The Hidden Technological Labour of Service Workers in Health and Beauty Shops

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ABSTRACT

Advances in computing have started the digital transformation of work and there is hardly any occupational domain that is not affected by it. Yet, some jobs are still considered "nontechnical" - such as for example the work of shop assistants in health and beauty retail. In this paper we take a focused look at the ways that advances in computing have also affected their work routines: Which technological labour do these "nontechnical" workers perform on a daily basis? And why is this dimension of their work so often overlooked? To address these questions we present the results of an interdisciplinary qualitative study. The findings highlight the versatility of technologies employed and illustrate the sociotechnical complexity of the performed work tasks. Our discussion relates our insights to previous research on functional invisibility and offers a supplementing analysis of several hiding mechanisms. Thereby, the paper contributes a critical look that reveals the ways that keep technological labour downplayed, overlooked and undervalued in this particular female-dominated low-wage occupation of the service sector.

CCS CONCEPTS

• **Human-centered computing** → *Empirical studies in HCI*.

KEYWORDS

invisible labour, low-wage work, hidden technological working skills, service workers, digital transformation

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1 INTRODUCTION

The digital transformation of work is a traditional topic in Human-Computer Interaction (HCI), Computer Supported Cooperative Work (CSCW) and related fields in Computing. Research in these disciplines has contributed for decades to the design of technologies that have revolutionised the workplace, work tools and work practices [35]. We now live in a time when advances in computing have changed occupational profiles in industry and even created new forms of technically enabled work. Much has been written on related topics such as industry 4.0/smart factories (e.g. [8, 21, 33]) as well as crowdworking/gig economy (e.g. [12, 19, 24, 58]). Reflections in HCI highlight both new exciting technical potentials for shaping the future of work [3, 25, 48] and critical issues with the shifts towards work automation [57] and the disruptive effects of the gig economy and service industry commoditisation [24]. Altogether, this work sketches scenarios for the future of work which suggest that there will be hardly any occupational domain that is not affected by digital transformation.

Yet, some jobs are still considered "nontechnical". For example, service occupations (such as in retail, home care, hospitality, etc.) tend to be framed around working with people rather than with technologies. Many of these jobs also tend to be underpaid. It also happens that far less academic attention has been paid to the impact of the digital transformation on "nontechnical" low-wage service jobs. Dombrowski et al. [13] were among the first ones to take a focused look at low-wage workers and explored their sociotechnical practices to address wage theft. Their paper marks the recent beginning of a new direction in HCI research on workers [17] that also draws on emerging social justice agendas in this field [14, 54]. We share the authors' assessment that it is problematic to frame low-wage work as "nontechnical" because *"such professions are often inundated by technology in the workplace. For example, their practices are frequently regulated and shaped by technology (e.g., computerized work scheduling systems that control their time; keycards that track worker's location and movement; timekeeping systems that document their work hours)"* [13, p.4585].

To this critical perspective we add a feminist concern: One can speculate that the academic blind spot towards "nontechnical" low-wage service jobs might be related to the circumstance that many service occupations tend to be not only underpaid but also female dominated. This speculation brought it to the feminist attention of our interdisciplinary team of researchers. We suspect that the widely spread imagination of service work being "nontechnical" originates in historical gendered traditions and implicitly carries on a (pre-industrial) division of labour that imagines men's work as paid work and women's work as unpaid emotional/reproductive labour (cf. [4, 30]). This construction is problematic not only in that

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it is categorically ignorant to the technical dimension of contemporary service work (cf. [59]) but also in that it risks reinforcing a value gap between men's and women's work (cf. [42]).

In this paper we seek to address the mentioned issues with the "nontechnical" framing of service work and present our results from exploring the technological dimension of work practices performed by a specific group of employees in a low-wage service occupation. Our interdisciplinary team of researchers was interested in the technologies that workers in health and beauty shops use as part of their work and conducted a qualitative multi-method study to ask: Which technological labour do retail employees perform on a daily basis? And why is this dimension of their work so often overlooked (and excluded from academic discussions about the digital transformation of work)? We present our findings on the remarkable extent of technological labour which these workers perform and detail the abundance of technologies these workers need to operate on a daily basis. We found that they employed a variety of the technologies in versatile ways. The data gives an impression of the sociotechnical complexity of the performed work tasks as well as several hiding mechanisms which we found to be instrumental in keeping technological elements of their service work routines overlooked or downplayed. Our discussion relates our research insights to previous research on functional invisibility and reflects on the particular role that sociotechnical aspects play in the hiding of technological labour.

