Intervening, Teaming, Delegating: Creating Engaging Automation Experiences

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ABSTRACT

Automated systems are becoming common in private, public and professional life. Given their increasing ubiquity and availability to a growing diversity of users, it is important to explore requirements, design principles, and user experience factors across application sectors and scientific disciplines. This workshop provides a forum for researchers and practitioners active in the field of "Automation Experience". In a keynote talk, a poster madness, discussions, and hands-on sessions, the participants will explore and discuss specific opportunities and challenges related to future forms of engagement with an increasing number of automated entities (automations). To this end, the focus topics for the workshop comprise (1) novel ways for monitoring of and intervening with increasingly intelligent agents and artifacts, (2) collaborative interaction to support teaming up and cooperation among humans and automations, and (3) orchestration and delegation of increasingly complex tasks to smart spaces. The results of the workshop are a set of research ideas and drafts of joint research initiatives to drive further automation experience research in a collaborative and interdisciplinary manner.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**.

KEYWORDS

Automation, user experience, engagement, intervention, teaming

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1 BACKGROUND AND GOALS

Automated systems are becoming increasingly common and are transitioning towards self-initiative counterparts, embodied as vehicle cockpits, connected homes, self-checkout machines and manufacturing tools. Supported by artificial intelligence, their capabilities are evolving towards higher human cognitive functions, since they are integrating analysis and decision-making based on large datasets [20]. While there has been a long tradition of research on human factors in automation, scholars have traditionally focused on highly specialized professional work tasks, such as control center operators or pilots. More recently, however, the specific challenge of designing for private use or for professional use with domain experts (who are not necessarily automation technology experts) has been recognized [10].

As has been highlighted in previous research within this evolving field of "Automation Experience" ([1, 2, 12], topics have mostly been revolving around the design for better intelligibility, more intuitive monitoring, ethical aspects, as well as the measurement of engagement and acceptance. With the advent of more flexible and powerful settings of automation, for example collaboration between teams of humans and robots, the question arises how to make also these accessible to non-automation professionals within their everyday contexts. Based on these considerations, this workshop

sets out to investigate novel forms of human engagement with automated technology: (1) monitor and intervene, (2) team up and cooperate, and (3) orchestrate and delegate.

The objectives of the workshop are as follows:

- Explore factors of engagement with automation,
- Discuss major challenges of automation engagement,
- Identify promising future research topics in the form of project ideas and a research agenda,
- Expand a multi-disciplinary network of automation experience researchers

2 CHALLENGES

In the workshop, we will elaborate on challenges related to different forms of human engagement with automated technology:

2.1 Monitor and Intervene

Automation involves transferring tasks from humans to automated systems, which typically reduces human interaction. Since users are no longer actively controlling an automated process, they often cannot respond rapidly when the system needs assistance [24]. The requirements for such control takeover situations will differ between the respective tasks and contexts, such as when driving automated cars [6, 16], managing fleets of automated vehicles in a logistics center [15], or when surveying the quality of an automated manufacturing process [3, 18].

The long-term formation of trust in automation and corresponding design patterns for monitoring and interventions are increasingly provided by the HCI research community [8, 14], but their applicability across other tasks and contexts is not straightforward. Trust in automation systems may be even harder to accomplish when the underlying data is uncertain, such as when it is relying on learned data or digital twins [5]. In this context, ways to communicate the mechanisms defining their behavior and the origin of underlying data have to be presented in a trustable way [4, 13]. When designing for suitable monitoring and interventions, research questions such as the following are to be considered:

- How can non-experts be engaged prior to and throughout their initial encounter with an automated system to the point that they understand its capabilities and potential risks?
- How to create takeover requests that encourage operators to intervene and emphasize possible outcomes?
- How can we encourage sustained interaction with automated systems?
- How can automated interaction be created with gender and diversity in mind, responding to various motivations, competency levels, and realities, and guaranteeing accessibility for all user types?

2.2 Team Up and Cooperate

Automation is often regarded from the point of view of a single operator with a single automation he/she is interacting with. This is particularly salient in ground vehicle automation where the driver is alone and interacting with multiple automations, usually independent. For instance, the Anti-lock Braking System (ABS) in cars prevents drivers from causing the wheels to lock by pressing the brake pedal excessively and this system is fully independent from other ones such as the Lane Assist system (which keeps the car in its lane on the road). In those cases, automations are designed and used as a set of tools exploited by the operators at discretion.

