TRUST IN AUTOMATION

How This Is Shaped By The Human Operator and The Underwater Domain

Introduction

❖ To aid in the facilitation of increasing levels of automation in Submarine Command and Control Centres.

"optimised human integration into combat systems is critical to the effectiveness of remote and automated systems (RAS) in guarding against unanticipated catastrophic error" (Hawley, 2017)

❖ Integration of human operators with emergent specialised systems, such as trust in automation, artificial intelligence and robotics.

❖ Push to introduce Human-Human/Human-System analogies with AI Avatars and three dimensional representations of environments (MoD, 2018)
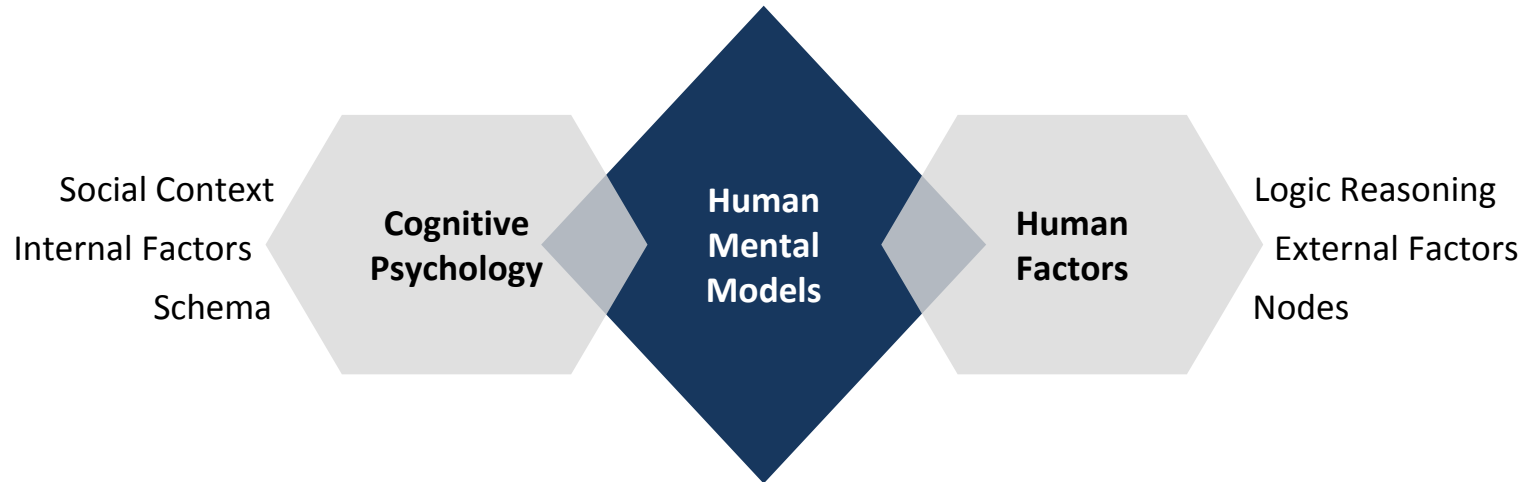
Our Explanations Of Tech

❖ Actor-Network Theory (Latour, 1996)

❖ Socio-Technical Systems and Macroergonomics (Rasmussen, 1997; Carayon, 2006)

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http://www.assignmentpoint.com/arts/social-science/actor-network-theory.html
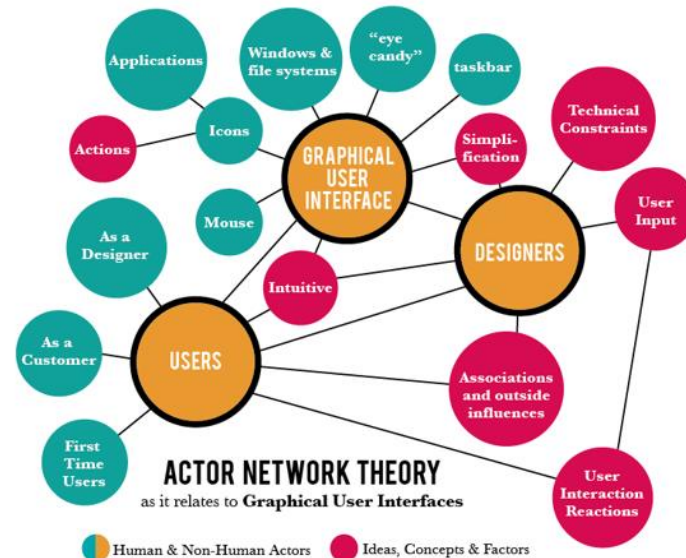
Human-System Interaction

