Human Machine Interfaces for supporting Sensemaking in Critical Situations

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Background

- Project Smacs (2017-2019)
    Sense Making in Safety Critical Situations

    - MAROFF program– Research Council of Norway
    - Maritime sector, ships operation in an increasingly digitalised environment
    - Case: Dynamic Positioning
    - Challenges when critical situations arises or during safety critical operations

    - **RQ3**: What are the characteristics of an HMI that facilitates sensemaking and resilience in safety-critical situations in the maritime domain?

Smacs

How to enhance human, technical and organizational capabilities to handle safety-critical situations?

— Sensemaking as a key for reducing ambiguity

Collecting material

- What are the characteristics of HMI that can support sensemaking in critical situations?

- Scope: safety critical industry, not only maritime

- Resources:
  - Databases: Science Direct, Scopus, Google Scholar

- Challenges
  - Terms, definition and use
  - Disciplines (Organisational sciences, Human Factors, Computer science)
  - Notable variance

Safety critical industry

Safety critical operations

Situations or operations that if they go wrong have a large ptential of causing harm to people, environment or property

Sense(-)Making

Situation Awareness

Human Machine Interface

Human computer interaction

Sensemaking in a digitalized control centre

- Sense making is human centred process

- Control centre activity is characterized by human – technology co-agency. Quickly evolving.
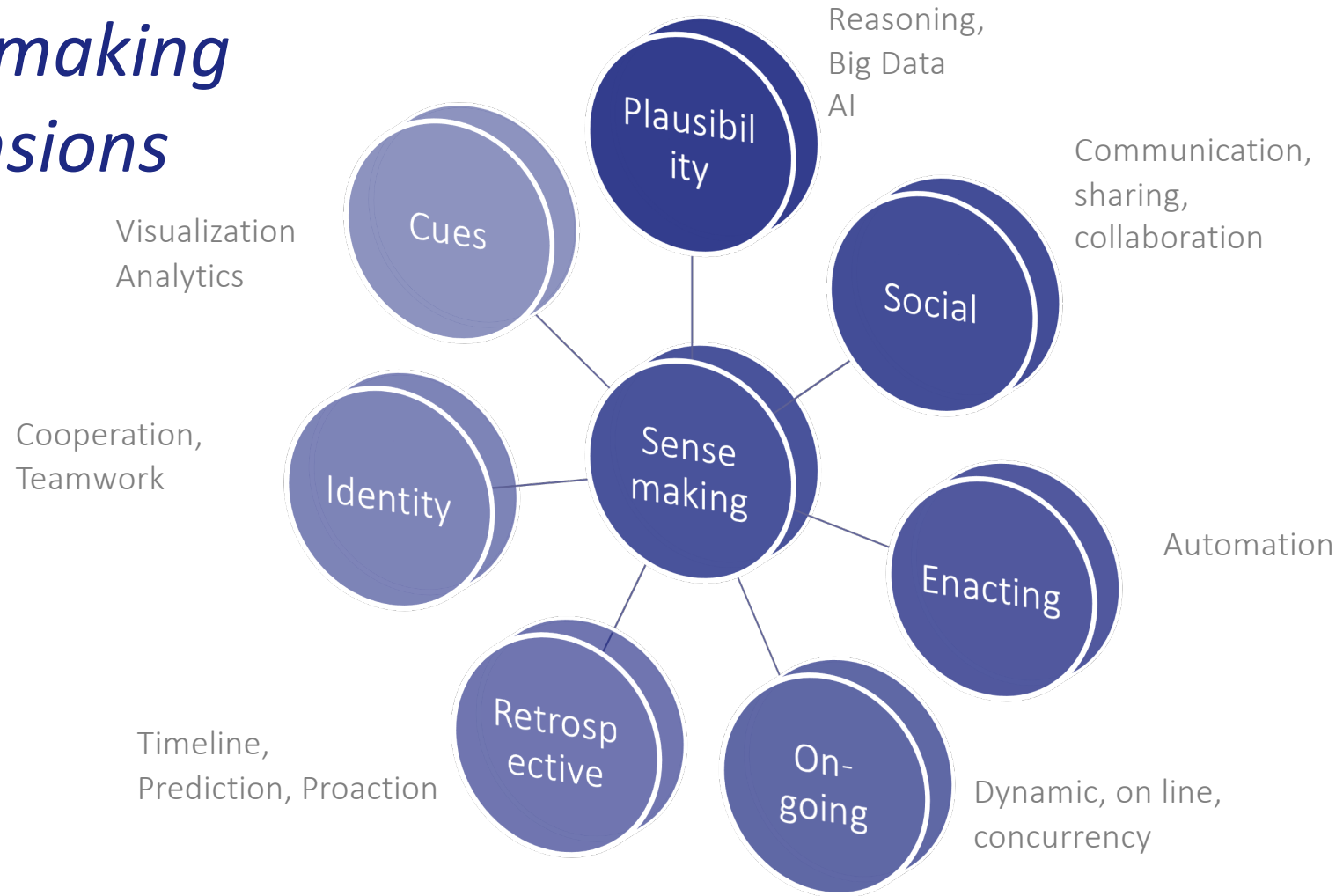
«.. A process prompted by violated expectations, that involves attending to and bracketing cues in the environment creating intersubjective meaning through cycles of interpretation and action, and thereby enacting a more ordered environment from which further cues can be drawn»
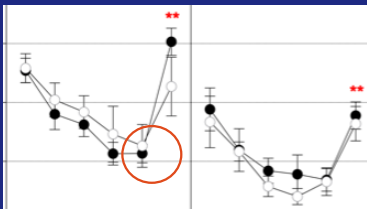*- Maitlis and Christianson 2014*

