Human factors
- and e-Navigation solutions

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Agenda

• Human factors and ship systems

• Examples of project work
  ➢ Design- and interaction review
  ➢ Design work with users

• Display of e-Navigation information
Human Factors and ship systems
Human factors

- Discipline of research and practice - aiming at design, optimization and improvement of systems with human and technical components

- Focus is primarily on safety, occupational health, efficiency and quality

- The theory and methods used, is based on psychological and ergonomic research and knowledge
Human factors
Human factors
The human element

Perception and attention
Cognition, memory and decision making
Emotions
Motivation
Behavior
Human factors and ships

Steering information:
- Rudder angle
- Heading
Examples of project work
Design- and interaction review

• An expert based analysis that utilize background knowledge of human behavior and psychological processes to assess the usability of a tool – in this case the Arctic web

• The analysis identified potential issues and provided suggestions for improvements of the ArcticWeb – moreover, these inputs has been integrated in the development of the BalticWeb
Input 1

• Selected vessels can be difficult to identify on the map

• The link between selected vessel and information needs to be remembered
Input 1

- A traditional tracking line was suggested

- It helps:
  - Improve visualization of active vessels
  - Minimize the load on cognitive resources
Input 1

• The tracking line input has been integrated in the development of BalticWeb

• Here, the tracking line is designed as an arrow – creating a direct link between information and vessel
Input 2

- It can be difficult to keep track of which chart layers have been selected from the menu.

- Without clear indication of selected layers, the load on cognitive resources increases.
Input 2

- It was suggested to add an object to the selected information – using the "squint for eye" technique

- It helps:
  - Selected informations stand out - overview
  - Minimize the load on cognitive resources
Input 2

- The “squint for eye” input has been integrated in the development of BalticWeb

- Here, it is designed as a tick off box – making it easy to see which layers has been chosen
Input 3

- The menu takes up space on the map, causing parts of the map to be hidden.
- The menu is not necessary of value to the user – if e.g. the goal is to navigate directly around the map.
Input 3

- It was suggested to allow the user to hide the menu bar

- It helps:
  - The user to navigate undisturbed in the map
  - The user to subjectively control the interface
Input 3

- The input on the menu bar has been integrated in the development of BalticWeb.
- Here, the menu button allows to click the menu on/off – putting the user in control.
Design work with users

Project with interaction design students
at NTNU in Trondheim

April, 2016
Arctic Web - Design project with 3 masters students in Interaction Design from Norwegian University of Science and Technology

Linn, Aurora, Truls and the captain on the Hurtiguten’s M/S Midnatsol
“Papirkart kommer aldri til å forsvinne fra broa”

