Evolution of Human Factors standards - challenges for robotics and automation

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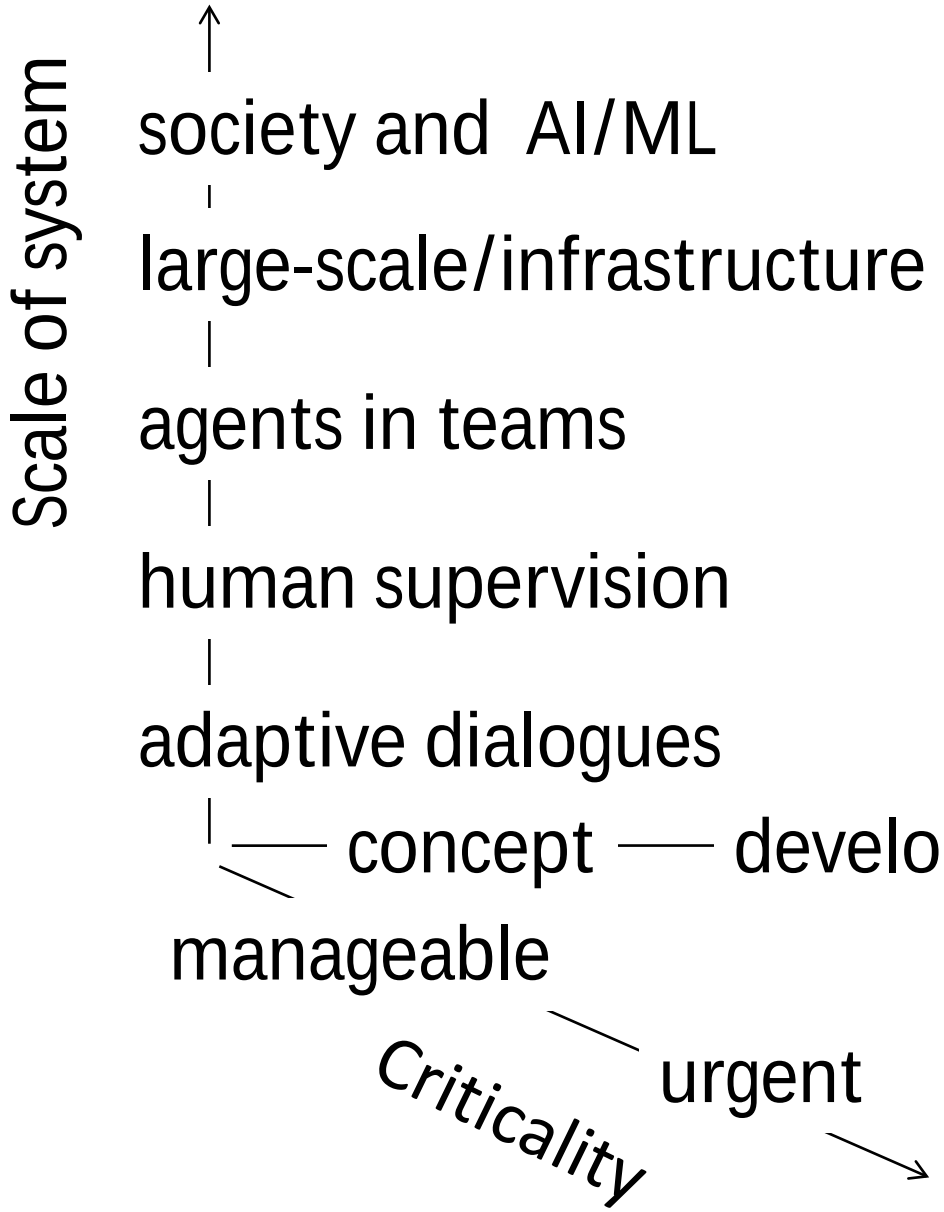
Agenda

- Describe ISO 9241 TR -*Ergonomics of human-system interaction — Part 810: Human-system issues of robotic, intelligent and autonomous systems*
- Discuss issues for maritime control/automation based on findings from discussions within ISO TC159 so far.

