation provides interim findings from a scoping review of current research concerning the health effects of motion sickness among offshore wind farm workers.

Category: Wellbeing, physical, and psychosocial health

3

Bridging social divides? Characteristics and antecedents of seafarers' personal support networks during the COVID-19 pandemic

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During the COVID-19 pandemic, when the measures implemented to prevent the spread of the virus severely disrupted crew changes and restricted seafarers' access to shore, many seafarers found themselves with limited access to outside support. In this situation, support from fellow crew members on board was arguably even more important for physical and mental health, as well as for coping with everyday job demands and the additional challenges presented by the COVID-19 pandemic [1].

However, the antecedents of social support are still poorly understood. Previous studies on multinational and multilingual crews suggest that informal social relations may be largely formed within, rather than across, subgroups [2]. Such a tendency towards homophily, well-known from research on different types of relations across a range of contexts [3], might limit the availability of social support to seafarers, who tend to work in multinational settings with marked hierarchical structures. This raises questions about the social support available to seafarers, and the factors that facilitate or hinder the provision of support between crew members belonging to different subgroups. It also raises the question how these social divides might be bridged. Here we examine whether this might be achieved by organizational and individual characteristics that reduce perceived interpersonal risk and facilitate communication, notably psychological safety and proficiency in English, the maritime "lingua franca".

The purpose of this study is to (1) identify the types of support provided by fellow crew members during the COVID-19 pandemic, (2) analyze the composition of personal support networks, and (3) examine the role of psychological safety and English proficiency in the provision of support between crew members at different hierarchical levels and with different nationalities. Data came from responses provided by 437 seafarers on international commercial vessels to a cross-sectional survey in summer 2020.

Preliminary analyses suggested that fellow crew members provided instrumental, informational, emotional and companionship support. The type of support provided was

associated with the helper's hierarchical level: those at higher hierarchical levels were more likely to provide informational support, while those at the same or lower hierarchical levels provided companionship support. "Helpers" tended to be co-nationals and were at the same or a lower hierarchical level as the respondent. Further analyses suggested that the tendency towards homophily was reduced by psychological safety, which increased the likelihood of support from those at higher hierarchical levels. Proficiency in English increased the likelihood of support from crew members of a different nationality in higher (but not in the same or lower) hierarchical positions.

Taken together, the findings indicate that the social divides created by hierarchy and national diversity may limit the availability of social support. To reduce these barriers and increase the resilience of crew members in the face of crises and everyday job demands, increasing crew members' perceived psychological safety and (to some extent) English language skills is important.

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Category: Laws and regulations: compliance and consequences of change

1

Assessing Norwegian maritime cadets: compliance with laws and regulations for competence evaluation

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How do we know that ships are navigated by well educated, experienced people? The International Maritime Organization (IMO) and its Standards of Training, Certification, and Watchkeeping (STCW) Convention play a crucial role in establishing guidelines and requirements for Maritime Education and Training institutes (METs) and flag states. A certificate of competency (CoC) may grant the holder authority to serve as a responsible watchkeeping officer on board a vessel, irrespective of its size and operating area. In other words, individuals with a CoC may be authorized to serve as a deck officer or captain on the world's largest ships, navigating them across all international waters.

The STCW code outlines the essential knowledge that students must acquire to obtain a CoC, but it lacks clarity regarding the assessment methods. This raises concerns about the adequacy of competence evaluation for maritime officers. In Norway, the onboard time served as part of the qualifications needed for a (CoC), is assessed by a dedicated person. Assessment of competence is the topic for this article, more accurately, the assessment of maritime cadets in Norway. The purpose of this article is to try to answer two questions regarding Norwegian maritime cadets: 1. According to current laws, how should assessments be conducted? 2. are the assessments conducted accordingly?

A quantitative approach in the form of a survey was used to examine the frequency and extent of effective and inadequate assessments of maritime cadets in accordance with current regulations. The survey targeted maritime cadets who completed their training between January 2020 and August 2022 and applied for a maritime certificate from the Maritime Authority. The survey design and data collection process ensured the validity and reliability of the study findings, despite potential limitations related to respondent selection and potential biases.

The results of the survey indicate that 56 of a total 453 respondents have not worked together with their assigned assessor. Furthermore, 54 individuals report that they did not undergo any form of assessment.

This leads to the question: How many individuals are required to conclude that "no, assessments are not being conducted in accordance with current regulations"? Currently, we can confirm that there are 54 individuals in Norway, holding a competency certificate, who have not undergone a satisfactory competence evaluation. Consequently, it remains uncertain whether they possess the necessary knowledge to

effectively carry out their certified responsibilities. To underscore the importance of this matter, let us reiterate two sentences from the introduction:

"A certificate of competency (CoC) may grant the holder authority to serve as a responsible watchkeeping officer on board a vessel, irrespective of its size and operating area. In other words, individuals with a CoC may be authorized to serve as a deck officer or captain on the world's largest ships, navigating them across all international waters."

Category: Laws and regulations: compliance and consequences of change

2

A study on the analysis of navigators' understanding of COLREGS navigation rule interpretation and ship encounter situations

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The Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) consists of rules designed to prevent collision incidents in maritime environments. These rules are based on the qualitative rules of seamen and ordinary practices. With the influence of the Fourth Industrial Revolution, research on autonomous navigation in ships has emerged, known as the advent of Maritime Autonomous Surface Ships (MASS) by the International Maritime Organization (IMO). Since MASS operates autonomously, research on technologies for automatic collision avoidance has been presented. Various collision avoidance algorithms have been developed based on the COLREGs, which serve as rules for preventing collisions. However, the qualitative nature of the COLREGs has led to issues in the interpretation of navigation practices. Previous studies have addressed this need by investigating how actual navigators interpret navigation. The perception of collision avoidance situations was surveyed among real navigators, focusing on head-on, crossing, and overtaking scenarios. Three types of ship encounters were distinguished based on radar screens used on actual ships: head-on situations, crossing situations, and overtaking situations. The speed vectors remained constant, while the bearing angle was adjusted by 2 to 5 degrees for the survey. In this study, surveys were conducted with approximately 100 actual navigators, and the collected data were analyzed through statistical analysis and modeling to apply the results to maritime collision situations. Curve fitting using distribution functions based on navigation interpretation zones was utilized to apply navigators' understanding of navigation situation. This study provides an understanding of navigators' interpretation of navigation in relation to the COLREGs, and it also allows for a comparison with collision avoidance algorithms developed for autonomous ships through the use of models. In addition, the results of this study provide clues to solve the introductory different navigation interpretations even if the rules are not changed through the understanding of COLREGs.

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