Automation Experience at the Workplace

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ABSTRACT

Automation is transforming traditional workplaces and work processes tremendously. While automated systems are no longer restricted to manufacturing environments but pervade various work domains in manifold appearances, automation initiatives and research are still driven from a technology and performance perspective. The goal of this workshop is to provide an interdisciplinary forum for automation-focused user experience research. It will bring together researchers and practitioners from different disciplines to create and transfer knowledge on automation experiences of skilled workers and professionals at workplaces across domains. In a keynote talk, participant presentations, and the group-wise drafting of research ideas, the workshop will address three recent main challenges: encountering workplace automation, collaborating as well as building meaningful relationships with workplace automation. The outcome of this workshop will be a research agenda consisting of ideas for promising future research on automation experiences at the workplace.

CCS CONCEPTS

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

KEYWORDS

Automation, user experience, human-automation collaboration

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1 BACKGROUND

Automation pervades manifold workplaces taking up an increasing part of human tasks and transforming work dramatically. It emerges in different appearances (e.g., from scripted tasks over digital agents to physical robots) with various scopes (e.g., (home) office, production, maintenance). However, the future of work has raised a lot of discussions. The International Labour Organization has chosen human-centered future of work as the main theme of their centenary declaration [21], and the EU High-Level Expert Group on Artificial Intelligence calls for research on human-centered AI at work [26]. An ethical and human-centered perspective to automation also outside the workplace is much needed. For instance, IEEE makes a strong statement of prioritizing human well-being in the design of autonomous and intelligent systems [20]. The CHI community should contribute to the implementation of these initiatives, but so far, publications focusing on user experiences of automated systems at work are scarce [28].

Various recommendations and guidelines have been proposed to design automated systems (e.g., [2, 27, 36]), but their generic nature calls for customization when specific interactive systems have to be designed, engineered, and deployed in the real context. This customization of generic guidelines will make it possible for designers to address the fact that those technologies are being deployed in very different contexts (e.g., satellite ground segment workstation, home) with very different types of users (e.g., aircraft pilots, Netflix users) focusing on different and usually conflicting properties (e.g., dependability, user experience). A previous CHI workshop on

"Automation Experience across Domains" [14] addressed this broad scope of automation.

This workshop focuses on skilled workers and professionals who increasingly encounter new forms of automation in specialized and demanding workplace environments. Taking a human-centered perspective, opportunities and challenges for establishing effective forms of collaboration and for building up meaningful relationships with automated systems are explored. In line with this overall goal, it will pursue the following sub-goals:

- Share knowledge about human-centered design and user experience of automation in specific workplace contexts.
- Understand users' needs in collaboration with automation in different work contexts and roles.
- Reflect on major challenges of designing interactions and collaborations with (semi-) automated systems at different workplaces and discuss ways to address them.
- Exchange ideas to enable knowledge transfer regarding design strategies for automation at workplaces.
- Identify promising future research topics in the field of automation experience at workplaces in the form of project ideas and a research agenda.
- Form a network of work-automation-experience researchers.

2 CHALLENGES

The workshop is going to address the following pressing human-oriented challenges in the field of automation at workplaces.

2.1 Encountering Workplace Automation

In most workplace environments, people need to familiarize themselves with an increasing number of systems that have intelligent, automated functions. For example, office workers get suggestions by workforce automation software on when to provide certain reports and can make use of quality pre-checks. In logistics and production sites, workers are surrounded by an increasing number of special stationery and moving machinery that behave autonomously but require interventions and "appropriate behaviors" by their human counterparts. Many of these interactions will not anymore be continuous and manual, but more implicit [33] and at the periphery of attention [4]. The resulting challenge is to design intelligibility cues that provide information about the awareness and intent of such systems. Also, in order to avoid under- or overtrust, systems should provide real-time information on the reliability of those systems [32]. Design patterns and experiences about trust formation for reliability displays have been started to be gathered for certain industrial use cases, but more validation and consolidation is necessary [24].

In the work context, people will be confronted with more than one automated process or system in their digital landscape, which renders requirements even more complicated. To facilitate situational awareness and to reduce cognitive load, concepts for orchestrating displays and interactions have to be conceived, taking into account the full design space (cf. [6]) and modalities (cf. [12]). This research should also get inspired by investigations of the long-term appropriation and acceptance of automated systems in complex workplaces and smart factories [37].

When it comes to first time usage and configuration, we also need to consider that with the introduction of such automation functions in various workplace contexts, most affected people will not be experts in computer science, let alone control theory and artificial intelligence. This means that, in order to tailor such systems to the usage context, end-user customization approaches have to be provided that allow for efficiency optimizations and personal preferences settings, but that do not hinder the correct functioning of the system [13].