❖ The Media Equation and Social Actors

    ❖ One-Down, One-Up, One-Across

❖ Human-Human / Human-system Teaming

    ❖ In-, Out-, On-the-Loop

❖ Technology Anthropomorphising and Category Boundaries

    ❖ Uncanny Valley (Mori, 1970/Mori & MacDorman, 2012)

    ❖ Mental Schema of Robots as More Human (Broadbent (2011))

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Mental Models and Schemata

Social Context
Internal Factors
Schema

Cognitive Psychology

Human Mental Models

Human Factors

Logic Reasoning
External Factors
Nodes

Why Use Mental Models?

Obsolescence

There is a 'half-life of knowledge' (Siemens, 2004). Validity and advancements of research in automation is changing at a similar rate to Moore's Law (Moore, 1965),

Neither information nor technology is future-proof. Personnel and operators are the primary constant.

Future Trends

A primary future trend in the military (and civilian domains) is increased use of automation.

As automation accuracy increases, operator roles will change from teammate to supervisory role in multi-agent teams.

Outcomes

Due to the diversity of using mental models, they can provide and influence a number of outcomes, ranging from ecological user interfaces, design recommendations, to operator training.

Narrative Framing

- ❖ Narrative approach seeks to capture experience

    - ❖ Constructed and mediated between actors to acquire complex, multi-faceted and nuanced views of reality

- ❖ Structuring of experience

    - ❖ Narrative constructs and reconstructs remembered stories of a person's experience.

    - ❖ Values, beliefs and experiences guide interpretations.

- ❖ Narratives are characterised by multiple voices, perspectives, truths and meanings.

Trust and Narrative Inquiry

❖ Trust is formed inter- and intra-personally through lived experiences.

❖ Nuances of Trust Research

  ❖ Behavioural intention

  ❖ Internal action and choices based on internal morality

  ❖ Synonymous with Trustworthiness?

  ❖ Crystalline or fluid through life?

  ❖ Synonymous for cooperation or risk-taking?

❖ Trust as a construct

  ❖ Multi-disciplinary research has both helped and hindered the definition and conceptualisation.

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Trust in the Literature

❖ Trust, Trustworthiness and Trust Propensity

   ❖ Trustworthiness and Propensity can be mediated when Trust is controlled and manipulated

❖ Trust and Reliance

   ❖ *"In the context of trust and reliance, trust is an attitude and reliance is a behaviour" (Lee and See, 2004)*

❖ Trust and Antitrust

   ❖ *"Trust, I have claimed, is reliance on others' competence and willingness to look after, rather than harm, things one cares about which are entrusted to their care" (Baier, 1986)*

The Military Interest in Narrative

- ❖ Storytelling to convey complex technical communication can *"aid in transfer of complex information involving multiple actors, operations and motivations in a holistic, digestible format"*

- ❖ The use of narratives in the military has cognitive benefits of *"comprehension, retention and analysis of information"*

- ❖ Nuances in inter- and intra-personal psycho-socio-cultural differences.

(Finlayson and Corman, 2013)

Exploring Trust Narratives

- ❖ *Civilian Cohort:* 7 Participants (SME and Non-SME)
    - ❖ Age (21-55)
    - ❖ Male and Female participants
- ❖ *Military Cohort:* 20 Participants (Army, RAF, Surface Navy, Subsurface Navy)
    - ❖ Age (30-60)
    - ❖ Male and Female Participants
    - ❖ Higher proportion of sub-surface personnel
- ❖ Semi-structured responsive interviewing – Grounded Theory
- ❖ Data analysis through hermeneutical phenomenology (Interpretative phenomenological Analysis) and Hierarchical Content Analysis via NVIVO and Leximancer.

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Expressions and Notions of Tech

"...Say you had a control room(.), and you say it's fully automated(.), does everything it needs to do(.), but we have:: to put some people in there ↑just↓ in case, and <u>you use those words></u>.

At <u>no point::</u> have they said, these people have <u>any</u> idea what the system is, >what it's doing, how to fix it if it breaks, they have no idea of anything<,

*but <as **soon::>** as you say(.), ↓we've put some people in there to check just in case, ↑**everyone goes oh ok great**(h).*

>And you sit back and you go<, the automated system is so:: much more intelligent than <u>everybody</u> in that room combined(.), and ↑yet↓ you're quite happy to dismiss that over somebody else that you've <<u>had no evidence </u>of their capabilities>(.). Chances are with an automated system it's been demonstrated and whatnot (sigh)"

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Expressions and Notions of Trust

">At least in my mind I know that the machine never did it on purpose< (.) and and ↑I↓ feel like it is easier to forgive a ↑machine than it is to forgive a ↑human >because the human could have made one of many thousands of mistakes< <right>, and you don't know if it was ↑malicious↓ or <anything>."