The project

- Origin
- Scope
- Team & backgrounds
- Method
- Format

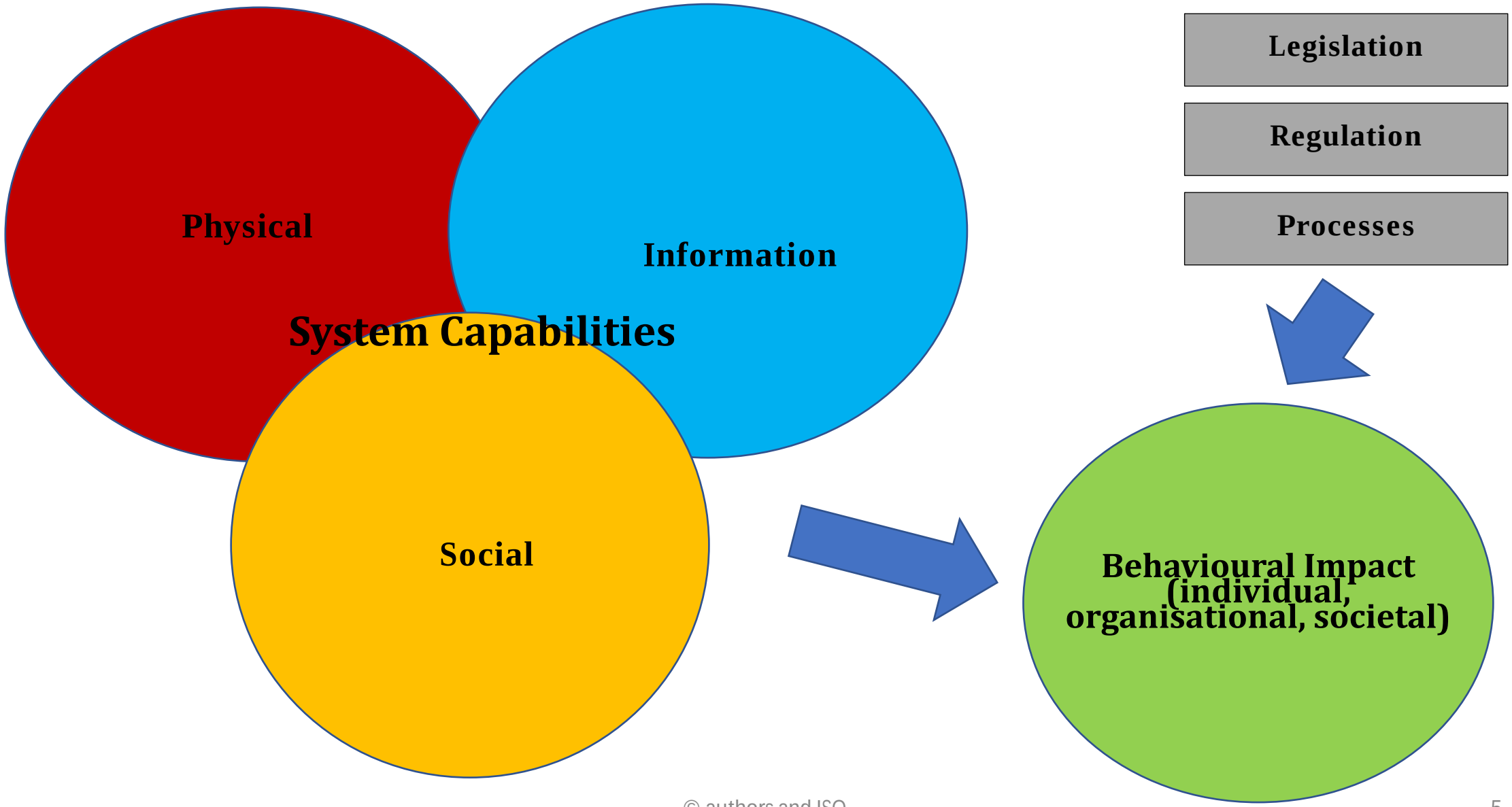
Dimensions



Trend is for more connected, complex, probabilistic, social and human-augmentation