In line with these challenges, in this workshop, we aim to discuss the following research questions:

- How can workers obtain an initial understanding of the reasoning and the reliability of automated processes in their workplace surroundings?
- Which styles of communication should be used to convey the automation state at specific workplaces?
- How to enable people at the workplace with no or little programming skills to customize the behavior of a system?
- How to adequately capture and theoretically frame automation experiences at the workplace that are encountered unobtrusively?

2.2 Collaborating with Workplace Automation

Recently, the role of human workers in automated work environments has been starting to evolve from operators of (semi-) autonomous systems to collaborators. In particular, this shift can be observed in the manufacturing domain where so-called "cobots" (collaborative robots) started directly assisting human workers in close proximity [18]. Similar developments can be expected for other work domains and appearances of automation such as virtual agents collaborating seamlessly and efficiently with human office workers (cf. [11]), for example. The creation of respective collaboration experiences, among others, includes the design of interactions suitable for the current work context and the agent's pro-active behavior and assistance considering the user's current work activities and emotional and physiological state (cf. [1, 3]).

With the increasing intelligence of automated systems, their capabilities will not be restricted to take over simple repetitive tasks, yet allow to assist in complex and creative tasks [10]. Thus, the distribution of work (sub)tasks between human workers and automated systems needs to be reconsidered. Task assignment may be no longer predefined and static, yet may become dynamic and happen during the workflow, initiated by both humans and machines, to best utilize available capabilities and resources [7].

This increased flexibility will allow workers to identify tasks to be automated and even (explicitly or implicitly) teach the corresponding systems themselves. We observe first respective appearances at office workplaces in the form of "robotic process automation" (RPA) [19], where RPA systems observe a worker's actions in a graphical user interface and repeat his or her steps. Researchers have started to investigate general frameworks for transforming human-executed routines into robot-automated routines [29], yet studying the worker's perspective of such transformations falls short (cf. [34]). While concepts such as "programming by demonstration" [9] have a long history, knowledge about workers' attitudes towards sharing their tacit knowledge with non-human

collaborators in modern working environments and corresponding best practices is scarce, for example.

Research questions regarding human-automation collaboration experiences include:

- How should we design autonomous systems for efficient assistance of workers?
- How to enable and support (dynamic) work task distribution between humans and machines?
- How to support workers in automating selected work tasks themselves?
- How can workers share their tacit work knowledge and train machines themselves?

2.3 Building Meaningful Relationships

Work forms a major part of life, and the extent to which it provides meaningful experiences is a major determinant for overall well-being [16]. Important related needs are to feel successful in the job, the presence of challenges that are interesting to solve and lead to meaningful contributions, good relationships to colleagues, and pride to be part of the organization. While many aspects influence these meaningful experiences at work, there are various opportunities for technology and automation to shape them. Today, however, it is rare to set experience goals [22] for automation design, but design goals are about pragmatic aspects such as efficiency and safety. Unlike the current efficiency-oriented understanding of automation that is focused on avoiding supposedly unwanted chores, a more humanistic perspective might foster well-being by shaping enjoyable and meaningful experiences [17, 23]. This humanistic perspective should also incorporate ethical principles [8], which should eventually result in a contextualization for various forms of future work automation [35].

Technology in its progression towards high levels of autonomy [30] has the potential to influence human feelings of agency and control and consequently can impact meaning and satisfaction at work. One phenomenon that tends to be promoted by higher degrees of system autonomy is that people perceive systems more as a social entity rather than a tool [25], due to their opacity, proactivity and limited predictability. This can evolve towards new qualities of "Human-Machine-Teaming" between groups of human and autonomous systems [36], but the realization of opportunities is so far unclear. Even if automated systems induce a sense of relationship in the workplace, they are fundamentally different from humans when it comes to social aspects. For example, an autonomous system will not "feel" competent, when succeeding in a task. In human-human cooperation, a person might enjoy the successes of a colleague and can derive social value from it, such as pride or enjoyment of the others' gratefulness. In human-automation relationships, the autonomous counterpart has no own feelings, such as gratefulness, that a human could refer to. Therefore, the design of autonomous systems should consider these differences to fulfill humans' social needs in the workplace.

Corresponding research questions to be addressed in the workshop include:

- How can meaningfulness be conceptualized, and how can it be defined as design goals for automated systems?
- How should human-automation teaming be designed to lead to a fulfilling and meaningful work setting?
- How can we design automated systems with an appropriate efficiency-user satisfaction trade-off?
- What social attributes should we design in autonomous systems to create a meaningful experience at work?