Karl E. Weick
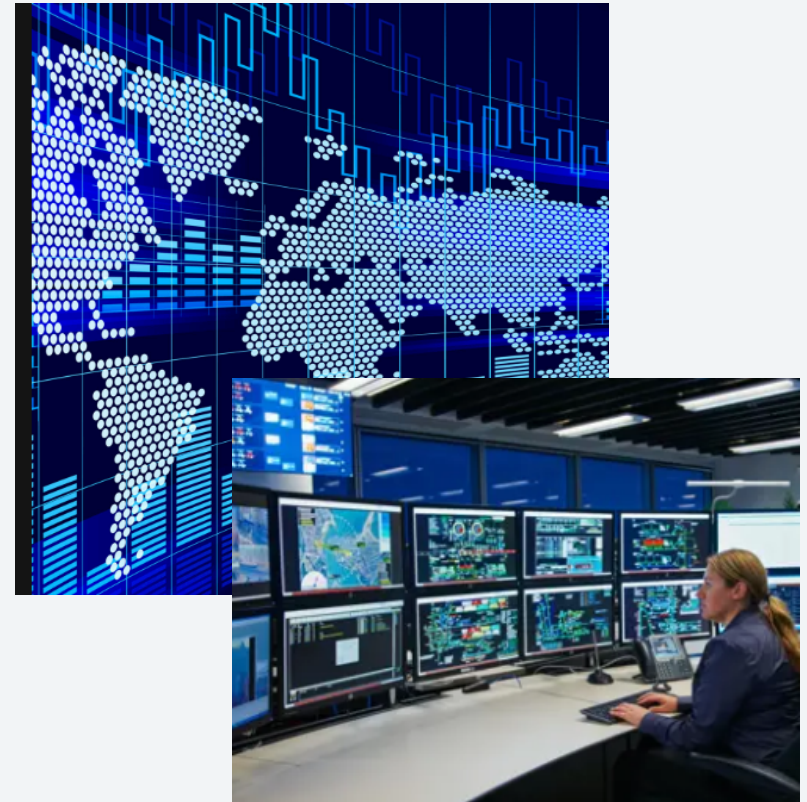
The most addressed dimensions in HMI

Cues

equivocal / confirmed

papers:
8

HMI for Visualisation

to present data, variables, processed information in usable form.
impact our ability to extract meaning (ecological interfaces)

Effective variety, multiple perspectives, a dynamic level of right complexity (avoiding hindering SM)

Automation and reframing activity (confirmation bias , over trust)

Equivocal cues, avoiding too narrow interpretation
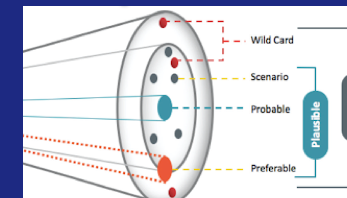
Plausibility

possibility / probability

papers:
5

Incomplete information, uncertainty, situation 'similar' to.. Human cognition

HMI: intelligent systems and compatibility with human cognitive processes to promote innovative thinking and productive learning (explainable AI)