An important challenge that was addressed by the Computer Supported Cooperative Work community in the early 80s was the fact that work is often performed by a group of operators with dedicated roles including authority and responsibilities. Design groupware systems thus required the identification of these roles and associated attributes. Integrating automation in that context brings similar problems of role identification and designing interaction with automation requires going beyond the basic-tool paradigm, to the interactive-tool paradigm and even to the partner paradigm [7]. Beyond these levels, more complex paradigms may be considered including users-automation teaming (known as Human Automation Teaming which has been around for a long time [19] but still of interest [9] or automation leaderships (as well as user leadership) [25]. Engaging users in cooperations poses specific interesting research challenges such as the following:

- How to design for overall reliability of human-automation teams?
- How to support development of trust in these assemblies?
- How to ensure and support the well-being of the human operators?
- How to deal with authority and responsibility in human-automation teams?

2.3 Orchestrate and Delegate

Acceptance and adoption of smart spaces in daily life depend on their ability to obtain an engaging orchestration among a wide set of connected objects and services [17]. Existing solutions to define the behavior of such Internet-of-Things (IoT) ecosystems range from systems that grant users complete control for establishing the joint behavior of smart objects to solutions that automatically define smart objects behavior by exploiting intelligent techniques. In this continuum, different technologies, frameworks, and approaches present different levels of user control and automation [21]. Besides user-driven orchestration approaches for smart homes, for example, we also observe increasing endeavors to delegate formerly manual office tasks to digital assistants. Modern approaches for non-developers to automate workflows include *Robotic Process Automation* (cf.[22]) and *Low Code* (cf. [23]) tools.

It is not only important for users to configure and monitor the automations, but also to make them more suitable to their needs. Current solutions for this purpose are based on visual apps with conceptual representations of possible automation elements. However, they tend to be static, abstract and detached from the user's real context. One important research topic is to explore the opportunities of various innovative interaction technologies (e.g., chatbots, augmented reality, embodied robots) and their impact on the ease of automation configuration and monitoring, as well as on relevant user experience factors. Research questions to be addressed with regard to orchestration and delegation include:

- How to stimulate users to think about automations that orchestrate nearby objects and relevant services on the cloud?

- How to feel in control and manage conflicts between automations generated by AI-based systems and those created by users?
- How to support the serendipitous creation of novel orchestrations?
- Which role does diversity of users play when offering them features for orchestration and delegation?

3 ORGANIZERS

The members of the organization team cover the wide spectrum of user-centered automation research. They have previously organized successful in-person and online workshops on various topics of user experience, as well as automation in everyday life, transport, and safety-critical applications (e.g., CHI, MobileHCI, AutomotiveUI). Furthermore, several members of the team are experienced workshop and conference chairs (e.g., MobileHCI, HRI, AutomotiveUI, Persuasive).

- **Peter Fröhlich** (main contact) is a Senior Scientist at AIT Austrian Institute of Technology, Center for Technology Experience. He investigates automation experience phenomena in industrial production, autonomous driving, smart home environments and industrial production.
- **Matthias Baldauf** is a Professor for Business Informatics at the Eastern Switzerland University of Applied Sciences in St.Gallen. He leads user-centered projects in the domain of human-automation interaction in smart manufacturing and office workplaces.
- **Philippe Palanque** is a Professor of Computer Science at the University of Toulouse III. His research focuses on interactive systems design, development, certification and deployment in various safety critical contexts (e.g., aircraft cockpits, satellite workstations).
- **Virpi Roto** is a Professor of Practice in Experience Design at Aalto University. She studies the means to design automation that improves user experience, for example, in maritime and industrial contexts.
- **Fabio Paternó** is Research Director at C.N.R.-ISTI in Pisa. His research interests include user experience aspects of ubiquitous interactive systems, end-user development, and adaptive user interfaces.
- **Wendy Ju** is an Associate Professor at Cornell University. Her work in the areas of human-robot interaction and implicit interaction highlights the ways that interactive devices can communicate and engage people without interrupting or intruding.
- **Manfred Tscheligi** is a Professor for HCI and Usability at the University of Salzburg (heading the newly formed Department oof Artificial Intellgence and Human Interfaces) and Head of the Center for Technology Experience at AIT Austrian Institute of Technology in Vienna. He leads a variety of research projects investigating automation experience in various contexts (e.g., intelligent production, driving, robotics, and retail).

4 WEBSITE

The website http://everyday-automation.tech-experience.at/ will include the workshop description and goals, call for papers and suggested topics, detailed workshop schedule, ways to get involved during the workshop, and information about the organizers.

