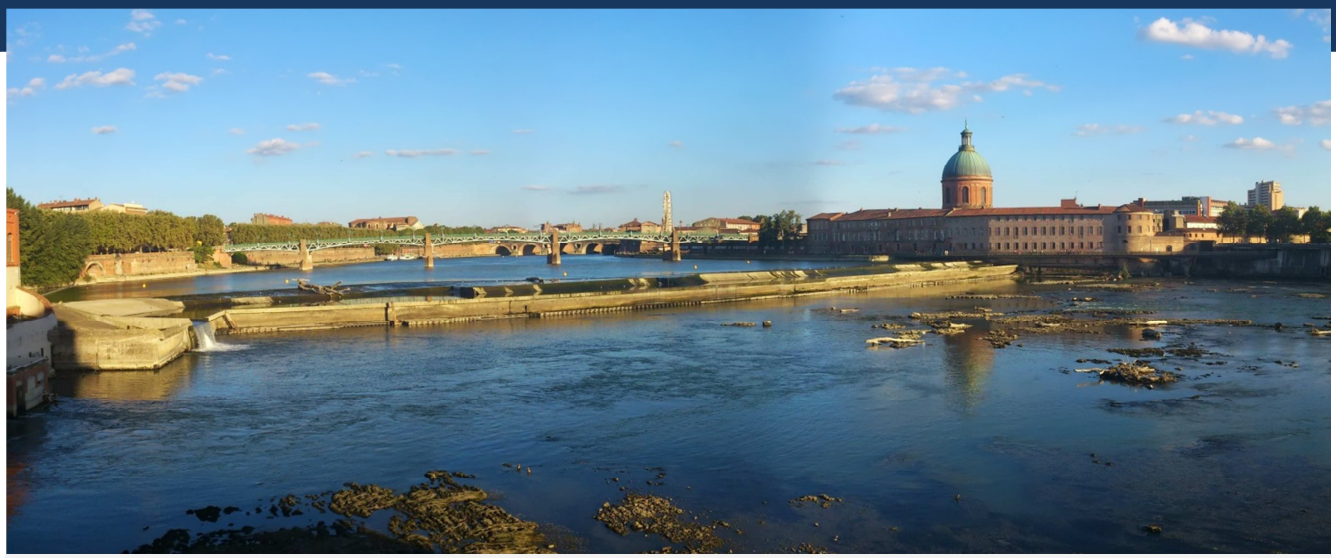

The 1st International Conference on Cognitive Aircraft Systems – ICCAS

March 18-19, 2020

https://events.isae-supaero.fr/event/2

Scientific Committee

- Mickaël Causse, ISAE-SUPAERO
- Caroline Chanel, ISAE-SUPAERO
- Jean-Charles Chaudemar, ISAE-SUPAERO
- Stéphane Durand, Dassault Aviation
- Bruno Patin, Dassault Aviation
- Nicolas Devaux, Dassault Aviation
- Jean-Louis Gueneau, Dassault Aviation
- Claudine Mélan, Université Toulouse Jean-Jaurès
- Jean-Paul Imbert, ENAC

Permanent link : https://doi.org/10.34849/cfsb-t270

MOHICAN: human-machine performance monitoring through trust and collaboration analysis. – Towards smarter design of a virtual assistant and real time optimization of machine behavior

Prof. BOY, Guy Andre (CentraleSupélec & ESTIA); Mr DEZEMERY, Julien (SYNAPSE Défense); Ms MOREL, Chloé (ESTIA Tech)

Content

Evaluation of the performance of Human-Machine Teaming brings two substantial values to military effectiveness: (1) enhancing the design quality of cognitive aircraft systems, (2) synchronizing the behavior of the virtual assistant with the cockpit needs during fights.
This paper presents "MOHICAN", a system-of-systems approach for monitoring the performance of Human-Machine Teaming in combat aircraft cockpits. MOHICAN will include a method, its tools, and a model addressing a multirole aircraft. Those principles developed for the cockpit may be extended to more complex systems of systems by expanding measure criteria, and by integrating collective teaming contribution to global performance of the system as a whole (e.g., military air operations).
System performance relies on the articulation of three factors encapsulated within the TOP Model (Boy, 2011 , 2013): technological (e.g., usability, explainability, etc.), organizational for teaming (e.g., trust and collaboration, etc.) and human (e.g., workload, stress, memory, etc). MOHICAN associates interdisciplinary knowledge and knowhow for technology (e.g., aeronautics, artificial intelligence and human-computer interaction), human and organizational factors, field expertise, that will enable the assessment of human-machine teaming performance. MOHICAN 's objectives are threefold.
(1) A multi-agent model supports information processing and transfer among the various human and machine systems (or agents) based on tactical scenarios and contexts, as well as required physical and cognitive functions, {Fc} = {Role, Context of validity, multi-agent Resources}. This model will be used both for guiding performance monitoring and discovering emerging cognitive functions.
(2) A three-layers assessment model, based on iterative human-in-the-loop experimental simulations (essential for agile design and development of human system integration studies), that will integrate:
(a) low level objective (e.g., eye tracking data, military performance data) and subjective (e.g., Cooper-Harper evaluation scales, NASA TLX) measures {mi}, as well as a-posteriori analysis of agents' activities (e.g., self-assessment of recorded flight scenes), into
(b) human factors criteria {Cj} (e.g., workload, fatigue, attention, vigilance, engagement, affordances, flexibility, maturity [technological, organizational and human], tangibility). The model Cj = g ({mi}) is developed using the cognitive function analysis method (Boy, 1998) extended by operational performance criteria (e.g., risk management, task achievement, operational margin).
(c) Teaming performance will then be modeled using shared situation awareness and human-machine cooperation through teaming metrics, {Tk} [Tk = fk,context({Cj})] within contextualized use cases. Two metrics will be developed: trust and collaboration.
(3) A method of Tk qualification to check the consistency and pertinence of teaming performance with the measured military operational performance.
Keywords: human-machine teaming, human-systems integration, trust, collaboration, cooperation, modeling, human-in-the-loop simulation, virtual assistants, human factors and ergonomics, human-computer interaction, artificial intelligence, systems of systems, multi-agent systems.

Keywords : Intelligent assistants, Virtual assistants, Simulation, Virtual reality