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# FACTORY WORKERS' ORDINARY USER EXPERIENCES: AN OVERLOOKED PERSPECTIVE

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Abstract: *Experiences with technology often are described as exciting and outstanding, for instance, in relation to novel technologies at home or at work. In this article, we aim to complement this perspective by emphasizing people's mundane and ordinary experiences with technology, that is, unremarkable experiences happening in the background of people's attention. Based on our investigations of user experience in a semiconductor factory, we show how such ordinary experiences are substantial in workers' everyday interactions with technology, which are mainly shaped by repetitive activities and routines. However, current conceptions of user experience seem to overlook those mundane experiences and how they can contribute to positive experiences with technology, as well as work engagement in the factory. In this article, we describe how ordinary experiences can be understood and described to amend current user experience conceptions by discussing theoretical, methodological, and design consequences.*

Keywords: *user experience theory, nuances of ordinariness, experiences with technology, computer-supported practices, factory, automated systems.*


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## INTRODUCTION

Positive or good user experiences are not only those that are exceptional, remarkable, or unique. A good or desired experience with technology can also stem from human–computer interactions that are unremarkable (Tolmie, Pycock, Diggins, MacLean, & Karsenty, 2002), mundane (Michael, 2003), implicit (Ju & Leifer, 2008), or on the periphery of people's attention (Bakker, Hoven, & Eggen, 2015). This may be the case in factories, where interactions with technologies are shaped by routines and repeated activities. In order to contribute to a fuller concept of work engagement—understood as the positive fulfillment of workers' well-being (Schaufeli, Salanova, González-Romá, & Bakker, 2002)—it is essential to holistically understand user experience in the factory. Such awareness must take into account both the exceptional experiences and the ordinary experiences with technology. Although ordinary interactions with technology are acknowledged in human–computer interaction (HCI), for example, by Dourish (2004), Kuutti and Bannon (2014), and Norman (1988/2002), there is currently little systematic discussion in the user experience literature on how ordinary experiences are shaping people's experiences with technology. By drawing on the use case of factory work and human–machine interactions with automated systems in a semiconductor factory, we show the relevance of ordinary experiences when encountering these systems. We aim to characterize user experiences regarding their ordinariness by reflecting on our previous research on how factory workers experience working together with automated systems (i.e., robotic systems). In order to sufficiently address the dynamics of user experience in general, and specifically for the context of factory work environments, where ordinary interactions are a considerable part in daily work, researchers and designers need to pay attention to the relation between user experience and ordinary interactions. Thus, we discuss ordinary experiences on three levels: (a) theoretical conceptions of user experience, (b) research methodology, and (c) user experience design.

Referring to the research of McCarthy and Wright (2004) and considering experiences with technology as everyday phenomena, we focus on nuances of ordinariness in the everyday experiences with technology in the factory. We want to raise awareness that experiences with technology need to be considered along a continuum ranging from ordinary to unordinary experiences, changing over time. In this article, we present a conceptual framing of user experience along this continuum ranging from experiences related to repetitive everyday activities in the background of peoples' attention (i.e., ordinary and mundane) to experiences related to infrequent situations that intervene people's routines (i.e., unordinary and exceptional). We propose that (a) encountering technology is experienced as more or less ordinary; (b) shifts between ordinary and unordinary experiences may occur suddenly or slowly; and (c) experiences with technology can be related to different ways of encountering by users. This view complements current conceptions of user experience and consequently opens up new opportunities for user experience research and design. The conception of ordinariness can serve as theoretical basis for empirical research on experiences with technology. For example, this may guide the setup of study designs or support the selection of an appropriate method to assess ordinary user experience.

We begin this article with a description of research on everyday life in HCI and user experience. Next, we introduce the use case of a semiconductor factory and characterize everyday work in this context. Then, we describe various nuances of experience with

technology ranging from ordinary to unordinary experiences. Finally, we discuss the conception of ordinariness of experiences in relation to existing theoretical conceptions, research methodology, and design.

## BACKGROUND

As theoretical background, we draw on work that discusses everyday life phenomena in HCI as well as literature on user experience. Because we are drawing on the use case of a semiconductor factory to exemplify the conception of ordinary experiences, we subsequently provide an overview of literature on HCI in the factory and user experience specifically in factories.

### Everyday Life and Ordinariness

Ethnomethodology is an established theory concerned with the study of everyday life phenomena, in particular, how "the structures of everyday activities are ordinarily and routinely produced and maintained" (Garfinkel, 1967/2015, p. 38). According to Garfinkel, one way of researching this topic is to "start with familiar scenes and ask what can be done to make trouble" (Garfinkel, 1967/2015, p. 37). This is based on the assumption that mutual comprehensibility is achieved through common practices that are taken for granted most of the time; only when problems occur do these activities lose their ordinariness and become foregrounded.

In Dourish's (2004) seminal article on context in HCI, the chapter "Being Ordinary" is dedicated to the topic of ordinariness. He discussed ordinariness as basis for an alternative model of context for computer-supported practices. Therein, ordinariness is understood as an occasioned property of action, meaning that it is managed moment by moment and achieved by those carrying out an activity together. Based on the seminal work of Sacks, Dourish discussed the ordinary character of everyday activity, that is, "the very fact that most things are ordinary and unremarkable" (Dourish, 2004, p. 24). Specific things that are worth reporting, then, emerge out of the ordinary, for instance, observing an accident on the way to work. Speech reflects whether things are remarkable and exceptional or, alternately, ordinary and mundane. Again, referring to Sacks, Dourish pointed out that activities "are not simply ordinary in their own right but rather are designated as ordinary by social actors in the course of their activities" (Dourish, 2004, p. 24). Further, he emphasized that ordinariness has to be seen in relation to particular communities and sets of activities.

Embedding people's everyday routines meaningfully in interaction design also has been discussed in the literature. Based on the assumption that information and physical actions are often perceived and performed at the periphery of people's attention, Bakker et al. (2015) discussed "peripheral interaction" as a relevant direction for interaction design. With regard to the increasing ubiquity of technology, they emphasized the role of peripheral interaction designs to embed people's everyday routines meaningfully. In a similar manner, Tolmie et al. (2002) proposed the terminology "unremarkable computing," emphasizing the invisibility of ubiquitous computing technology. Going beyond explicit interactions, Odom and Wakkary (2015) raised the notion of "intersecting" to describe relations between humans and unaware objects. Whereas explicit interactions are characterized by direct manipulation, intersecting "can range from experiences of being mindful of the artifact, to subtle uses of the artifact that

may be only briefly noticed (or go unnoticed)" (Odom & Wakkary, 2015, p. 35). Ju and Leifer (2008) explored the design of "implicit interactions," exemplified by an automatic door opener, to make interactive technology more usable. Similar to these notions, Dourish pointed out that practiced skill is not only necessary to notice or attend to some phenomenon but also to disregard it, that is, "to render it ordinary, invisible, or unremarkable in the course of its use" (Dourish, 2004, p. 29).