3 ORGANIZERS

The members of the organization team cover the wide spectrum of automation experience research and user experience research at workplaces. 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.
- **Shadan Sadeghian** is a postdoctoral researcher at the University of Siegen in Germany. Her research focuses on designing user interfaces in automated vehicles and automated systems in production context.
- **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.
- **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.
- **Lynne Baillie** is a Professor of Computer Science and Robotics at Heriot-Watt University. She and her team have developed wireless and robotic systems which have created new opportunities for interaction to assist people in the workplace and for physical rehabilitation.
- **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/automationxp21) 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 participant's workshop contribution. 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 experiences at workplaces.

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. Furthermore, we will make participants' presentation slides available online before the workshop to allow for preparation by participants with limited proficiency in English or bandwidth-limited internet connections (and potential problems in an online meeting, see below).

6 WORKSHOP STRUCTURE

The workshop comprises paper presentations, discussions, and hands-on sessions. Table 1 shows an overview of the preliminary workshop schedule. Since CHI'21 will not be held physically, we will run the workshop in an online format using *Zoom*. Over the last few months, many researchers have been using Zoom frequently and thus we expect many participants to be familiar with the tool (for others we offer a dedicated preparation and training session just before the workshop). Dependent on the number of interested researchers, we will consider streaming this Zoom session to *Youtube* to reach a broader audience.

All workshop organizers have experience in running academic workshops with online participants (e.g., [15, 31]). Both the schedule and the activities of the workshop take the special requirements of such an online setting into account (e.g., 4.5 hours overall length, shorter phases, additional breaks).

Following the workshop opening by the organizers and a short introduction round of the participants, Philippe Palanque [5, 7, 27, 28] will give a keynote to introduce the history and current research challenges of automation experience a the workplace. His talk will provide a common ground for further discussions and inspiration for the later creative working session.

Afterwards, the participants will present their recent work in the field of automation experience at workplaces in two sessions. To create a quick-paced, inspiring, and engaging atmosphere, presenters will be asked to prepare Pecha Kucha-style live presentations (fixed number of slides with a fixed number of seconds of commentary per slide). The concrete duration and number of slides will be defined as soon as the number of presenters is known. Each paper session will close with a short group discussion to address emerging issues, identify common subf 2.4694 and( ) presenters concrete emerging commonp

Time	Phase (details in text)	Method/Tools
12:30 - 13:00	*Arrival of participants*	Preparation, tech troubleshooting
13:00 - 13:10	*Welcome and introduction (all organizers)*	Video conferencing in plenary
13:10 - 13:25	*Participants introduction*	Shared live online presentation
13:25 - 13:40	*Keynote by P. Palanque*	Online talk
13:40 - 13:50	*Break*	Break-out room for (off-topic) chat
13:50 - 14:35	*Paper madness, session 1 (chaired by M. Baldauf)*	Shared live online presentations, plenary discussion
14:35 - 14:40	*Break*	Break-out room for (off-topic) chat
14:40 - 15:25	*Paper madness, session 2 (chaired by S. Sadeghian)*	Shared live online presentations, plenary discussion
15:25 - 15:35	*Break*	Break-out room for (off-topic) chat
15:35 - 16:20	*Group nding and proposal brainstorming (chaired by P. Fröhlich)*	Break-out room per group, group discussion, collaborative white-boards or slides
16:20 - 16:30	*Break*	Break-out room for (off-topic) chat
16:30 - 17:00	*Proposal consolidation (chaired by V. Roto)*	Presentation via video conferencing in plenary using collaborative whiteboards or slides, plenary discussion
17:00 - 17:30	*Future work and wrap-up (all organizers)*	Video conferencing in plenary

Table 1: Preliminary schedule for the online workshop.

describing their relevant recent or future work. Topics of interest include but are not limited to

- Support the understanding of reasoning and reliability of automated systems
- Communication styles to inform about the state of automated systems
- Propose models for workload management
- Customization of automated systems by non-computer scientists
- Capture and frame experiences with automated systems
- Understand contextual factors for the experience and engagement at the workplace
- Design of human-automation interactions and collaborations
- Support for task distribution and orchestration
- Share tacit work knowledge with automated systems
- Gain insights on the meaningfulness of human-automation work relationships
- Ethical aspects of advanced automated systems at the workplace

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 to https://easychair.org/conferences/?conf=automationxp21. 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. All workshop participants must register for both the workshop and for at least one day of the main conference. Important dates:

- Position paper deadline: February 11, 2021
- Acceptance notification: February 18, 2021
- Workshop date: May 7th, 2021

All details about the workshop can be found at the website https://matthiasbaldauf.com/automationxp21.

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