Location on these axes determines use/user issues/ problems

Peoples' interaction with RIA system



Paradigms/models for human - RIA system relationship

Gap – paradigms relating to organisational, social/cultural, societal relationship with RIA system

- Augmentation of human capability
- Replacement of function/job

- Remoting - control from a distance
- Teaming - working together for common goal
- Symbiosis - working together for mutual benefit
- Parasitic - human is source of data
- Influence - influencing human behaviour

- Watched over by machines of loving grace - governance

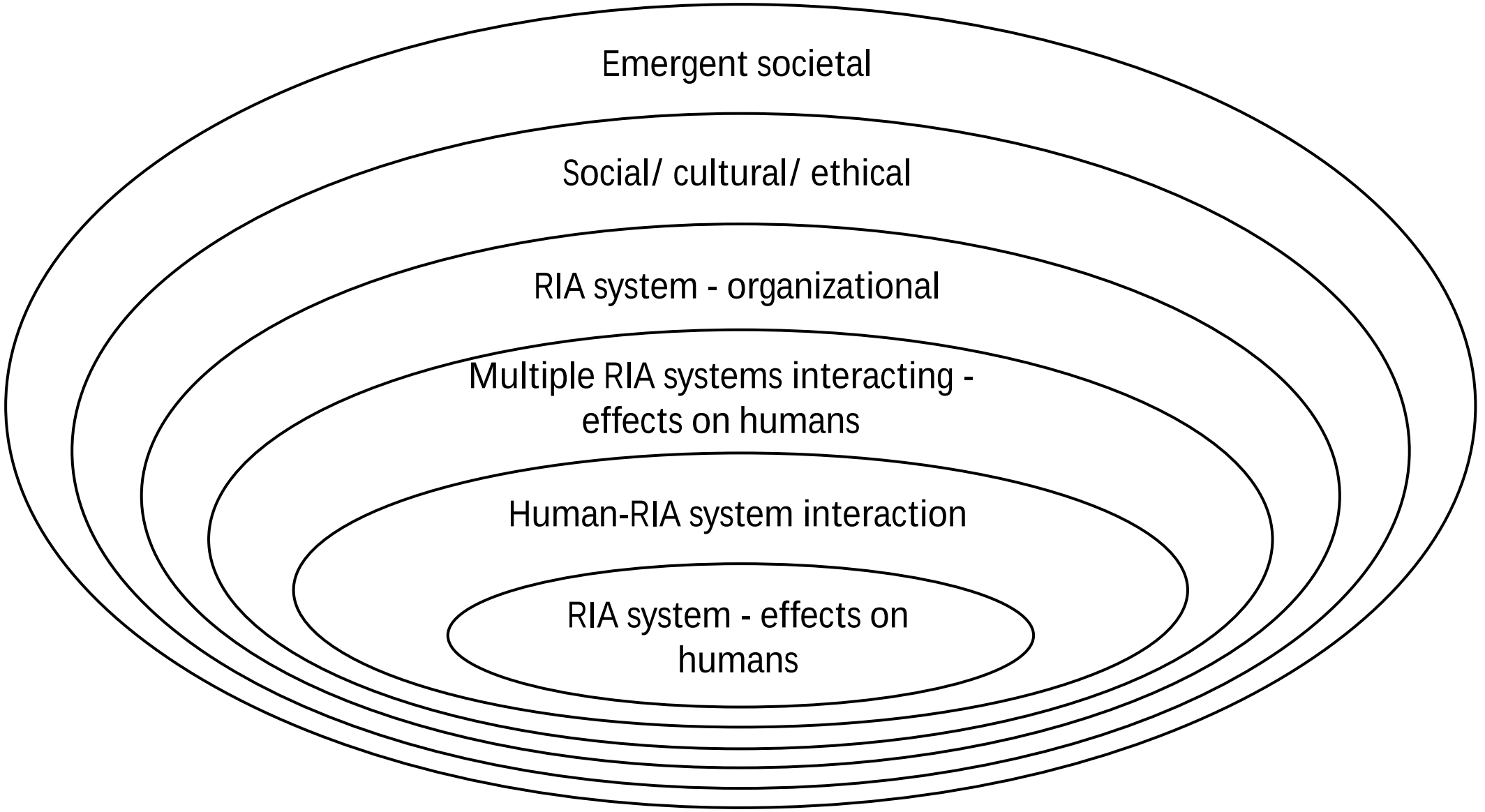
Risks of not addressing ergonomics in RIA systems include:

- negative user experience (both users and those affected) – impact beyond performance
- compromised safety through error, delay and violations
- negative social impacts
- dysfunctional workplace
- failure to realise anticipated benefits
- rejection of RIA systems

Mitigation through: human enhancement, seamless integration with social context, and particular care to management of change.

Contents of 9241-810

Six categories of RIA system issues identified



Relevant Ergonomics standards produced by TC159

- Principles of ergonomics (ISO 26800, 27500)
- Human-centred design process (ISO 9241-210, 220, 18152)
- Interaction and interface (ISO 9241-110, 112, 13, 129, 154)
- Accessibility (ISO 9241-171, ISO/IEC 29136, ISO 9241-129, ISO 9241-971, ISO/TR 22411)
- Workspace and workload (ISO 6385, 9241-2, 10075)
- Context and environment (9241-11, 11064, thermal/physical environment)

Safe system behaviours

Issue category	Type of safety set	Location of requirement	HCQ emphasis/ development
RIA system – effects on humans	Effects on individual humans that are to be prevented	Regulation (part of rights and occupational health and safety)	User experience
Human-RIA system interaction	Situations to be prevented, acceptable latency, authority to decide/override	Performance standard, possibly mandated (similar to competence)	Usability, accessibility, avoidance of harm
RIA systems interacting – effects on humans	Degree of transparency, ability to override	Regulation, business practices, engineering standards, contract	Avoidance of harm
RIA system – organizational	Process requirements, governance, effect on stakeholders, learning behaviours	Industry sector codes, and standards of practice, possibly mandated	All components as objectives plus context coverage
Social/ cultural/ ethical	Fairness, trust, offence, safeguarding, privacy	Regulation or convention, possibly faith ruling, probably tort	Extension of user experience to address community experience Extension of harm to address cultural issues
Emergent societal	Loss of control, accountability	International conventions and regulations	Application of HCQ at societal level

Conclusions - Physical/Environment

- Controlling spaces in vehicles, buildings, cities. What system thinks state of user is. Wearable tech. Determining threat/capability.
- Vehicle and domestic environments. Robots in public spaces.
- Working environment. Social as the core area. Customer and services perspectives as well as user.
- Context and its components. Does it become context of co-existence?
- *Discuss with reference to control and advanced automation and what this might mean for safety authorities (regulators, assessors, industry associations)*

Conclusions - Cognitive

- Workload in control tasks. Mental & organisational principles for worksystems.
- Response & behaviour data (incl. physical and recovery) for work with cobots.
- RIA system training & change management.
- Use of AI in gamification and training.
- *Discuss with reference to control and advanced automation and what this might mean for safety authorities (regulators, assessors, industry associations)*

Conclusions - Social

- Evolution from automatic systems to intelligent agents.
- Extend organizational human-centredness guidelines for jobs and work with RIA systems.
- Suitable models for properties such as trust in relation to social, cultural and ethical issues.
- Add social benefit to human-centred quality.
- *Discuss with reference to control and advanced automation and what this might mean for safety authorities (regulators, assessors, industry associations)*

Conclusions - Design/process

- Take account of non-users affected by RIA systems.
- Human-centred design more dynamic to take account of agents that learn.
- Definition of system and boundary(ies). Interaction principles vs. forms of automation.
- Who is user of the technology? What do they do now?
- *Discuss with reference to control and advanced automation and what this might mean for safety authorities (regulators, assessors, industry associations)*