Norman (1998) addressed ordinariness by discussing affordances of everyday things, for example, an everyday interaction with a keyboard or a door handle. When designing for such everyday interactions, the aim is not to design for outstanding experiences, but rather for interactions that can be performed thoughtlessly (Norman, 1998). Graham and Rouncefield (2007) discussed the notion of mundane technology in a position paper, arguing that, for instance, the use of photos within families can be studied regarding its mundaneness. Although some research in HCI focuses on everyday ordinary phenomena, the link between ordinary interactions and user experience, that is, how ordinary interactions shape people's experiences, has not been thoroughly established yet. Thus, theoretical conceptions of user experience need to address the relation between user experience and ordinary interactions. However, current conceptions rarely do so, which we illustrate in the following section.

## User Experience

User experience is an umbrella term for all forms of experiences that arise in HCI (Roto, Law, Vermeeren, & Hoonhout, 2011). Both research and design practices are engaged with people's experiences: the former in the form of researching individuals' experiences and how technologies influence them, the latter by designing for those experiences or creating or shaping them. Terms such as experience-centered design (Wright & McCarthy, 2010) and experience design (Hassenzahl, 2010) have found their way into the literature to emphasize the focus on experiences with technology. However, the ordinariness of experiences with technology is not explicitly reflected in these existing theoretical conceptions of user experience. Thus, the potential relevance of this type of experience has been overlooked.

The current focal point of HCI research, considered the "third wave HCI"[1] by Bødker (2015), primarily addresses home, everyday life, and culture, leading to increased attention on enjoyment, fun, and similar distinctive experiences and situations (i.e., mainly extraordinary experiences). For instance, research on the hype of consumer products indicates that iPhones, as an example, were not adopted primarily for their functional value but rather due to their social, epistemic, and emotional value, thus being a hedonic end in itself (Hedman & Gimpel, 2010). With the focus on home and leisure, entertainment also became an appealing topic for design and research. Aspects of experiences, such as enjoyment, are central, and in turn, require active experience (i.e., a cognitively and emotionally enhanced body; Nakatsu, Rauterberg, & Vorderer, 2005). This active experience is again related to a user's level of attention, as it requires cognitive and emotional commitment from users in the interaction with an artifact, leading to a high manifestation of unordinariness.

Joy of use is another buzz term (Blythe, Overbeeke, Monk, & Wright, 2004) that puts a focus on the unordinariness of experience. For example, Carroll (2004) argued that interactions with objects are fun when they attract, capture, and hold users' attention by provoking new or unusual perceptions or arouse emotions in untypical contexts. Remarkable and memorable

experiences, which are outstanding from everyday routines and interactions (Dewey, 1934/2005), are considered as meaningful and emotion-rich experiences with technology (Hassenzahl, 2010; Wright, McCarthy, & Meekison, 2004). Related to that is the aim to design for surprise or challenge (Csikszentmihalyi, 1990), fun, excitement, appeal, novelty, and change (Logan, 1994), as well as for surprise, diversion, or mystery (Gaver & Martin, 2000). Further, unordinary experiences are often referred to as positive experiences, such as "wow" experiences (Desmet, Porcelijn, & van Dijk, 2007), compelling experiences (Hassenzahl, Diefenbach, & Göritz, 2010; Hull, Reid, & Kidd, 2002), or engaging and absorbing experiences (Wright et al., 2004). The overall distribution of research is clearly skewed towards the exceptional, a phenomenon that can be found in theoretical framings as well.

Theoretical approaches and frameworks have evolved in the past decade that aim to describe, explain, or model what can or should be understood as user experience and what influences it (e.g., Hassenzahl, 2010; Wright & McCarthy, 2010). One of the first frameworks of experience for interaction design was developed by Forlizzi and Ford (2000). The authors built upon the work of philosopher John Dewey regarding aesthetic experience (Dewey, 1934/2005). Central to Dewey's understanding of experience is the distinction between "experience" and "having an experience" (Dewey, 1934/2005, p. 36). This distinction is relevant to understanding user experience in the field of HCI because prevalent approaches, such as the one from McCarthy and Wright (2004), are building upon Dewey. Experience in Dewey's sense is considered as a constant stream of what happens beyond specific situations, that is, the continuous perception of the interaction with one's environment: "Experience occurs continuously, because the interaction of live creatures and environing conditions is involved in the very process of living" (Dewey, 1934/2005, p. 36).

In contrast, having an experience refers to a concrete, specific situation or process with a beginning and an end. Dewey (1934/2005) referred to having an experience as being demarcated from the constant stream of experience as it is outstanding and complete within itself, having its own quality and self-sufficiency. The following quotation from Hassenzahl (2010, p. 1) nicely illustrated what is considered as having an experience: "Luzine [a restaurant] was an experience. It was an episode, a chunk of time that I went through and I am going to remember. It was sights and sounds, feelings and thoughts, motives and actions, all closely knitted together and stored in memory, labeled, relived and communicated to others."

Distinguishing between an experience and experiencing is also essential for conceptions of temporal user experience. Luojus (2012, p. 353) differentiated between "short-term and long-term" user experience. Short-term user experience is dynamic and connected to a specific moment or situation, whereas long-term user experience is created cumulatively over time. Whereas the former refers to a specific interaction having a beginning and an end (considered as an experience by Forlizzi & Ford, 2000), the latter represents an accumulation of single interaction episodes in the sense of recollecting multiple periods of use (Roto et al., 2011), not reducible to single interaction episodes.

Although the presented understandings and facets of user experience tracing back to Dewey (1934/2005) do not explicitly exclude ordinary experiences, they neither clarify their role nor their relation to unordinary experiences. The theoretical approaches in particular lack a distinct discussion of the mundane. In order to create more awareness for these forms of experiences and, as a result, provide a basis for reflection and further research, this article contributes to a discussion of and a theoretical frame for ordinary experiences. This provides

a basis for articulating what form of ordinariness is investigated, evaluated, or designed for. In order to ground this discussion, we develop the argument based on the example of a semiconductor factory context because everyday routines play a crucial role therein. Thus, the following subchapter presents research within this context, especially on how workers experience interactions.

## User Experience in the Factory

For decades, scientists have been occupied with investigating factory work from a point of view of classical or social psychology (e.g., Brown, 1954; Fischer et al., 1998; Noor & Abdullah, 2012). Considerable research addresses health or safety aspects, as well as ergonomics. Regarding humans' interaction with systems, the factory context has been less prominent in recent HCI research and publications. Little research material can be found that makes factory workers the focal point when designing interfaces. In 1991, an IEE colloquium (i.e., HCI: Issues for the Factory) dealt with the psychological basis for computer system design, operator support systems, and industrial inspection. This colloquium, however, remained a unique event and was not repeated in any related form in subsequent years.

Only recently, a distinct human-centered orientation has evolved for factories. For example, May et al. (2015) indicated that workplaces of the future should be worker-centric to optimize production performance. That means that workplaces should fit workers' needs. Similarly, Village, Searcy, Salustri, and Neumann (2015) argued for an early consideration of human factors in production design processes to improve workers' performance and well-being. However, field studies focusing on human–computer interactions with systems specifically in the factory context have been less prominent. One reason for this may be the fact that a factory represents a very challenging research context. The first and foremost demand when doing research in this context is to not hinder daily work and production processes (Björndal, & Ralph, 2014; Tscheligi et al., 2012). Further, the complexity of the factory environment (in terms of work practices, processes, and equipment) represents a hurdle for researchers (Weiss, Kluckner, Buchner, & Tscheligi, 2012). Access is crucial and often difficult in terms of sampling (i.e., accessing people who are the focus of the research) or the physical presence of a researcher (i.e., accessing specific areas in the factory; Wurhofer, Fuchsberger, Meneweger, Moser, & Tscheligi, 2015). Thus, the restricted accessibility and complexity of the factory context may be one of the reasons why user experience research in this context is scarce (Ardito, Buono, Caivano, Costabile, & Lanzilotti, 2014; Tscheligi et al., 2012).