5 PRE-WORKSHOP PLANS

The workshop will be announced through well-known HCI related mailing lists (CHI Announcements, Ubicomp Announcements, etc.) and suitable websites. Furthermore, we will send out personal invitations to contact our scientific network directly, e.g., former participants and organizers of prior related workshops. All promotional material will include a link to the workshop website. We will solicit position papers of up to 6 pages (incl. references) in the ACM Master Article Submission Template that describe the participants' workshop contributions. Suitable contribution types include work in progress, concrete research ideas, novel perspectives, and demos that are addressing research questions of the described challenges or complementary pressing issues related to automation engagement.

The organizing committee will review and select submissions based on their relevance to the workshop scope, originality, significance, and quality. We plan to accept 15-20 submissions which will be published on the workshop website before the workshop. In addition, authors of accepted papers will create virtual posters made available online as well (see 8.1.2).

6 ACCESSIBILITY

Authors of accepted position papers will be encouraged to make their papers accessible. During the preparation of the camera-ready papers, the organizers will support the authors with tips on tagging the documents, adding alternative texts for figures, defining tab orders, etc. To further ensure the accessibility of the workshop for people with impairments, we will consider real-time subtitles and/or transcripts of the video conference dependent on the participants' requirements.

7 ASYNCHRONOUS ENGAGEMENT

Asynchronous engagement for participants with technical or accessibility issues will be supported through several activities before and after the workshop. We will publish the participants' position papers on the workshop website one week before the workshop. In addition, a link to a *Miro* board with virtual posters will be shared and allow for priorly familiarizing with all the participants' contributions. Offering these materials in advance, allows for preparation and engagement by participants with limited proficiency in English or bandwidth-limited internet connections (and potential problems in an online meeting). After the workshop, all material created during the workshop will be published on the website for subsequent asynchronous access.

8 WORKSHOP FORMAT AND STRUCTURE

Our workshop is arranged as a one-day workshop with a duration of about six hours. We plan for a hybrid setup involving both physically present and remote participants (via Zoom, Jabra Speakers, and an external webcam) in an interactive manner. The schedule accommodates the hybrid setup, e.g., by longer breaks than in a

merely in-person workshop. Table 1 shows an overview of the preliminary workshop schedule.

8.1 Morning Session

The morning session of the workshop comprises a keynote, poster presentations, and discussions.

8.1.1 Introduction and Keynote. The organizers will kick off the workshop by welcoming the participants, introducing the workshop topic, and explaining the main workshop goals. Furthermore, they will briefly introduce themselves, followed by an introduction round of all participants. In the keynote talk "Interaction Intelligence for Human Interaction with Automation", workshop co-organizer Wendy Ju will give an overview of the core challenges and her recent research on designing engaging automation experiences.

8.1.2 Poster Madness. Participants will be asked to prepare compact virtual posters for their workshop contributions on a collective *Miro* board. The posters will be clustered and scheduled thematicwise by the organizers before the workshop. In two "poster madness" sessions, the participants then will present their recent work using these posters. Depending on the number of participants, we will restrict the presentation length to a duration of 5 to 8 minutes. We deliberately opted for this format to encourage quick-paced visual presentations, to allow easily referring back to participants' work in later workshop sessions, and to make the participants' contributions available in an interactive attractive format. In addition, participants can easily add remarks, questions, and suggestions as post-its attached to the virtual posters.

8.2 Afternoon Session

The afternoon session consists of collaborative group tasks, a results presentation and discussion in the plenary, and a wrap-up by the organizers.

8.2.1 Eliciting Themes and Ideation. Having introduced and discussed their recent relevant work, participants will identify common themes, research questions, and methodological approaches on designing, assessing, and measuring engaging automation experiences. The organizers will guide and support this process on the collective *Miro* board with polling features. Some example themes will be provided by the organizers to kick-start the eliciting phase. Group forming will take into account the participants' location for efficient collaboration, i.e., we will try to compose in-person groups who physically work together at the conference location and remote groups who discuss online in Zoom break-out rooms. For the groups of in-person participants, we will provide physical material (paper sheets, colored pens, post-its, etc.). For the online groups, we will prepare further digital white boards for collaborating remotely. To foster knowledge and idea exchange between the groups, we will use a "World Café"-like phase where participants are encouraged to visit other groups (either physically or by joining one of the remote groups via Zoom) and discuss their interim results. The results of this group work can be research ideas and drafts of (joint) research projects.

