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Matthias Baldauf, Peter Fröhlich, Virpi Roto, Philippe Palanque, Siân E. Lindley, Jon Rogers, Wendy G. Ju, Manfred Tscheligi

► To cite this version:

Matthias Baldauf, Peter Fröhlich, Virpi Roto, Philippe Palanque, Siân E. Lindley, et al.. Engaging with Automation: Understanding and Designing for Operation, Appropriation, and Behaviour Change (Extended Abstract). Conference on Human Factors in Computing Systems (CHI 2022), ACM SIGCHI: Special Interest Group on Computer-Human Interaction, Apr 2022, New Orleans, LA, United States. pp.1-6, 10.1145/3491101.3503735 . hal-03855009

HAL Id: hal-03855009

<https://hal.science/hal-03855009>

Submitted on 18 Nov 2022

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Engaging with Automation: Understanding and Designing for Operation, Appropriation, and Behaviour Change

Matthias Baldauf
Eastern Switzerland University of
Applied Sciences
St.Gallen, Switzerland
matthias.baldauf@ost.ch

Peter Fröhlich
AIT Austrian Institute of Technology
Vienna, Austria
peter.froehlich@ait.ac.at

Virpi Roto
Aalto University
Espoo, Finland
virpi.roto@aalto.fi

Philippe Palanque
Université Paul Sabatier - Toulouse III
Toulouse, France
palanque@irit.fr

Siân Lindley
Microsoft Research
Cambridge, United Kingdom
sianl@microsoft.com

Jon Rogers
Northumbria University
Newcastle upon Tyne, United
Kingdom
jon.rogers@northumbria.ac.uk

Wendy Ju
Cornell University
New York, USA
wendyju@cornell.edu

Manfred Tscheligi
University of Salzburg
Salzburg, Austria
AIT Austrian Institute of Technology
Vienna, Austria
manfred.tscheligi@sbg.ac.at

ABSTRACT

Automation has been permeating our everyday lives in various facets. Given both the ubiquity and, in many cases, the indispensability of ubiquitous automated systems, creating engaging experiences with them becomes increasingly relevant. This workshop provides a platform for researchers and practitioners working on (semi-)automated systems and their user experience and allows for cross-discipline networking and knowledge transfer. In a keynote talk, paper presentations, discussions, and hands-on sessions, the participants will explore and discuss user engagement with automation for operation, appropriation, and change. The results of the workshop are a set of research ideas and drafts of joint research projects to drive further automation experience research in a collaborative interdisciplinary manner.

KEYWORDS

Automation, user experience, engagement, appropriation

Automation: Understanding and Designing for Operation, Appropriation, and Behaviour Change. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '22 Extended Abstracts)*, April 29-May 5, 2022, New Orleans, LA, USA. ACM, New York, NY, USA, 6 pages. <https://doi.org/10.1145/3491101.3503735>

1 BACKGROUND AND GOALS

From consumer electronics in our households over assistive functions in cars to automated processes at work: we all are confronted with an increasing number of automated appliances in everyday contexts. While the inherent purpose of automation systems is to relieve humans of performing interaction tasks, they still necessitate different forms of engagement of the humans meant to live with them. In fact, one of the best known ironies of automation is that it requires human involvement (e.g., in the presence of automation degradation or failures), even though it is meant to decrease it [2, 14]. Designers thus have to think about ways to engage and train the target operators, users, and customers to be introduced appropriately before system use, they have to entice them to intervene at the right time with the right behavior, and they need to think about long-term usage retention.

Beyond these aspects of system operation, the growing autonomy of systems will increasingly enable them to “decide” when and how to take initiative and what to communicate to users. Naturally, the ways how this communication is realized can influence overall attitudes and behaviors of users. For example, automated energy feedback systems already now provide customer engagement to household owners [23], and social networks have sophisticated means of enticing communication behaviors [24].

Acceptance of a technology is the basic step towards engagement [8]. User engagement has been a topic (often implicitly) addressed in Human-Computer Interaction [7, 15], and related fields like Persuasive Technology [11] have their own tradition. However,

only recently efforts for a comprehensive conception, abstraction, and measurement of user engagement have been started [9]. While the conceptualization of human usage in increasingly autonomous and intelligent technology has progressed in recent years, the multifaceted roles for user engagement have so far not been reflected in enough depth.

Whereas previous CHI workshops on “Automation Experiences” focused on cross-domain knowledge transfer and consolidation [13] and working contexts [3], this workshop sheds light on the interplay of engagement and automation. We explore three levels of engagement with automation: (1) engagement for operation (how can users be enticed to consume, monitor and operate an automated system in a contextually suitable way?), (2) engagement for appropriation (what are recommendable ways to actively appropriate the automated system for own purposes?), and (3) engagement for behavior change (how can increasingly autonomous systems take initiative to entice humans for attitude and behavior change?). Based on these considerations, the conceptual understanding of automation experience and contextual engagement will be advanced, which eventually will result in a design space for engaging with automation systems.