Human Reliability Assessment for digital systems

Cognitive system engineering

The most characteristic SM features
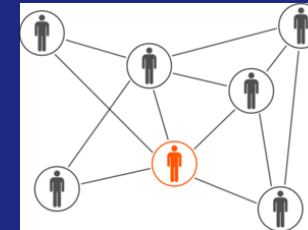

Enacting

enactive / reactive

papers:
5

For a wide spectrum of actions (tasks) automation is already at work

Automation transparency, strategies for mixed control

Hazard analysys: Stystem Theoretic Process Analysis

Social

social / solitary

papers:
3

Network of communication channels (collective intelligence)

Teamwork and HMI (ex: field operator)

Bringing machines in the network (responsability, trust)

Joint cognitive system framework

The remaining dimensions, but not the least

Ongoing
continuous / episodic

papers:
1

(adaptive process)

Ex. in HMIs: trend visualisation of most relevant parameters

Implies change

But ex.: Auditory signals and stress level,

Flexibility in choosing HMI

Retrospection

Backward noticing / forward

papers:
2

Controversial, perspectives

Expected results, risks evaluation

interpreting what has happened in the light of the ground for past decisions

Identity
defined / vague

papers:
2

Role in team, ability following what the others are doing

Automation transparency   (H -> M)

Sensors on human to detect status, ex. overload (M -> H)

Conclusion

- Use of Weick's framework to get insights how HMI impacts on sensemaking
  - Sensemaking a key process but easily 'disturbed'
  - Need of adaptive HMI to situations (overview controlled process, environment, team solving the problem)
  - Attention to human cognitive processes
    - Automation: over trust, confirmation bias
  - Challenges in integration of information
  - Focus on the Human Machine (Automation) interaction in the design process, specially early phases

HMI has a growing role in the digitalised control centre where hybrid teams work

wiseGEEK
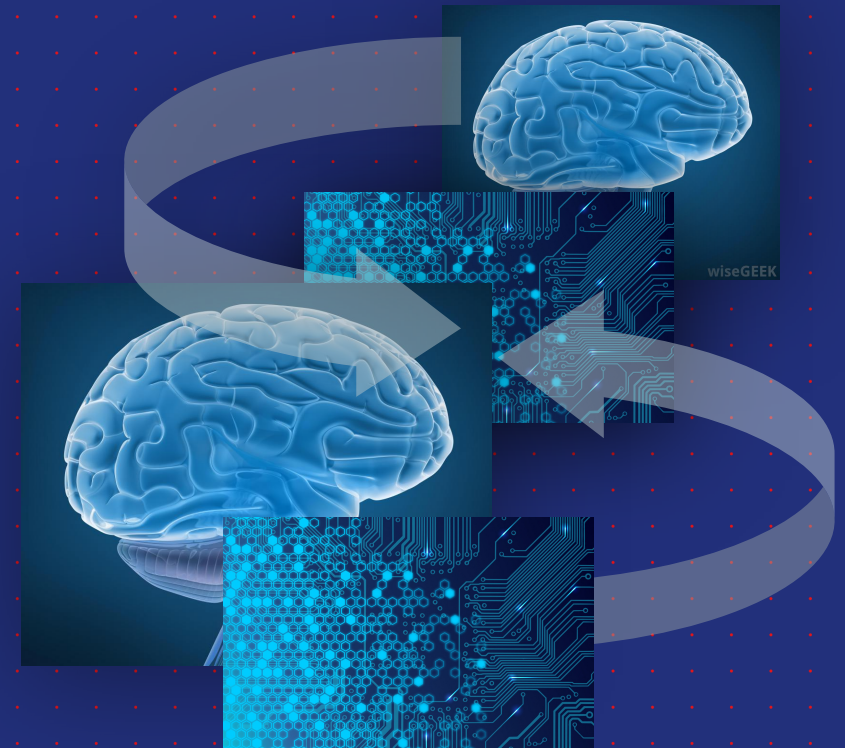
Key role during critical operations and situations

Thank you !

Q & A

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