AUTONOMY RESEARCH CENTER FOR STEAHM

Human-Machine Teamwork With Explainable AI

Building Trust in Human-Machine Teams (HMT)

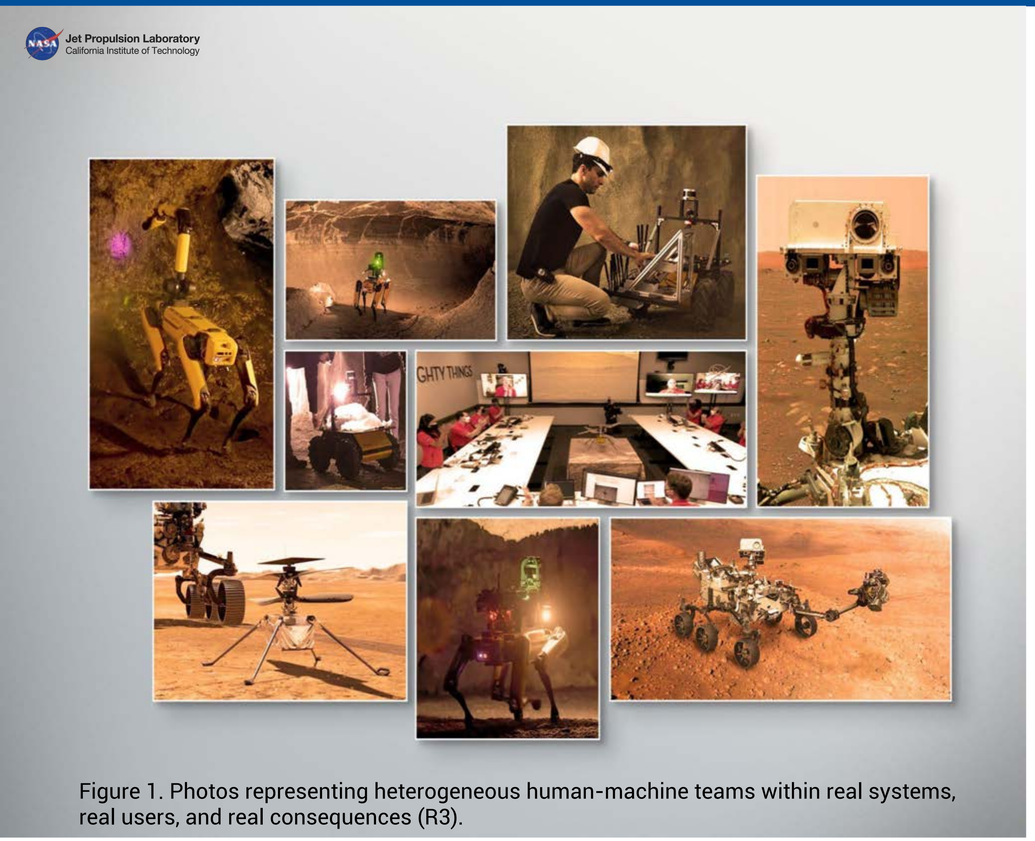


Figure 1. Photos representing heterogeneous human-machine teams within real systems, real users, and real consequences (R3).

Synopsis

- Study explores trust development in human-machine interactions using ethnographic, qualitative methods in real-world settings.
- Research focuses on heterogeneous human-machine teams (HMT) with different roles, capabilities, collocation, and collaboration durations.
- We investigate how these diverse factors influence trust and team performance in practical, real-world scenarios.

Research Objective

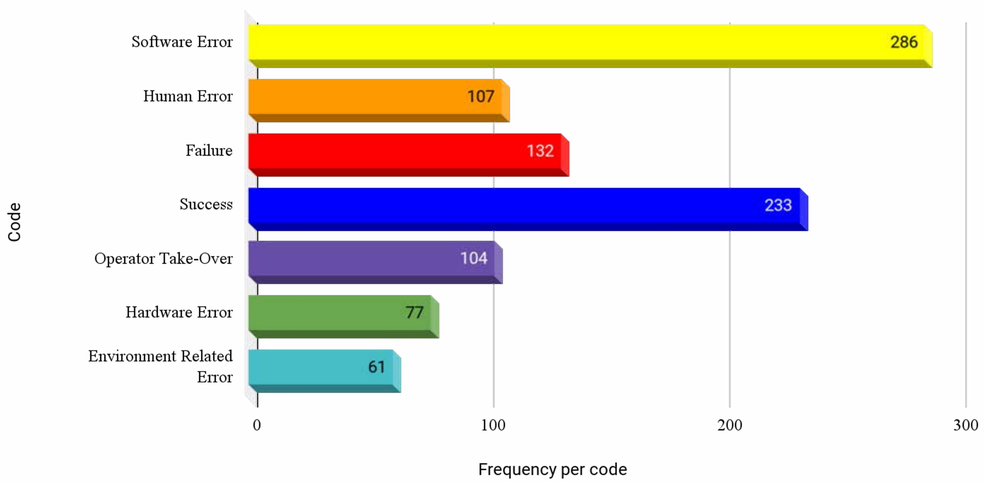
- Obtain foundational lessons and insights on how trust is calibrated and evolves over time.
- Identify how technology and non-technology-related factors (e.g., organizational, cultural, personal) influence the trust evolution.
- Validate extant theoretical trust models against trust calibration and evolution of heterogeneous Real World, Real Users, Real Consequences (R3) HMTs, and adapt or extend the models.
- Generate hypotheses for trust evolution and calibration in heterogeneous R3 HMT contexts.

Research Approach

- Use complementary qualitative methods for select R3 HMT at NASA JPL, including participant observation, surveys, and interviews (unstructured and semi-structured).
- Analyze data using a grounded theory approach, involving thematic coding and a constant comparative method to generate hypotheses and new theoretical models.
- Utilize an iterative case study method to refine design, preparation, and collection phases based on emergent themes or topics.

Factors Influencing Trust in Human-Machine Teams

Fig 2: A visual representation of emerging themes in the interviews



Research Results and Products

- Log data confirms our findings that knowledge of software is a high indicator of trust with R3 HMT.
- Zoom meetings and ritualistic practices created a strong sense of communitas, enhancing trust and social cohesion without physical proximity.
- Trust increases as humans become more grounded and take more ownership of robot behaviors/capabilities.
- Higher stakes, complexity, and asset risk in Mars 2020 HMT reduced trust in robot team members, leading to more cautious use of autonomous features.
- Hypothesis: The presence of a human safety operator in R3 HMT leads to more aggressive or risk-taking use of autonomous features.

Commercialization and/or Societal Impact Opportunities

- Develop a framework and guidelines to build trust in diverse Human-AI teams, emphasizing ethical AI design and responsible governance.
- Inform advanced operations concepts involving heterogeneous HMTs and related advanced autonomy technologies by prioritizing people for responsible AI.

Team Names & Collaborators

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Citations

Lyons, J. B., Sycara, K., Lewis, M., & Capiola, A. (2021). Human–Autonomy Teaming: Definitions, Debates, and Directions. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.589585

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