Fallman, Kruzeniski, and Andersson (2005) pointed out the importance of investigating new technologies in the factory context and considered the industrial use of information technology (IT) as paradigm shift. In recent years, some researchers have attempted to promote user experience research in industrial settings by pointing out the importance of user experience goals regarding the design of industrial systems (Kaasinen et al., 2015), ways to create value for companies through user experience research (Väätäjä, Seppänen, & Paananen, 2014), or how to investigate user experience in industry (Ardito et al., 2014). Although it is challenging to research an industrial context, it is valuable in order to improve workers' user experiences. For instance, user experience goals can be beneficial in guiding the design of industrial systems (Kaasinen et al., 2015). Evoking positive and meaningful experiences at work—for example, personal engagement (Lu & Roto, 2015)—has various positive effects for both employees and employers

(Lu & Roto, 2015). Positive experiences with technology are, for example, related to the worker's efficiency, work satisfaction, and professional pride. This, in turn, affects productivity, competitiveness, or brand image (Väätäjä et al., 2014).

Even though it is arguably important to create ordinary experiences that are positive and meaningful for workers, our review of the literature demonstrates that there is a lack of orientation toward the mundane in user experience theory. In this article, we close this gap by promoting sensitivity for these kinds of experiences, addressing the following overall research question: How can users' experiences be described regarding their ordinariness? Therefore, we draw on a use case of human–machine interactions with automated systems in a semiconductor factory (Meneweger, Wurhofer, Fuchsberger, & Tscheligi, 2015), as described in the next section.

## THE USE CASE OF A SEMICONDUCTOR FACTORY

To gain a deep understanding of ordinary user experiences, we examined work practices in a semiconductor factory. The respective factory is a major industry company in the electronics sector, producing microchips. We collaborated with this factory within a national research project over 7 years. The overarching research goal of this project was to understand and characterize the contextual peculiarities of user experiences emerging within the specific and challenging context of a factory. We conducted a range of interview studies, ethnographic research, contextual inquiries, surveys, and workshops (for an overview of our research, see Wurhofer, Fuchsberger et al., 2015). Over the years, we investigated workers' experiences with robotic systems, mobile interfaces, assistive systems, and collaboration tools, thus providing rich insights into ordinary factory life. By exploring different facets of human–machine interactions in this factory through an experiential lens and reflecting on related literature, we recognized an over-representation of unordinariness in current user experience concepts. This might derive from a primary focus on enjoyment, fun, and other outstanding experiences, as described above. However, that did not seem to represent the workers' day-to-day experiences with technology in the factory. The relevance of ordinary experiences with technology that we observed in the factory is not explicitly reflected in current user experience literature. However, we consider evoking ordinary experiences as an essential goal for designing and deploying technology (also beyond the factory context). Thus, user experience research can benefit from a look at factory workers' experiences, where ordinary experiences are specifically visible and technology that was once novel and exceptional has become ordinary and mundane.

### Approach: Reflecting on Workers' Experiences in the Semiconductor Factory

We developed the concept of ordinariness by drawing upon our long-term engagement in the semiconductor factory. In particular, we found that experiences evoked by encountering different kinds of systems in this context can be described as more or less ordinary. This motivated us to theoretically reflect on the ordinariness of experiences with technology. We further elaborated the initial conceptual idea of ordinariness by reflecting on data gathered within an in-depth interview study about workers' experiences with automated systems (Meneweger et al., 2015; Wurhofer, Meneweger, Fuchsberger, & Tscheligi, 2015).

This previous study aimed to investigate workers' experiences regarding the deployment of industrial robots in this factory. To investigate how workers experienced the interaction with robots and changing working procedures, we conducted 10 narrative interviews with workers who experienced the deployment of robots in their working areas. The participants were recruited by a manager of the automation department, and within the selection process, diversity was sought in terms of age, working experience, and role. We interviewed eight male and two female workers, with a mean age of 40 years (*SD* = 12), ranging from 22 to 57 years. Their average working experience at the specific factory was 16 years (*SD* = 11), ranging from 0.5 to 30 years. Work experience with the robots ranged from 0.5 to 5 years. After the workers gave their informed consent, the interviews were conducted in a quiet and comfortable atmosphere (i.e., a meeting room). Each lasted about an hour and all were audio recorded and later transcribed. The interviews were conducted in German; the interviewees and the interviewer were fluent in German. We applied an open-structured interview guideline aimed at collecting workers' personal experiences in the form of stories and situation narratives. The main task of the interviewer was to stimulate personal reports by asking narrative trigger questions (e.g., "Can you remember the first day working with the robot? Please tell me about that."). In line with Flick (2000), the interviewer served primarily as a listener as the participants recounted their experiences. The focus of the interviews was on three stages of becoming familiar with the automated systems: (a) before working with the robots; (b) briefing, training, and first interactions with the systems; and (c) daily work with the robots. Thus, we collected episodes of certain experiences, ranging from pre-expectations and first-time experiences to the current experiences of workers. The specific benefit of this approach is that the open-structured interview provided the interviewees freedom to articulate their experiences, thoughts, and reflections as they prefer, meaning the participants decided what experiences they recounted. This allowed us to get rich insights into everyday factory life and corresponding experiences[2] (see Meneweger et al., 2015; Wurhofer, Meneweger et al., 2015).

The primary analysis of the data was conducted by the first two authors, with the final authors contributing to the process of refining and grounding the insights and reflections. Thus, to theoretically frame ordinary experiences, several reflection sessions were conducted during summer 2015. Within these sessions, the first two authors examined the use case of the semiconductor factory regarding ordinary experiences by reflecting on the interview data, that is, revisiting the data through the lens of ordinary experiences. These two also conducted the interview study and were familiar with the gathered data and as well with the specific context on site, which they had researched for several years. The reflection sessions followed an open discursive style and aimed at characterizing the interview data regarding the ordinariness of experiences. Thereby, we aimed to create links between the conceptual idea of ordinariness and the data gathered in the interview study. Based on our assumption that experiences are more or less ordinary, we structured the reported experiences regarding their concreteness. For example, we contrasted reports of distinct experiences with specific information on space and time against abstract, rather general descriptions of reoccurring situations. Further, we structured activities related to the automated systems (i.e., the way in which the workers encountered the systems) and mapped them to the degree of ordinariness. Within this iterative process, the concept of ordinariness evolved and was revised and enhanced based on feedback and discussion with the two other researchers who had experiences with the specific factory as well, but who were not directly involved in the interview study.