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Socio-Cultural Nuances

"I suspect a submariner that stood in front of you twenty years ago would give you exactly the same message, and no doubt, my successor's and their successors in twenty years' time would tell you exactly the same story. Submarines change, but submariners don't."

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Trust, Experience and Schemata

"Yeah I mean it's quite interesting, we've all talked about trust trust trust with automation and probably your instinct would naturally say I trust my teammates, but actually we all know they fail, they fall asleep, they miss things, they've been out the night before, and you've got very inexperienced, but we do tend to put more stock into human emotion, I suppose because for years and years you've relied on it, and all your training was based on team training, but the reality is, automation is entirely logical, whereas teammates aren't.

...I think that's the area where there's no logic we apply to trust. I mean some of the...junior guys that have just come straight from training, actually we might not trust them, because we say they haven't got the experience, but if they've just came from training, they haven't got the bad habits, they haven't got the, oh just do it this way even though the instruction book says so, I think we're actually not very good at picking the right part."

Trust Adaptation in the Military

"I think they do, whereas we resist it because we rely on each other, and I think that's one of the main differences."

"But I think that a lot of members of the military have got a higher risk appetite which means that although their trust or their reliance is probably enforced or not based on trust, based on knowledge but I think they understand the risk because they've got that greater knowledge. Most people don't have to think about it because they don't live inside a complex and controlled environment which is supported by systems, automated systems or human operated systems. Most people have probably never even had a think about that because what is the oxygen level, who cares, the trees are still green."

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Thoughts on Trust and Tech

❖ Trust is defined as positive expectations but negative experiences are oft used as example interactions

❖ Dissonance between verbalised sentiments and underlying expressions

❖ Expressions of mistrust and distrust closer to technology closer to category boundaries

❖ Conflicting narratives within and between military subgroups whether the Military culture primes operators for technology adaptability.

❖ Expressed differences in attitudes and behaviours between their individual subcultures across the branches of the military. Attitudes towards trust seem to persist post-service regardless of time elapsed in civilian roles

Future Work

- ❖ Post-Hoc Analysis and Frameworks

    - ❖ Sensemaking, Flexecution and Data Frame Theory (Klein, 2007)

- ❖ Training Vignettes and Narratives

    - ❖ Story based learning and training based upon the dominant narratives concluded from the research.

    - ❖ Graphical Narrative and Storytelling as alternative data visualisation technique.

References

❖ Baier, A. (1986). Trust and antitrust. ethics, 96(2), 231-260.

❖ Broadbent, E., Lee, Y. I., Stafford, R. Q., Kuo, I. H., & MacDonald, B. A. (2011). Mental schemas of robots as more human-like are associated with higher blood pressure and negative emotions in a human-robot interaction. International Journal of Social Robotics, 3(3), 291.

❖ Carayon, P. (2006). Human factors of complex sociotechnical systems. *Applied ergonomics*, *37*(4), 525-535.

❖ Colquitt, J. A., Scott, B. A., & LePine, J. A. (2007). Trust, trustworthiness, and trust propensity: a meta-analytic test of their unique relationships with risk taking and job performance. Journal of applied psychology, 92(4), 909.

❖ Finlayson, M. A., & Corman, S. R. (2013). The military interest in narrative. *Sprache und Datenverarbeitung*, *37*(1-2), 173-191.

❖ Hawley, J., 'Patriot wars', Centre for New American Security, available at https://www.cnas.org/publications/reports/patriot-wars

❖ Klein, G., Phillips, J. K., Rall, E. L., & Peluso, D. A. (2007). A data-frame theory of sensemaking. In *Expertise out of context: Proceedings of the sixth international conference on naturalistic decision making* (pp. 113-155). New York, NY, USA: Lawrence Erlbaum.

❖ Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale welt*, 369-381.

❖ Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. Human factors, 46(1), 50-80.

❖ Mori, M., MacDorman, K. F., & Kageki, N. (2012). The uncanny valley [from the field]. IEEE Robotics & Automation Magazine, 19(2), 98-100.

❖ Moore, G. E. (1965). Cramming more components onto integrated circuits.

❖ Siemens, G. (2004). Connectivism: A Learning Theory for the Digital Age. In eLearnSpace.