Doing so, this paper connects to the mentioned recent shift in HCI and CSCW research and contributes to further addressing the gap in this under-researched domain. In particular, the paper contributes to HCI research on work by (i) offering a tentative definition of technological labour that is inclusive to the interactions of "nontechnical" workers with computing technologies, (ii) providing qualitative findings that reveal the variety of technologies that health and beauty shop workers use on a daily basis, and (iii) supplementing previous research of invisible work with a close look at downplayed, overlooked or hidden work routines in a female-dominated low-wage occupation of the service sector.

2 RELATED WORK

Our study chose to explore the work practices of service workers in health and beauty shops because they represent a female-dominated low-wage profession in Austria. Statistics show that in 2021 98% of starting trainees in this profession were female [2]. This data indicates an even higher percentage of female workers in this trade than in other areas of retail. For example, in food trade 86% of salespersons and stock clerks were estimated to be female [47]. The same study also shows that sales professions are still generally in the lower third of the national income scale. Retail employees, for example, earn less than 1,300 Euros net/month on average. This is approximately 24% less than the average income in Austria [6].

We note some particular cultural specifics about health and beauty shops in Austria. The context differs to for example chemists in the United Kingdom or drugstores in the U.S.A. in that they do not include a pharmacy department. In Austria prescription medicines can only be purchased in licensed pharmacies whereas health and beauty shops offer sanitary articles and over-the-counter healthcare products. They further offer cosmetics, household items, and health food. Hence, in comparison to other countries, health and beauty shops in Austria are positioned more as specialised supermarkets with an explicit focus on products for personal health and beauty. It might be speculated that the specialised range of products (which often happen to target female consumers) also affects a cultural framing of those people working in such "shops for women".

By placing our inquiry focus on this specific group of workers, our research ties into several traditions of research:

Firstly, we build on a vast historical body of HCI and CSCW research [13, 17] related to computer-assisted work tools, workplace studies and cooperative work. This body has not only been growing but also shifting its scope to better address the complex collaborative character of computer-supported work. At the same time, we see an issue with its historically constituted focus on "technical jobs" and "computer workplaces" - our work seeks to address this issue by choosing a nontraditional research scope on a "nontechnical" service profession.

Secondly, our research motivation and methodological approach tie into a long tradition of exploring women's work and uncovering invisible forms of labour therein. In feminist social sciences this work has been key to bringing attention to unpaid care work and reproductive labour [23] - but also how paid labour differs for female and male workers. Most notably "technical skillsets" are projected differently onto workers depending on if they are part of male- or female-dominated professions, trades or industries [61]. Our work takes a similar approach as many historical studies to reveal the hidden labour and skills of workers in a female-dominated profession and thereby seeks to add a contemporary perspective on this topic.

Finally, the topic of invisible work builds a conceptual bridge between classic CSCW literature and concepts of invisibility in the social sciences. We adopt these concepts from multidisciplinary literature to put us into a position that allows us to discuss different reasons for technological labour often being hidden and invisible.

2.1 Shifts in Scope of HCI Explorations of Work

HCI, CSCW and related fields of technoscience have a long tradition in exploring the impact of digital technologies on work [13, 17].

Myers [35] notes that HCI research in the 1960s created the foundation for developing the digital key technologies (such as graphical user interfaces, the computer mouse or text editing programs) that later came to revolutionise workplaces. In the 1970s/1980s they became computer-assisted work tools and started to equip many offices. This development is also reflected in a growing body of workplace studies (e.g. [56]) that started to explore work settings as a particular application context for ICTs and began to explore issues such as the design of "office information systems", "computer-mediated communication" and "office automation" [46].