## Everyday Work with Automated Systems in the Semiconductor Factory

To provide a better understanding of the research context and our insights, we describe the daily work and experiences of this factory identified in previous studies (e.g., Meneweger et al., 2015; Wurhofer, Meneweger et al., 2015). In this context, interactions and related experiences are shaped mainly by repetitive everyday activities. Despite that, when infrequent incidents interrupt workers' routines, shifts between ordinary and unordinary interactions occur. For example, working activities are interrupted when workers have to deal with unexpected errors or sudden problems that need to be solved immediately. Additionally, working routines are reshaped when new technologies are introduced that fundamentally alter working procedures (e.g., the introduction of new robotic systems to perform tasks completed manually earlier).

The overall goal within the production process is to have as few defects ("zero-defect production") and as high performance as possible to maximize the factory's output ("throughput"). Products (i.e., microchips produced on silicon wafers) are produced on shop floors, which often are loud and busy places. Most of the fabrication systems are permanently running to allow 24/7/365 production. The factory contains several clean rooms, that is, areas with low contamination with specific restrictions and rules to ensure a nearly dust-free environment for producing the microchips. Thus, operators have to wear special clothing (e.g., gloves, head covering, and special suits). Before an operator enters the clean room to work, he/she must put on the special clothing and pass beneath an air shaft that blows away particles. In the clean room, there is a range of fabrication machines ("equipment") needed for the various steps in producing microchips. In general, microchips are produced through building multiple layers on the silicon wafers.

Over the years, increasing automation has been deployed at the production site, for instance, for transportation and pick-and-place tasks (i.e., grasping and moving artifacts from Point A to Point B). The human operators are responsible primarily for maintaining a fluid production process and, depending on the automation level, to distribute the products or components to the designated equipment.

In regard to these automated systems, the workers perform mainly loading and unloading activities. Additionally, they monitor and/or adjust settings for specific production processes. To illustrate operators' everyday work in the semiconductor factory, we present quotes[3] taken from the narrative interviews with the operators. An operator described the daily work in the factory as follows:

> *Overall, we are loading [wafers] onto the equipment and unloading them, monitoring processes, and correcting errors if they occur. Yes, generally speaking, that's the main work. From time to time, necessary tests of the systems are also completed by us [operators]. Wafers, which are ready for further processing, have to be delivered. Visual checks and measurements that are related to our working area, all such things are done by us.* (Operator, female, 32 years)

Less frequent activities are, for example, learning to operate and interact with newly introduced machines or interfaces, as shown in a previous study (Meneweger et al., 2015). Knowledge acquisition is especially relevant for learning to manage the robot when system errors occur. In the long run, operators develop routines in handling the robots due to continuously interacting with them. In the short run, however, learning how to operate the

robots is—in addition to brief trainings—often characterized by trial and error strategies, as one operator described: "*When an error occurred, someone came and you watched him [fix the error]. Then, he told you that it works like this and that or that you just have to confirm and suddenly you adopted that*" (Operator, male, 39 years).

Due to the demand that the systems run continuously, addressing errors (in the product or production process) is an essential activity for the workers. Moreover, troubleshooting is disruptive and often specific:

> *It is assumed that they [the robots] work autonomously, but, as already stated, sometimes problems occur related to the robot. If there is no one [of the technicians] available—as is the case during night shift—we [operators] have to cope with this by ourselves. It is often the case that he [the robot] blocks our path to the equipment, which we could operate if the robot would not be there. Therefore, we have to be able to help ourselves every once in a while.* (Operator, female, 32 years)

However, for workers mainly focusing on error handling and troubleshooting in their daily work (e.g., maintainers, service technicians), regularly occurring problems may be something ordinary. Next to error handling and troubleshooting, adaption represents another example for changing experiences (regarding their ordinariness) in the factory. As stated by an operator, workers need to adapt continually to the robots:

> *Previously, our tables [for storing the wafers] were distributed all over the clean room. There was enough space to move and to work. You could prepare and arrange the wafers well. Today, there are just the trays mounted on the equipment and I have to wait until one has finished processing. I have to remove it [the tray of wafers] and take it away because I cannot get there [to the machine] with the cart anymore. I have to carry it for 20 meters and then get the new one in. Previously, the cart was placed stationary in the center [of the clean room] and it was possible to put everything on the cart. At the beginning of the shift, I could deliver everything and I used the cart also for carrying them away.* (Operator, male, 57 years)

This means that workers had to adjust their working routines and practices to the robot's behavior or very presence. Such a reconfiguration of existing practices represents a break in existing work processes, and thus, over time, new (adapted) routines and practices evolve.

Increasing the number of production units and productivity are important goals in these types of factory environments. When technical errors occur, troubleshooting and fast correction of errors are highest priority. Especially in such situations, good teamwork and problem-solving abilities are crucial from a worker's perspective. Beyond handling the machines, the social environment also plays a crucial role in operators' daily work. On one hand, unmotivated colleagues or unequal treatment from superiors, as well as lack of staff, can be considered as negative experiences in daily work life. On the other hand, motivation and appreciation of work done by an individual or the group, as well as self-affirmation, are causes of positive experiences (Wurhofer, Buchner, & Tscheligi, 2014). By referring to the use case of user experiences resulting from interactions with automated systems in the factory, we outline our concept of ordinary experiences in the following sections.

## NUANCES OF ORDINARY EXPERIENCES IN THE FACTORY

In order to conceptualize the notion of ordinary experience, we reflected on insights from our long-term engagement in the factory regarding various aspects of ordinariness. In other words, we assessed whether our perspectives on the incidences pointed toward one of the two poles of ordinariness and/or revealed something notable about using or, as we present below, encountering technology. Thus, this section is dedicated to describing those conceptual facets of ordinariness.

### Conceptualizing Ordinariness

According to Abrahams, ordinary experiences are typical in the sense of "what happens again and again to individuals finding themselves in similar situations" (Abrahams, 1986, p. 60). In our studies, we found that most everyday interactions with technologies in the factory are related to daily routines and practices without any specific value or memory of them. Only when the routine is disrupted by specific incidents do practices require increased attention or are perceived as specifically valuable. We consider experiences that someone has no specific memory of, attributes no specific value to, or requires hardly any of someone's attention as *ordinary experiences*. Experiences that are memorable, valuable, or the focus of people's attention are referred to as *unordinary experiences*. This represents a conceptual distinction, highlighting that experiences with technology emerge along a continuum of experiences ranging from ordinary to unordinary experiences.

Most of the time, workers are not expected to directly manipulate systems that are supposed to run automatically; therefore, the systems are mainly perceived peripherally by the workers. Encountering such automated systems can be considered as intersecting in the sense of Odom and Wakkary (2015), that is, workers being mindful of the system or just briefly noticing it. Encountering these systems corresponds to what Dewey (1934/2005) referred to as experience, that is, the constant stream of what is experienced beyond specific situations. From our point of view, this can be the most basic form of ordinary experience. However, when the systems in the factory stop running smoothly because of, for example, failures (problems, errors, malfunctions), experiences can be evoked that are "demarcated in the general stream of experience from other experiences" (Dewey, 1934/2005, 37). This is what Dewey considered as having an experience—a concrete, specific situation or process with a beginning and an end. Such experiences that require the attention of the user and which the user attributes value to can be considered unordinary experiences. Corresponding to the dynamic character of experiences, the transformations between ordinary and unordinary experiences within this conceptual distinction are conceived as especially relevant.

