Introducing an Autonomous Crewmember

Helen MUNCIE

Thales Innovation Hub UK, Manor Royal, Crawley, West Sussex, RH10 9HA

Keywords. Autonomous Crewmember, Interaction Design, Adaptable Autonomy, Human-Centred Design.

1. Introduction

Why are we developing an Autonomous Crewmember? In Thales, there is a growing realization that state-of-the-art system engineering practices require new interaction design methods that can accommodate the variations in levels of autonomy that are inherent in complex systems. We also recognize the need to develop design guidelines for the human-machine interface for systems that have adaptable autonomy. Therefore, Thales initiated a user-centred design study to explore interactions with autonomous systems and develop new solutions. In this poster, the concept of an Autonomous Crewmember is introduced as a component of Thales systems architecture that is specifically designed to manage the variations in autonomous aspects of the system.

2. Method

Thales designers are using a human-centred approach that starts with the people we're designing for and ends with new solutions that are tailored to suit their needs.

Following this approach, the first step is to gain inspiration by immersing ourselves in the (operational) lives of users of autonomous and automated complex systems. In the case of crews operating unmanned air systems (UAS), this involved an ethnographic study of how they currently work in an operational environment. Ethnography is one way of empathizing with our end users to gain a deep understanding of their unmet and often unarticulated needs and, as an Army Reservist, the author of this paper had the opportunity to experience first hand the highs and lows of supporting the Theatre UAS Battery in Afghanistan.

The next stage was to communicate the experience back to the design team. Traditionally they would have received a list of prioritized problems and issues, however the aim was get the team to really understand what it was like to be a crew member in that environment, so the experience was captured in a story. Personae based around the demographics, descriptions, personalities and needs of the end users were then created to help the rest of the design team to empathize with the people they were designing for.

The next step was to identify opportunities and generate possible solutions to meet real users' needs. One of the challenges identified was to help to improve the way that human operators interact with autonomous systems and one solution was to create an Autonomous Crewmember (AC) as a component of Thales systems architecture that is specifically designed to manage the variations in autonomous aspects of complex systems.

Our poster depicts a specific scenario that emphasizes the collaborative aspects of the interaction between a human operator and a possible AC. The interactions portrayed in the scenario seem simple and natural, which is intended. Our philosophical basis for understanding interactions is evolving from system-theoretical approaches that analyze and model observable reciprocal action-effect relationships to considering interaction as a rich experience rooted in the whole body, involving emotion, cognition, intentionality,

dialogue, agency and timing.

The next stage therefore is an exploratory study to design the interactions between human crew members and autonomous aspects of the system and choose the most appropriate method to support the interaction. We intend to capture the logistics of how work and information actually flows when crew members are cooperating and solving problems in a changing environment. Therefore in order to design an AC that helps by automating tasks and interacting with people, a model of work practice is required that focuses on informal, circumstantial, and localized behaviours in which the task contributions of humans and machines flow together to achieve common goals.

Our poster illustrates just one possible implementation of the AC and in spite of progress in artificial intelligence and other disciplines, there are still many theoretical and practical issues raised in this scenario that need to be considered in order to construct an AC. We hope that our poster stimulates the debate in this area.

For example, the AC will need to be able to understand speech and tone. It must also possess the ability to infer emotional states from verbal (and non-verbal) communication. Therefore natural language capabilities, including mixed initiative dialogue, will provide the AC with the ability to comprehend and generate human-like interactive behaviours. This means that they can cooperate with and be taught by people in a wide range of contexts with ease. The AC will also need to perform many tasks involving real-time cooperation with people and other autonomous systems which may operate at different levels of sophistication and with dynamically varying degrees of autonomy. Therefore, they will require some common means of representing and appropriately participating in joint tasks. The developers of such systems will also need tools and methodologies to ensure that such systems will work together reliably, even when they are designed independently. The idea that the AC can access personal and mission critical information and may be granted control over other systems profoundly changes the nature of security. Whereas security in socio-economic systems fundamentally relies on human beings to be the ultimate resolvers of trust decisions, this may no longer be the case for a truly autonomous crewmember. Therefore, in order to understand how to build such autonomous systems and in order for them to function as members of a team, there is a need to generate a theory of trust and trustworthiness.

We look forward to debating the merits and shortcomings of our approach with others who are interested in the topic, to learn from, change and improve the foundation and practical application of an AC.