The key shift here was however that research began to pay attention not only to the technologies and the direct interactions with users but also to the embedding of these tools into wider collaborative settings [11, 31]. This formed the starting point for CSCW in the 1980s as a specialized (interdisciplinary) research community to address the digital transformation of work [46, 55]. With its focus

on cooperative work CSCW has embraced the collaborative character of work processes [45] and went on to further explore the social complexity of work practices [46, 56]. Schmidt noted that workplace studies were key to highlight this complexity in the first place [45]. He argues that critical investigations of workplaces and new technologies being introduced to them contributed fundamentally to developing the conceptual foundations of CSCW.

However, workplace studies were based on the assumption of a fixed workplace that was equipped with technologies. Hence, much HCI research focused on settings such as offices, factories and hospitals. Back in the 1980s/1990s, offices were early adopters of ICTs and computer-assisted work tools. As they became a primary site of research, it can be speculated that this also settled a strong focus on work around "technical" jobs and work settings that are framed around direct interaction between humans and technologies. That is, it subtly established a tradition of rendering some forms of work being more relevant for HCI than others. Yet, these assumptions might be partly outdated and challenged: Working at a fixed workplace with a computer still might be the case for many jobs, though it is not for all occupations. Since the "early days" computing has become mobile and pervasive [1, 60]. That is, employers can equip their workers now with ICT-tools beyond the confines of PC terminals (e.g. with smartphones and tablets). However the traditional focus on workplaces still persists in that HCI research still focuses on work sites where digital technologies are expected to be found. For example, much attention has been paid to online freelancers, platform workers, click-workers and other people performing new forms of work that have evolved in direct response to advances in computing and system design (e.g. [12, 19, 24, 40, 58]). Another prime example would be factory work that involves interacting with specialised machinery. Research in HCI and HRI have explored for instance assembly line workers' experiences of collaborating with robots (e.g. [33, 62]).

Given this long legacy (at least for a relatively young discipline like Computing) of studies exploring computer-assisted work, it is important to note that standpoints matter in research and that emerging shifts in research focus have also affected which forms of work are covered by this work and which might be left out. Dombrowski et al. [13] identify that the sociotechnical practices of low-wage workers present an understudied area in HCI and relate this to cultural perceptions of these occupations being "nontechnical". In light of our brief (and certainly oversimplified) historical review, it hence might not be surprising that the predominant HCI research focus lies on other areas of work than traditionally "nontechnical" occupations - such as for example low-wage female-dominated service professions.

This observation creates an opportunity for investigating this gap through a feminist lens. Dombrowski et al. [13] related their research on the sociotechnical practices of low-wage workers to an emerging strand of HCI studies focused on social inequality (cf. [14, 54]). Our work now draws more specifically on feminist (CSCW-related) literature that has addressed the invisibility of women's work [4] and some other forms of marginalised work [49, 51]. This does not mean we take an entirely different approach, rather we see our approach concentrating on one particular aspect within the wide field of social inequalities.

2.2 Explorations of Women's Work

Having identified this gap in research, the reader might still question the actual need for addressing it. They might also ask why someone should look for hidden technological labor in occupations that seem to be "nontechnical". Scholars from the fields of feminist sociology of technology and sociology of work deliver good reasons to question the "nontechnical" image of female-dominated professions. They argue that gendered dynamics can lead to technological labour being widely overlooked and underpaid. To give an example, Judy Wajcman describes in her book "Feminism Confronts Technolgy" [59] the ways in which the skilled labour of female industrial clothing workers with sewing machines was perceived in the 19th century: *"Although this is one area where women are at ease with machines, this is seen as women's supposed natural aptitude for sewing and thus this technical skill is devalued and underpaid"* [59, p.49]. Wajcman's work analysed such problematic projections of skills on female workers and came to the conclusion that women's status as unskilled and low paid workers and technological developments in "their" domains are mutually constitutive [32, 59].