In our research, the term *encountering technology* refers to a wide variety of interactions with technology in the factory, ranging from explicit, direct manipulation of a system to the peripheral interaction with unremarkable systems. Related technology experience may be more or less ordinary, depending on the specific situations and the different ways of encountering technology. For exemplifying the ordinariness of experiences in the next section, we refer to the following notions of encountering automated systems. In addition to the (a) properly running automated systems, where no explicit interaction and no direct manipulation of the system is needed, we distinguish between (b) interactions with specific interfaces or systems, for instance, a single control panel of an automated system; (c) tasks in the factory where systems and interfaces

are involved and interacted with, for example, as part of maintenance procedures; and (d) routines related to technology usage, for example, being responsible for monitoring systems in a certain area of the factory. As part of the work routines in monitoring these machines, several tasks are involved and various kinds of systems and interfaces are engaged. In these ways of encountering technology, different attributes can be ascribed to indicate whether the encountering is oriented toward ordinary or unordinary. Within our conception of ordinariness, we use attributes such as repetitive, frequent, and everyday to describe ordinary ways of encountering, whereas attributes such as initial, infrequent, and intervening will be used to describe unordinary ways of encountering technology (see Figure 1).

## Experiencing Automated Systems in the Factory

Employing the use case of a semiconductor factory, we describe in this subsection the experiences with automated systems regarding their ordinariness. Figure 1 presents distinct nuances of ordinary

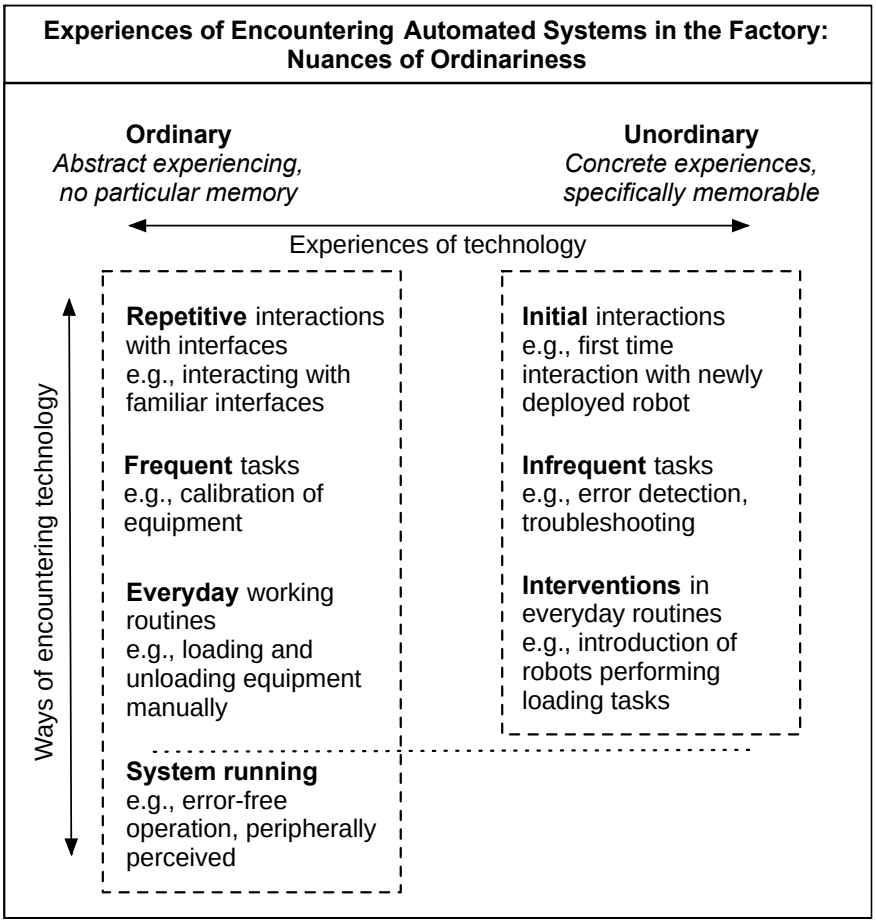


**Figure 1.** Examples of ordinary and unordinary experiences in a factory context from a worker's perspective, representing the nuances of ordinary experiences in relation to different ways of encountering technology. The peripheral perception of a properly running automated system, as well as repetitive interactions with interfaces, frequent tasks, or everyday working routines are typically related to ordinary experiences. In contrast, initial interactions, infrequent tasks, or interventions in everyday routines, are frequently experienced as unordinary.

experiences. We explain the figure in the following. In addition to the peripheral perception of a properly running automated system, the factory work is often characterized by repetitive interactions with interfaces. Workers are familiar with these interfaces so that interactions only require a low level of attention.

Experiences of repetitive interactions like the everyday handling of familiar interfaces may be considered as rather ordinary because they do not require much of the workers' attention and cannot be specifically remembered by workers. Frequent tasks like the calibration of equipment represent routine activities that may be experienced as ordinary. Such recurring actions of daily work life are probably not linked to memories of a specific situation or context, but rather represented as cumulative episodes of encountering technology. Further, we consider experiences of everyday working routines like manually loading and unloading the equipment in the factory as ordinary.

In contrast, experiences of initial interactions with systems, for instance, the first interaction with a newly deployed robot, are rather unordinary because of their novelty. They require higher attention as the workers are not yet used to the interaction. Infrequent tasks related to specific incidents like error detection or troubleshooting also require attention and are memorable to the workers, being linked to unordinary experiences. Such actions are unexpected and interrupt the current workflow, attracting the workers' attention. Workers are usually able to remember the concrete situation and context of the incident. Interventions in everyday routines, like the introduction of robots that substitute loading activities, interfere with everyday activities and therefore might be experienced as unordinary.

These different ways of encountering automated systems are interwoven in a complex way and cannot be considered as mutually exclusive contrastive pairs (e.g., repetitive vs. initial). Although experiences of initial interactions will interfere with experiences of repetitive interactions, initial interactions might also intervene with frequent tasks and everyday routines. Workers' experiences occur on a continuum of ordinariness according to different ways of encountering. Thus, the continuum ranges from repetitive, regular experiences of encountering technology to unique, exceptional experiences of encountering technology.

From a temporal perspective, we can depict the shifts between ordinary and unordinary experiences. Karapanos, Zimmerman, Forlizzi, and Martens (2009) already explored the different phases of user experience over time (being represented as shifts of experiences). However, they do not consider shifts between more or less ordinary experiences. Shifts from expected, unremarkable situations to unexpected, remarkable situations were also attended to in ethnomethodology (Garfinkel, 1967/2015). As humans take everyday activities and situations for granted most of the time, ethnomethodologists aim to challenge this by "making trouble" through drawing otherwise unquestioned activities to the foreground. Breaching experiments (see Garfinkel, 1967/2015) are the most frequent method of achieving this foregrounding. Although breaching experiments intentionally and artificially aim to provoke exceptional situations, such situations spontaneously occur in the factory. For example, exceptional situations evolve when new systems that radically change working procedures are deployed (e.g., robots as coworkers) or when unexpected incidents or errors interfere with everyday work. Figure 2 presents a sketch of how nuances of ordinariness evolve when encountering technology over time. It illustrates shifts in the ordinariness of experience. For instance, when a new system is deployed, routine activities are interrupted by this incident, reflected in a sharp rise towards unordinary experience. With increasing time, users become habituated to the new system, reflected in a slow shift towards ordinary experience. These