“Kan jo være det fungerer på de gode skjermene på laben, men må fungere når er sjøsyk og kan nesten ikkestå oppreist.”
User test with paper prototype
Display of e-Navigation information
<p>| MSP 1 | VTS Information Service (IS) |
| MSP 2 | Navigational Assistance Service (NAS) |
| MSP 3 | Traffic Organisation Service (TOS) |
| MSP 4 | Local Port Service (LPS) |
| MSP 5 | Maritime Safety Information (MSI) Service |
| MSP 6 | Pilotage Service |
| MSP 7 | Tugs Service |
| MSP 8 | Vessel Shore Reporting |
| MSP 9 | Telemedical Maritime Assistance Service |
| MSP 10 | Maritime Assistance Service (MAS) |
| MSP 11 | Nautical Chart Service |
| MSP 12 | Nautical Publications Service |
| MSP 13 | Ice Navigation Service |
| MSP 14 | Meteorological Information Service |
| MSP 15 | Real-Time Hydrographic and Environmental Information Services |
| MSP 16 | Search and Rescue (SAR) Service |
| MSP ... | More to come... |</p>
<table>
<thead>
<tr>
<th>MSPs</th>
<th>Information Items</th>
</tr>
</thead>
</table>
| 1 INS | • The position, identity, intention and destination of vessels;  
• Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points;  
• The mandatory reporting of vessel traffic movements;  
• Meteorological and hydrological conditions, notices to mariners, status of aids to navigation;  
• Maneuverability limitations of vessels in the VTS area that may impose restrictions on the navigation of other vessels, or any other potential hindrances: or  
• Any information concerning the safe navigation of the vessel. |
| 2 NAS | • Risk of grounding;  
• Vessel deviating from the recommended track or sailing plan;  
• Vessel unsure of its position or unable to determine its position;  
• Vessel unsure of the route to its destination;  
• Assistance to a vessel to an anchoring position;  
• Vessel navigational or maneuvering equipment casualty;  
• Inclement conditions (e.g. low visibility, high winds);  
• Potential collision between vessels;  
• Potential collision with a fixed object or hazard;  
• Assistance to a vessel to support the unexpected incapacity of a key member of the bridge team, on the request of the master. |
| 3 TOS | • Vessel movements need to be planned or prioritized to prevent congestion or dangerous situations;  
• special transports or vessels with hazardous or polluting cargo may affect the flow of other traffic and need to be organized;  
• an operating system of traffic clearances or sailing plans, or both, has been established;  
• the allocation of space needs to be organized;  
• mandatory reporting of movements in the VTS area has been established;  
• special routes should be followed;  
• speed limits should be observed;  
• the VTS observes a developing situation and deems it necessary to interact and coordinate vessel traffic;  
• nautical activities (e.g. sailing regattas) or marine works in-progress (such as dredging or submarine cable-laying) may interfere with the flow of vessel movement. |
| 4 LPS | • berthing information;  
• availability of port services;  
• shipping schedules;  
• meteorological and hydrological data. |
| 5 MSI | • National Hydrographic Offices, for navigational warnings and chart correction data;  
• National Meteorological Offices, for weather warnings and forecasts;  
• Rescue Co-ordination Centres (RCCs), for shore-to-ship distress alerts;  
• The International Ice Patrol, for Oceanic ice hazards. |
| 6 Pilotage | |
P&O North Sea Ferries’ M/V Pride of Hull
Captain Jason Ikiadis, right, and First Officer Nikos Ninios on the bridge of the Azamara Journey. (ERIC WYNNE)

http://thechronicleherald.ca/titanic/slideshow/83244-azamara-journey
Cognitive Resources Needed

Cognitive Resource Supply

Cognitive Resources Needed

Cognitive Resources Needed

Cognitive Resource Supply

Open Sea  Coastal  Confined waters  Berthing

Cognitive Resources Needed

Cognitive Resources Needed

Cognitive Resource Supply

Open Sea | Coastal | Confined waters | Berthing

Maximum

Cognitive Resources Needed

Cognitive Resources Needed

Cognitive Resource Supply

Open Sea  Coastal  Confined waters  Berthing

Person 1 Maximum

Workload overload
Person 1

Cognitive Resources Needed

Cognitive Resources Needed

Cognitive Resource Supply

Person 2 Maximum

Person 1 Maximum

Open Sea

Coastal

Confined waters

Berthing

Workload overload Person 1

Workload overload Person 2

Cognitive Resources Needed

Cognitive Resources Needed

Cognitive Resource Supply

Person 2 Maximum

Person 1 Maximum

Open Sea

Coastal

Confined waters

Berthing

Workload overload

Person 1

Workload overload

Person 2

Strategic Control mode

Tactical Control mode

Scrambled Control mode

Strategic Control mode

Tactical Control mode

Scrambled Control mode

Strategic navigation
"Back bridge"
(Electronic table, iPad, LapTop, ...)

Tactical navigation
"Front bridge"
(INS)

Scrambled navigation
(Conning, HUD, HMD, ...)

Florence Peruche 2016
Strategic navigation
"Back bridge"
(Electronic table, iPad, LapTop, ...)

Tactical navigation
"Front bridge"
(INS)

Scrambled navigation
(Conning, HUD, HMD, ...)
Strategic navigation
"Back bridge"
(Electronic table, iPad, LapTop, ...)

Tactical navigation
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Scrambled navigation
(Conning, HUD, HMD, ...)

Certain e-Nav information
Strategic navigation
"Back bridge"
(Electronic table, iPad, LapTop, ...)

Tactical navigation
"Front bridge"
(INS)

Scrambled navigation
(Conning, HUD, HMD, ...)

Most e-Nav information

Certain e-Nav information
Strategic navigation
"Back bridge"
(Electronic table, iPad, LapTop, ...)

Tactical navigation
"Front bridge"
(INS)

Scrambled navigation
(Conning, HUD, HMD, ...)

Most e-Nav information