Nowadays similar mechanisms can be observed: Kupfer and Ranftl [30] found that "social skills" are still seen as a natural aptitude of women employed in service occupations. That is, the skills needed for working with people are rendered as supposedly "natural female competences" and can shape problematic projections onto occupations like nursing or retail assistants. Indeed, the idea of social skills being "natural" can lead to them being not adequately valued when it comes to payment [42]. Simultaneously, digital technologies are culturally framed as a male (and therefore not female) domain in which related skills need to be learned and are hence considered worth being paid [42]. To challenge this framing of social versus technological skills, our inquiry seeks for presumably "male" technology skillsets being employed by workers in a female-dominated profession. Jochmann-Döll and her colleagues [26] were able to demonstrate with the help of case studies - for example in the female-dominated food industry - that the low valuation of female-dominated activities is also due to the fact that essential requirements are not taken into account. This applies not only to "old" technological requirements, but also to "new" ones caused by digitalization processes. In reference to Wajcman [32, 59], our goal is to reveal the digital sewing machine.

In this way, our work also connects to the growing body of feminist HCI and CSCW literature (cf. [5, 43, 44]) which has not only criticised issues with patriarchy in technosciences and industry [44, 53] but also expressed a pronounced motivation to put research into the service of social justice [54]. Furthermore, our aim to reveal this technological dimension aligns with classic studies of women's work. Balka and Wagner [4] conducted a historical literature study on such scientific work and highlight a historical desire to reveal invisible skills and thereby make women's work visible [4]. They emphasise that "invisible work" is a traditional key theme in studies of women's work and referred to studies of unpaid housework and reproductive work but also highlight several social dynamics that have been identified to negatively impact the valuation of women's work. This overlaps with accounts from social sciences (e.g. [20]) which note that the status definitions of work are produced by social hierarchies and can be problematic when they result in a

general lack of public appreciation of some forms of work that is expressed on sociocultural, -legal and -economic levels. Our study stays in this tradition as we set out to bring to the fore the hidden technological labour of retail assistants in health and beauty shops. We chose this particular group of workers because of the stereotypical cultural imagination as a female occupation domain and also statistic evidence that have shown it to be a female-dominated low-wage job [2, 6, 47].

2.3 Functional Invisibility of Work

As highlighted in the previous section, our work draws on concepts of invisible work [4, 20, 49, 51] because it has been emphasised in the social sciences literature that the low social status of certain jobs tend to reflect on socioeconomic, legal, and spatial levels [20]. Yet, there seem to be further factors to consider in the context of workers in health and beauty shops and why certain technological parts of their labour are rendered invisible. In particular, we refer here to the work of Susan Leigh Star [49, 51] who reflected on the relation of invisible work to technology design. According to her, invisible work can be found not only through the question of which work is paid and which not, but also through other revaluation processes that (among others) might surface through the development of technical systems. That is, if certain work routines are invisible to a designer, these are not very likely to be mapped into a system.

A large part of Star's work dealt with sociotechnical infrastructure which she describes as a complex system of resources (e.g. railroad lines, electrical power plants, and also large-scale technical systems). Star emphasizes infrastructure to be itself de facto invisible: *"It is by definition invisible, part of the background for other kinds of work. It is ready-to-hand (...) - turn on the faucet for a drink of water and you use a vast infrastructure of plumbing and water regulation without usually thinking much about it."* [51, p.380]. It is this invisibility that enables people to make intuitive use of infrastructure on a daily basis without constantly needing to deal with its properties or configurations. It's only for those working to sustain the system of resources or in cases of (technical) problems that infrastructure per se comes back into their attention: *"For a railroad engineer, the rails are not infrastructure but topic. For the person in a wheelchair, the stairs and doorjamb in front of a building are not seamless subtenders of use, but barriers. One person's infrastructur is another's topic, or difficulty"* [51, p.380]. This is why Star understands invisible work to be an inherent part of sociotechnical infrastructure. The implicit and relational character of infrastructure (and related work) makes it relatively difficult to identify problematic aspects therein (such as for example institutionalized social divisions). Yet, having said this, Star also notes that both infrastructure and related invisible work would in fact be visible if one only looked for it. Based on this observation she concludes that there are certain social aspects (e.g. a low social status) that render these forms of work "functionally invisible" in society's perception [51].

This aspect of functional invisibility is where our research builds on as we take a deliberate close critical look at the technological labour which is hidden behind the increasingly digital service provision infrastructure of health and beauty shops. In the following section we shift our gaze from the influences from related literature towards our specific approach to further exploring the concepts of computer-supported cooperative work, skill-projections on women's work and functional invisibility in the chosen research setting.