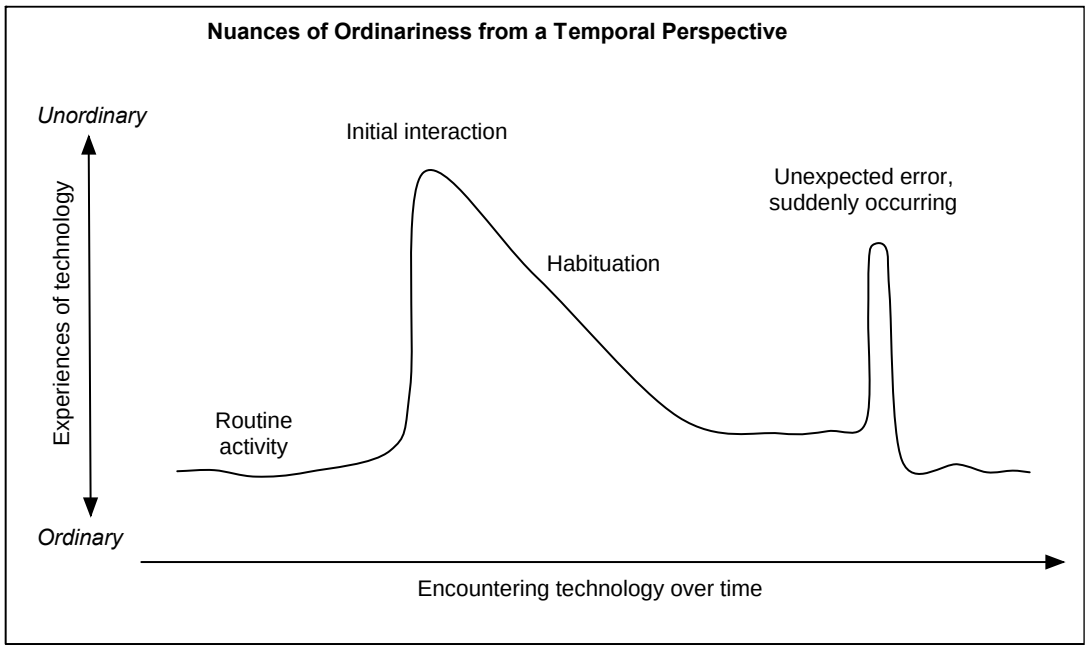


**Figure 2.** Visualization of how experiences in the factory can evolve over time with regard to ordinariness. By representing ordinariness (y-axis) in the course of time (x-axis), the figure illustrates shifts in the ordinariness of experiences. Ordinary, routine experiences are characterized by a rather smooth and shallow course. A sharp rise of the curve towards unordinary experiences represents exceptional, remarkable experiences (e.g., initial interaction with a newly deployed system). A slow decline of the curve reflects habituation effects (i.e., decrease towards more ordinary experience).

routine activities can be interrupted again by suddenly occurring errors or other unexpected incidents, again illustrated by a sharp rise towards unordinary experiences. Figure 2 is a simplification of everyday work life, where workers' experience is shaped by a multitude of technologies, mostly in workers' peripheral perception. However, this sketch illustrates the dynamic nature of experiences floating in between the ordinary and the unordinary.

## Postulating Ordinariness of Experiences

Our reflections on ordinary experiences are specific to the semiconductor factory context, as the high importance of routines and the repeatability in results skew toward ordinary experiences rather than a balance between ordinary and unordinary ones. However, the characteristics of ordinary experiences may apply to diverse contexts, for example, other workplaces, home, or other leisure domains. The following characteristics of ordinary experiences outline our reflections on ordinary experiences.

- **Encountering technology is experienced as more or less ordinary.** Experience with technology can range from ordinary to unordinary experiences. Figure 2 illustrates this conception by representing ordinariness (y-axis) over the course of time (x-axis), that is, visualizing how experiences evolve over time in regard to ordinariness.

- **Shifts between ordinary and unordinary experiences may occur suddenly or slowly.** Transitions between ordinary and unordinary experiences happen at different paces, that is, anywhere between fast or slow (see Figure 2). For example, interactions with technology may be characterized by learning and habituation effects, corresponding to smooth transitions regarding the ordinariness of experience. In contrast, interactions that are affected by unexpected incidents or sudden interruptions may be reflected by sudden changes of ordinariness.
- **Experiences with technology can be related to different ways of encountering.** Encountering technology may reach from peripheral perception of running systems to periodic interactions with interfaces and tasks in the factory, to ongoing routines. Each of these different ways of encountering can be experienced as rather ordinary or unordinary, depending on the very specific situation in which the encountering of the technology takes place.

## DISCUSSION

We clustered the following discussion along the areas that are affected by a conceptual distinction between ordinary and unordinary experiences: theoretical conceptions, research methodology, and design. By looking at this conceptual distinction from different angles, we show the specific value of our conception of ordinariness for HCI.

### Theoretical Conceptions

*"Normal is an illusion. What is normal for the spider is chaos for the fly."* (Charles Addams, n.d.)

This quote from cartoonist Charles Addams, creator of the Addams Family, nicely illustrates the subjective component of ordinariness. What is experienced as something outstanding and unordinary by someone could be experienced, at the same time, as something ordinary by someone else. To understand the nuances of ordinariness, it is necessary to explore people's subjective views and reflections. What people may consider as ordinary is quite context dependent and situational. According to Dourish (2004), ordinariness is actively constituted in the course of interactions and within certain communities. Thus, people may have a shared understanding of what is experienced as more or less ordinary within a specific context and community. So it is more about intersubjectivity than subjectivity (Dourish, 2001). Referring to Addams' quote above, other spiders may experience this situation also as normal, whereas other flies will experience it drastic as well. Transferred to the factory context, the same situation (e.g., occurrence of a specific error) may be ordinary for technicians but exceptional for operators. As a consequence of this argument, establishing a formula to measure the ordinariness of specific interactions would not seem possible.

Reflecting on the ordinariness of workers' experience in the factory, time is a crucial issue (see Figure 2). In the course of time, experiences often move from being new and extraordinary toward becoming accustomed and ordinary. Forlizzi and Ford (2000) stated that recurrent experiences become more and more automatic with repeating practice. In their framework, they consider this migration as a shift from cognitive experiences to subconscious ones, where learning and habituation play important roles. With increasing practice and frequency of

specific operations, activities, or actions, a decrease in the focus of attention may be required. However, this is no linear process, because ordinary experiences may be suddenly interrupted by unexpected incidents, attracting attention and generating cognitive load, suddenly becoming an unordinary experience. In temporal models of user experience, like that of Luojus (2012), long-term user experience—as created cumulatively over time—highly corresponds to how we describe workers' reflection on ordinary experiences. Similarly, what is considered a short-term user experience—being dynamic and connected to a specific moment or situation—corresponds to workers' reflection on unordinary experiences.