8.2.2 Group Presentations and Wrap-Up. Finally, the on-site and remote groups will meet again in the plenary to present the results of their discussions. All participants are asked to comment on the research ideas and jointly improve these research plans. Finally, the organizers conclude the workshop by drawing an agenda for further research and initiatives based on the created ideas. As far as possible, we will identify required complementary research communities, time frames, and funding programs and project types during this activity. Plans for a dedicated programmatic publication will also be drawn up at this time.

9 POST-WORKSHOP PLANS

The workshop documentation and results will be made available through the workshop website. This includes photos and screenshots of the interactive sessions, the (analog and digital) posters, and plans for future initiatives. For increased visibility and long-term archival, we aim to publish the participants' position papers through CEUR Workshop Proceedings.

Furthermore, we will contact potential venues for a special journal issue or a magazine article on the workshop contributions and outcomes. One suitable example is the journal on "Personal and Ubiquitous Computing" where several workshop organizers edited a theme issue on "Everyday Automation Experience" [11]. In addition, together with interested participants, the organizers will discuss opportunities for related workshops at suitable conferences to extend the discussions of this workshop (e.g., MobileHCI, UbiComp).

10 CALL FOR PARTICIPATION

Automated systems are becoming increasingly common and transitioning towards active communication partners, embodied as vehicle cockpits, connected homes, self-checkout machines and manufacturing tools. With the advent of more flexible and powerful settings of automation, for example collaboration between teams of humans and robots, the question arises how to make also these accessible to everyday usage scenarios. This workshop sets out to investigate different forms of human engagement with automated technology in various domains: (1) monitor and intervene, (2) team up and cooperate, and (3) orchestrate and delegate.

Participants are asked to submit a position paper describing their relevant recent or future work. Topics of interest include but are not limited to

- Communicating capabilities and risks of an automated system prior to its usage
- Creating efficient takeover requests that encourage operators to intervene and emphasize possible outcomes
- Encouraging sustained interaction with automated systems
- Designing for overall reliability of human-automation teams
- Supporting the development of trust in human-automation cooperation
- Ensuring and supporting the well-being of human operators
- Dealing with authority and responsibility in human-automation teams
- Enabling serendipitous automations by non-professionals through intuitive orchestration approaches
- Feeling in control and managing conflicts between AI- and user-generated automations

Table 1: Preliminary schedule for a hybrid workshop format.

Time	Phase (details in text)	Methods and tools for hybrid setup
08:30 - 09:00	*Arrival of participants*	Preparation for tech troubleshooting
09:00 - 09:15	*Welcome and introduction*	Video conferencing/streaming in plenary
09:15 - 09:35	*Participants introduction*	Video conferencing/streaming in plenary
09:35 - 09:55	*Keynote by Wendy Ju*	Video conferencing/streaming in plenary
09:55 - 10:10	*Coffee break*	Virtual break-out room for (off-topic) chat
10:10 - 11:00	*Poster madness 1*	Video conferencing/shared virtual poster boards
11:00 - 11:10	*Coffee break*	Virtual break-out room for (off-topic) chat
11:10 - 12:00	*Poster madness 2*	Video conferencing/shared virtual poster boards
12:00 - 13:30	*Lunch Break*	-
13:30 - 13:50	*Eliciting Themes*	Hybrid discussion, polling tool, forming of smaller groups
13:50 - 14:35	*Ideation Session*	On-site group work (posters), virtual break-out rooms (collaborative whiteboards),
14:35 - 15:00	*Hybrid world-cafe*	Switching groups (on-site and remote) for discussion
15:00 - 15:20	*Coffee break*	Virtual break-out room for (off-topic) chat
15:20 - 16:00	*Group presentations*	Video conferencing/streaming in plenary
16:00 - 16:30	*Future work and wrap-up*	Video conferencing/streaming in plenary
evening	*Joint workshop dinner (opt.)*	-

Papers must be formatted according to the ACM Master Article Submission Template and comprise up to 6 pages (incl. references). Papers must be submitted in PDF format (non-anonymized) to https://easychair.org/conferences/?conf=automationxp23. The submissions will be reviewed by the organizers based on relevance, originality, significance, and quality. Upon acceptance, at least one author of each accepted paper must attend the workshop. Important dates:

- Position paper deadline: February 14th, 2023
- Acceptance notification: March 1st, 2023
- Workshop date: April 23th, 2023

Website: https://everyday-automation.tech-experience.at

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