The overall objective of this workshop is an exploration of the interplay of engagement and automation from a multi-disciplinary perspective. In line with this overall goal, it will pursue the following sub-goals:

- Uncovering the dimensions of automation engagement,
- Reflecting on major challenges of automation engagement,
- Identifying promising future research topics in the field of automation experience in the form of project ideas and a research agenda,
- Forming a multi-disciplinary network of automation experience researchers.

2 CHALLENGES

In the workshop, challenges with regard to three levels of engagement with automation are discussed.

2.1 Engage for Operation

Automation is about transferring some tasks from humans to the systems, which typically decreases the need for interaction. As described above, the irony of this development is that users are no longer engaged with the automated process, and are thus not able to act quickly when the system needs help. This is a major challenge, e.g., with autonomous cars that may need a human to quickly take over in surprising circumstances [4, 16]. Similarly, other automated appliances in our everyday surroundings might prepare their users for manual interventions as well.

Engagement for operation might also mean emotional engagement with interactive systems [9]. User experience research grew from the need to study emotional aspects of technology use, and we now know that interactive systems can make life more enjoyable and meaningful. However, we know too little about the means to engage users of highly automated systems. In short term, engaging operation refers to enjoyable interaction with automation without having to worry about breaking the intelligent system. Therefore, transparent and explainable automation is a burning

challenge also from the emotional perspective. In the long term, businesses are worried about consumer products losing their emotional engagement power once consumers no longer interact with them. Less engagement means also less loyal customers and less recommendations of the products to potential customers.

Research questions around the above topics include:

- How can non-experts be engaged before and during their first encounter with an automated system to a level that they comprehend its capabilities and potential risks?
- How to design take over requests that entice operators for interventions and highlight potential consequences?
- How to support long-term engagement with automated systems?
- How can automated engagement be designed in a gender and diversity sensitive manner that responds to differing motivations, competency levels and realities and ensures accessibility for different types of users?

2.2 Engage for Appropriation

With the increasing penetration of automated services and processes in everyday life, special attention needs to be put on ways to appropriate them for the personal private or working context. Following established heuristics and guidelines regarding control and flexibility [20], opportunities for customization and personalization might not only result in efficiency gains but also help to create meaningful relationships and engaging experiences with automation.

This form of appropriation and customization of automated services might occur in various forms: users might choose between varying levels of automation support, re-orchestrate an automated workflow, or contribute their expert knowledge to improve an automated service, for example. The impact of such adaptation opportunities on the users' automation experience as well as how to design for them are unclear.

Besides the adaptation of existing automated processes, even the entire creation of automated workflows and services is possible for non-programmers. Driven by intense research on so-called “end-user development” [21], several technical solutions have been reaching the mass-market. In addition to trigger-action approaches (“if, then”-style rules) [17, 25], low-code programming platforms (software creation through graphical user interfaces) and robotic process automation (recording and playing back a user's actions in a graphical user interface) have been gaining interest in industry recently. While related prior research has been investigating and proposing various approaches for enabling the creation of automated workflows for non-programmers [18], HCI research on such recent trends has just been starting (cf. [26, 27]) and little is known about the impact of the user's contribution to the overall automation experience.

Research questions regarding the user-driven adaptation and creation of engaging automated workflows include:

- What are users' requirements regarding the adaptation of automated processes and how to address and design for them in different domains?
- What impact has the adaptability of automated processes on the user's automation experience?

- How can automated processes be tailored joyfully by non-expert users?
- How can users contribute their tacit knowledge to automated processes?

2.3 Engage for Behavior Change

With rising levels of automation, systems are taking initiative in the communication with their users and thereby can increasingly influence behaviors. Promising examples of engagement for behavior change are efforts to further more sustainable energy consumption via energy management applications [23], approaches to influence mobility towards more sustainable patterns [6], or applications to support physical and mental health [19]. Automated influence, however, has also raised concerns in the ethics and policy literature, with regard to privacy in targeted advertising, autonomy in health nudges, or economic harm in dark patterns [24].

Designing such automation-based engagement systems requires careful consideration of a range of important questions among which are the given contexts within which a system will try to engage, variations in user requirements and barriers that will play a role in success and failure including underlying motivation to be engaged and expected benefits, flexibility parameters of users, and how these connect with specific user characteristics [1, 5]. While a considerable body of behavior change theory and suggestions for integrating them in design is available [10], these are mostly restricted systems with classical user interaction levels, such as decision support systems, recommender systems, and gamification. So far, the discussion of HCI challenges for highly automated influencing systems have mostly been restricted to certain domains, such as embodied persuasive technologies (e.g. social robotics and virtual coaches). Taking up the scattered available research results from different research areas, we aim to systematically address the role of automation and engagement for behavior change.