The relevance of everyday routines for HCI that are highlighted by Kuutti and Bannon (2014) can be linked to the ordinariness of experiences in user experience conceptions. Kuutti and Bannon introduced a distinction between a prevalent "interaction perspective" in HCI that focuses on momentary and ahistorical human–computer interactions and an underrepresented "practice perspective." The practice perspective focuses on processes and long-term actions, which are interwoven with the physical, social, and cultural surroundings. Practices are composed of inseparably intertwined elements such as "physical and mental activities of human bodies, the material environment, artifacts and their use, contexts, human capabilities, affinities and motivation" (Kuutti & Bannon, 2014, p. 3545). The conception of ordinary experiences, as proposed in their article, is anchored in the practice paradigm. The question of whether encountering technology is experienced as more or less ordinary also cannot be reduced to single interactions but has to be considered as emerging out of everyday "computer-supported practices" (Kuutti & Bannon, 2014, p. 3550). This stands in contrast to (or perhaps expands) traditional usability concepts. Usability, often understood as effectiveness, efficiency, and satisfaction (International Organization for Standardization [ISO 9241-11], 1998), provides an interaction perspective that is reduced to momentary, explicit interactions. From a practice perspective, this falls short, even if learning, novelty, or improvisation—as suggested by Adler and Winograd (1992)—are included within such a conception, in that temporal trajectories of physical, social, and cultural surroundings are left out.

Taking an experiential, practice-oriented perspective allows researchers to understand that the same interactions can be experienced simultaneously as ordinary or unordinary (by different people). For example, when looking at human practices, one cannot assume that bad usability necessarily leads to bad (unordinary) experiences. Neither must a system with a good usability lead to positive experiences. To understand whether an experience with technology is ordinary or unordinary, it requires us researchers to zoom out and look more broadly at human experiences and how they are embedded in practices. This is especially relevant for experiences evoked by systems where no specific or explicit interaction takes place (e.g., ambient technologies, autonomous systems, or factory automation). Considering interactions, tasks, and routines as embedded in everyday practices is helpful to better understanding how specific ways of encountering technology may be experienced as more or less ordinary. However, further research, especially one that explicitly focuses on the relation of practices and experiences, is needed to further reflect on this relationship. Following Kuutti's (2010) claim regarding a conceptual and theoretical debate on user experience, we showed in this article that it is beneficial for research to draw attention to the ordinariness of experiences by articulating, reflecting, assessing, and designing (for) those experiences. This means that ordinariness—with its temporal, intersubjective, and situated qualities—needs to be an explicit dimension specified and acknowledged in existing user experience frameworks and theories. By doing so, directions

for future research can be articulated that facilitate the study of ordinariness of experience with technology in varying domains.

## Methodological Approaches

"*Speech is organised so as to designate the distinctions between those things that are remarkable and those that are not.*" (Dourish, 2004, p. 24)

Dourish's (2004) statement emphasized the significance of verbal accounts to access ordinariness of experiences. User experience research provides a variety of notions that aim to frame experience with technology (e.g., Forlizzi & Ford, 2000; Hassenzahl, 2010; McCarthy & Wright, 2004). In reference to ordinariness, however, there are no explicit reflections on how to access these forms of experiences, that is, what implications the sensitivity toward the nuances of ordinariness brings in terms of appropriate methods to capture experiences.

Certain research methods are particularly suitable for capturing specific aspects of experiences with technology. Thus, researchers should reflect on how specific methods can be applied to capture various nuances of ordinariness. Applying a practice-oriented perspective (Kuutti & Bannon, 2014)—that is, long-term engagement with users in natural, in-situ settings, such as through ethnographic approaches—is especially promising for capturing the ordinariness of experiences.

However, even with research methods that are usually not considered as specifically appropriate for accessing ordinary aspects of everyday life, it is possible to reveal insights regarding various nuances of ordinariness. Based on our research in the semiconductor factory, we found narrative methods (as part of our long-term ethnographic research in the factory) valuable in gaining insights on nuances of ordinariness. Narrative methods representing a retrospective approach are typically applied to gather reports on specifically memorable experiences (Meneweger, Wurhofer, Obrist, Beck, & Tscheligi, 2014). Hereby, participants were encouraged to report specific experiences that are particularly relevant for them (Wright & McCarthy, 2010). The openness of narrative approaches enable participants to extensively express personal reflections and thoughts, as well as reveal a broader spectrum of experiences (being more or less ordinary), such as descriptions of ordinary reoccurring situations (Flick, 2000; Meneweger et al., 2015). Other methods (e.g., diary studies, day reconstruction), where users are encouraged to report and reflect on concrete experiences of specific interactions or situations (e.g., after having used a device or prototype; Karapanos et al., 2009), may also contain broader insights on nuances of ordinary experiences. In particular, a research goal could be to explore user experience beyond concrete events. Particularly when recollecting long-term experiences, which are created cumulatively, researchers must consider that unordinary experiences may overshadow ordinary experiences, especially as those do not require much attention during the interaction.

We propose the following questions be raised whenever investigating the ordinariness of experience: (a) How does this method deal with the ordinariness of experiences? and (b) How can different nuances of ordinariness be addressed? Our conception of ordinariness offers the opportunity to guide the application of certain methods to explore ordinariness of experience, regarding data gathering processes as well as analysis approaches. For example, interview guidelines can be set up to explore more deeply the different ways of encountering

technology described in Figure 1. Further, data gathered in interview studies and ethnographic observations can be structured and organized based on these levels.

Regarding operationalizing user experience conceptions, user experience is often reduced to factors that are addressed with a technology (e.g., fun, enjoyment, anger, safety, trust; Bargas-Avila & Hornbaek, 2011). At this point, one can distinguish factors along the range of ordinariness of experience. For example, factors like fun or enjoyment are often related to specific situations, meaning that users can relate the situations where they experienced fun or enjoyment because those can be perceived as unordinary. Nevertheless, other factors are not constantly in the attention of a user (e.g., safety or trust). Users might have problems telling a story about a specific situation evoking a feeling of safety or trust simply because they do not pay specific attention to the feeling of trust or safety (i.e., when a technology is running properly). However, whether users are able to report these experiences significantly depends on the context of the interaction (e.g., if an interaction is situated in a safety-critical situation like cars, feelings of safety may be well communicable). Additionally, temporal conditions are influential regarding the shift from extraordinary to ordinary experience, for instance, as experiences with new technologies evolve over time (Karapanos et al., 2009). Thus, users may pay initial attention to trust as a component of the experience, whereas after several trustful interactions, it might become less prominent in the users' experience and thus less memorable. Being aware of the ordinariness of experiences helps researchers decide on specific methods to employ. Independent from how data were gathered, the different ways of encountering technology and related attributes (i.e., repetitive and initial, frequent and infrequent, everyday and intervening), can be specifically anchor the search within the data.