Related research questions include:

- How to define the right level of automation to reach users with interventions?
- How can engaging automation be designed in an ethically aware manner, enabling for a transparent behavioral goal definition and validation?
- How to prevent reactance with regard to behavioral recommendations issued by automated systems?
- What are the interaction design practices to ensure automation integrity in different types of projects and contexts?

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).

- **Matthias Baldauf** (main contact) 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.

- **Peter Fröhlich** is a Senior Scientist at AIT Austrian Institute of Technology, Center for Technology Experience. He investigates automation experience phenomena in industrial production, autonomous driving, and smart home environments.
- **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.
- **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).
- **Siân Lindley** is a Principal Research Manager at Microsoft Research in Cambridge. She investigates human-AI collaboration in the context of enterprise knowledge applications, with a specific focus on sense-making, content reuse and remix, and cross-application workflows.
- **Jon Rogers** is Professor of Design at Northumbria School of Design. Previously he held a personal chair in Creative Technology at the University of Dundee and is a senior research fellow at the Mozilla Foundation. His work explores the human intersection between digital technologies and the design of physical things.
- **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 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 (<https://matthiasbaldauf.com/automationxp22>) 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.

6 ASYNCHRONOUS ENGAGEMENT

Besides the position papers made available online before the workshop, we will also publish participants' presentation material in advance to allow for preparation and engagement by participants with limited proficiency in English or bandwidth-limited internet connections (and potential problems in an online meeting). In addition, all material created during the workshop will be published on the website as well for subsequent asynchronous access.

7 WORKSHOP 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 workshop program comprises a keynote, paper presentations, discussions, and hands-on sessions. Large portions of the workshop are reserved for collaborative and creative tasks. 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.

7.1 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 a keynote presentation, Virpi Roto [22] will give an overview of recent work in the field of engaging automation experiences and motivate the three core challenges.

7.2 Paper Madness

We plan for two "madness sessions", where participants briefly introduce their recent work on engaging automation experiences in quick-paced presentations. Submitted position papers will be clustered and scheduled thematic-wise by the organizers before the workshop. Depending on the number of participants, we will restrict the presentation length to a duration of 5 to 10 minutes. However, the presentation format and material (slides, posters, sketches, prototypes, etc.) will be left to the participants to create a dynamic, creative, and diverse workshop atmosphere.

We will prepare a shared document for joint note-taking during the presentations by both the in-person and remote participants. These notes are supposed to provide inspiration for the following group work and the advancement of the position papers by the authors.

7.3 Creative Group Work

Having introduced and discussed their recent relevant work, participants will work on selected challenges of engaging automation

experiences collaboratively. They will propose topics for this group work themselves, complemented by topics prepared by the organizers. The definition and selection of challenges as well as the group finding will be supported through an online poll.

Participants will then break up into groups. Aiming at a productive collaboration in a hybrid setup, we will try to form groups of physically present participants and online groups of remote participants (through break-out rooms in Zoom). Groups of in-person participants will be provided with physical material (paper sheets, colored pens, post-its, etc.). For the online groups, we will prepare digital white boards (Miro) 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 are research ideas and drafts of (joint) research projects.

7.4 Group Presentations and Wrap-Up

Finally, the groups will present their results to the plenary in short presentations. 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.

8 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, as well as a summary of the envisioned research agenda, and future initiatives. For increased visibility and long-term archival, we aim to publish the participants' position papers at 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" [12]. 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).

9 CALL FOR PARTICIPATION

Automation has been permeating our everyday lives in various facets, from consumer electronics in our households over assistive functions in cars to automated processes at work. Given both the ubiquity and, in many cases, the indispensability of such automated systems, creating engaging experiences with them becomes increasingly relevant. This workshop provides an interdisciplinary forum for researchers and practitioners working on (semi-)automated

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

Table 1: Preliminary schedule for a hybrid workshop, easily adaptable for both a solely on-site or virtual workshop.

systems and their user experience. In a keynote talk, paper presentations, discussions, and hands-on sessions, the participants will explore and discuss user engagement with automation for operation, appropriation, and behavior change.

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

- Engagement of non-experts during first encounters with automated systems
- Engaging humans in dynamic work collaboration between humans and machines
- User requirements regarding the adaptation of automated processes
- Support for long-term engagement with automated systems
- Design of take-over requests for various types of automated systems
- Customizing and tailoring of automated systems by non-expert users
- Impact of the adaptability of automated processes on the user's automation experience
- Ensuring automation integrity in different contexts

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=automationxp22>. 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, 2022
- Acceptance notification: March 1st, 2022
- Workshop date: April 30th, 2022

Website: <https://matthiasbaldauf.com/automationxp22>

ACKNOWLEDGMENTS

This work is in part supported by the projects *AWARD* (EU Horizon 2020, 101006817), *VA-PEPR* (SNF Sinergia, CRSII5_189955), *Sea4Value* (Business Finland, 81/31/2020), and *Cultural Differences in Driving Interaction* (National Science Foundation, 2107111).

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