## User Experience Design

> *"The design of everyday things is in great danger of becoming the design of superfluous, overloaded, unnecessary things."* (Norman, 1988/2002, p. 293)

This quote from Norman (1988/2002) pointed out what we consider a challenge for design: What kind of experience should designers aim for? In other words, what is considered a good or positive experience? The characteristics of good or positive experiences differ largely. Is it the extraordinary, exceptional experience, such as unpacking a new iPhone, that leads to a good experience with technology? Or is it the continuous, unexcited ordinary experience (e.g., the familiar feeling of touching the display during an ordinary e-mail checking activity on the phone) that is considered as a desired experience? It is not surprising that a great deal of current user-experience research activities focus on unordinary experiences due to the contexts that are investigated (e.g., home, leisure, culture). Certainly, there is also research addressing everyday, ordinary experiences, primarily in design research (e.g., Desjardins & Wakkary, 2013; Norman, 1988/2002; Wakkary, 2009). However, these differences still play a marginalized role when it comes to design and user experience research. Emphasizing ordinariness in the scientific discourse provides a link between different contexts and appropriate methods. We posit that, with the increased ubiquity of computing, interactions that are in the background of users' attention (i.e., peripheral interaction; Bakker et al., 2015) gain increasing importance. However, users are required to understand and learn how to interact with a system before the interaction disappears from the user's attention (Bødker, 2006). Thus, the experience addressed at any specific moment may differ

from the first encounter of an interactive artifact to long-term use; yet each of these needs to be articulated to allow reflection on the design (e.g., Dalsgaard & Halskov, 2012) and usage.

We are aware that different nuances of ordinariness are addressed in design practice, although often implicitly. The tacit knowledge of interaction designers (e.g., Moggridge & Atkinson, 2007) may help them design a specific, more or less ordinary, experience. However, it would be beneficial if the respective experiences could explicitly be articulated along the continuum of ordinariness in order to allow researchers and designers to discuss, learn from, understand, and finally improve interactions. Although experiences that are in the background of people's attention (Forlizzi & Ford, 2000) and part of their everyday life (Wright & McCarthy, 2010) have been mentioned in previous work, designing for ordinary experiences has not explicitly been addressed in the research literature. The conceptualization of experience in terms of ordinariness, as proposed in this article (i.e., ranging from ordinary to unordinary ways of encountering technology), is one means of facilitating this articulation by depicting the dynamics and characteristics of ordinariness, as well as by providing the respective vocabulary, such as the earlier proposed characteristics. We advocate for experience-centered design activities (for the factory and beyond) to address the following: (a) designing for positive, compelling, and outstanding experiences; (b) designing for ordinary experiences happening in the background of people's attention; and (c) designing for experiences that meander continually between the ordinary and unordinary along a temporal trajectory.

## CONCLUSIONS

Recognizing the distinction between outstanding and remarkable experiences (i.e., unordinary) and interactions that are unremarkable and happening in the background of people's attention (i.e., ordinary) in various everyday work experiences certainly is an important aspect of user experience research. Thus, interacting with systems embedded in everyday practices, for instance in a work context, has to be conceived as ranging from unordinary to ordinary experiences. For example, interactions cannot and should not evoke solely positive unordinary experiences. With this article, we show that mundane experiences might also be good and the intended experiences evoked by interactive artifacts. Especially in everyday work engagement, good and desired experiences are often those that do not attract people's attention and are less cognitively demanding. Promoting sensitivity for ordinary experiences, however, does not mean that ordinary experiences are superior to unordinary ones or vice versa. Thus, design activities can reach from addressing compelling and outstanding experiences to designing for ordinary experiences happening in the background of people's attention. It is the arrangement along the various nuances of ordinariness that an interactive artifact may address and be specifically tailored to the purpose of the design. We aimed to promote sensitivity in research and design for this conceptual distinction by highlighting ordinary user experiences. We further propose that ordinariness of experiences should be considered when defining user experience goals within an experience-centered design process, in terms of which nuances of ordinariness should be addressed with the designated design activity.

The semiconductor factory context, which is the basis for this reflection on ordinary experiences, provides rich, yet simultaneously limited, insights. It is rich in that its interactions are both ordinary and unordinary. It is limited as a specific work context that barely allows

transferal to work contexts beyond semiconductor or other manufacturing, let alone to leisure settings or contexts. Although we cannot provide evidence for a generalization, the lens of ordinary experiences can be taken as a basis to analyze experiences in other (e.g., work, leisure) contexts. It is likely that ordinariness can be found everywhere, though to a differing extent. Ordinary experiences might be an integral and important part of people's everyday experiences with technology, as the heterogeneous nature of interactions, settings, and contexts is likely to result in diverse nuances of ordinariness. The main goal of this work is, consequently, to raise awareness for ordinary experience. It represents the challenging endeavor of theoretically framing and describing ordinary experiences with technology by means of a specific use case, that is, factory work.

Our theoretical conception is not a fully elaborated theoretical framework yet. Necessary future work will address the aforementioned limited breadth of application, that is, we strive to broaden the notion beyond factory work. In terms of the depth of the elaborated framework, future studies will reveal details that are not covered by this first exploration, including an enhanced vocabulary to describe the nuances of the ordinary. However, even with these limitations, this reflection on nuances of ordinariness is needed, on one hand to better understand the spectrum of human experiences with technology, and on the other hand, to allow design practitioners to integrate this knowledge deliberately within design activities.

Our research provides a complementary conception and description of experiences with technology based on a practice-oriented perspective, which encompasses not only outstanding, extraordinary experiences but also ordinary, unremarkable experiences. By explicitly including ordinary experiences within the discussion on user experience, we emphasize a frequently overlooked perspective on user experience. As everyday, ordinary interactions with technology play a crucial role in shaping people's experience, a way to theoretically describe them with regard to user experience is required. The conception of ordinariness provides a basis to reflect on, research into, and design for nuances of ordinariness in multiple application areas as well. In particular, we encourage investigating how ordinariness of experience can be characterized in other application and context areas, or how specific methods can be advanced to better access nuances of ordinariness. Further, deeper theoretical discussions, for example, with regard to conceptions like learnability, affordance, or habituation, as well as cognitive psychology in general, will further increase knowledge on the ordinariness of experiences.

## IMPLICATIONS FOR THEORY AND APPLICATION

By promoting sensitivity for the ordinariness of experiences—ranging from ordinary to unordinary experiences—that users may have while interacting with technology, we contribute toward a more comprehensive conception of user experience in research and design. Beyond the use case of a factory, this might be also relevant for other work contexts as well as for home or mobile contexts. On one hand, our conception allows including unobtrusive, peripheral, or ambient interactions in the discussion surrounding user experience and thus paving the way for more elaborated and explicit approaches to research and design for ordinary experiences. On the other hand, our conception of ordinariness facilitates the refinement of methods to empirically assess and explore experiences—both generally and specifically related to unobtrusive, peripheral, or ambient interactions that are intended to be in the background of the user's

attention. This implies the need to conduct qualitative research, engaging with users in their everyday context, as well as the adoption of practice-oriented research with a focus on user experience. In particular, our conception offers the opportunity to guide the application of certain methods by considering how a method deals with the ordinariness of experiences and how the method addresses different nuances of ordinariness.

## ENDNOTES

1. Bødker (2015) distinguished between three waves of HCI: (a) the first wave of HCI was driven by cognitive science and human factors and mainly focused on systematically studying the user through formal methods; (b) the second wave's focus shifted to (group) work settings considering the context of use as relevant dimension; and (c) the third wave broadened its focus beyond work settings to homes and other leisure domains.
2. The applied interview approach specifically addressed memories of workers (after deploying the robots). Certainly, memory effects need to be taken into account (Norman, 2009). Thus, our conception on ordinary experiences (based on the previous study applying a retrospective method) refers to the reflective level of humans' experiences.
3. We translated the quotes from German into English and gave them to an English native speaker for proof reading.

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