3 INTERDISCIPLINARY APPROACH AND METHODS

This paper builds on an interdisciplinary research project which was conducted for over two years in a large city in Austria. The team members brought together research expertise from HCI, social science, and architecture. In our project, we sought to shape an interdisciplinary practice that made productive use of the different members' respective backgrounds and disciplinary viewpoints. This aspiration reflected in our conceptual and methodological approach.

Conceptually, we decided to refine the research scope by synthesising a working definition of *technological labour*. This definition combined multiple sociological definitions of work with related work in HCI/CSCW and the previously mentioned mutlidisciplinary reflections on invisible work.

Methodologically, we shared an interest in feminist themes and modes of conducting research for a social justice agenda. The general aim of the project was hence to make visible the (often) hidden dimension of technological labour provided by the workers in female-dominated service professions and to thereby contribute to political debates on revaluating these often underrated and underpaid occupations. We conducted two case studies which investigated different professions in stationary retail and mobile care work. In this paper, we focus on one of these case studies and discuss our findings related to workers in health and beauty shops.

3.1 Defining Technological Labour

In the social sciences literature, we found that the most direct approach to defining technological labour is to focus on digitisation processes and to circumscribe work practices that employ information and communications technologies (ICTs) as tools. For example, Flecker [16] summarises several ways in which work is digitised both in terms of the employed tools and the environments in which it takes place. He mentions several configurations for ICTs as work tools: integrated into work tasks and work places, as means of communication and collaboratively processing data, utilized to create a virtual workplace, as an organisational means to distribute specific work tasks (ie. microjobs in crowdsourcing), employed to manage company work flows and collaboration processes at scale, and as means of producing digital products. Not all of these configurations seem relevant for our research context. Hence, we chose to focus on those digital work practices that are performed in physical spaces (at least to some degree) and hence on the various ways in which ICTs are used as work tools. According to this approach, a worker would perform technological labour whenever they use digital technologies and therefore need to employ some form of digital skills. This conceptual approach forefronts digital work and eventually frames work as rational practices of systematically acting people [10].

However, we understand digital work to be only one facet of technological labour. We also noted alternative approaches to defining work as the product of collaborative interactions [15]. Rammert and Schulz-Schaeffer [41] described these interactions in the form of sociomaterial interrelations which involve both the intentional exchange between human actors and their interactions with things and symbols (such as ICTs). Here comes to mind the examples that Dombrowski et al. gave for technologies regulating and shaping the practices of low-wage workers: *"computerized work scheduling systems that control their time; keycards that track worker's location and movement; timekeeping systems that document their work hours"* [13, p.4585]. Defining work through sociomaterial interactions means that technologies also have the capacity to affect work on a more structural level. Building onto this conceptual approach, we sought to also include nuances of technological labour where technologies organised work processes or interactions between co-workers, clients and other stakeholders. For example, how does the use of click-and-collect shopping structure the interactions between customers and shop staff? When technologies organise the work processes related to such services, they become an embedded part of the sociotechnical infrastructure in the background - and according to Star this is when the work becomes prone to functional invisibility [50].

Based on these reflections, we define *technological labour* (as part of paid employment) as **(i) any professional activities employing digital tools or (ii) any work-related interaction which are impacted by digital technologies**.

Again, our assumption was that parts of this labour were "hidden" and we were aware that a too rigid definition of what counts as technological labour might contribute to the hiding. Hence, we decided to keep this definition open for further exploration.

3.2 Methods

For the exploration of technological labour we employed a mix of qualitative methods to capture workers' experiences and deepen our own understanding of the role of technologies in the investigated context. The primary data collection took place between June 2020 and March 2021 - that is during the global COVID-19 pandemic which is also reflected in our choice of methods. We conducted semi-structured interviews via telephone and video calls, observations in system-relevant shops, online content analysis, and documentary research analysing policy documents. This multi-method mix was partly due to the researchers' different methodological training by discipline (sociology, architecture and HCI/design), partly due to ensuring a low-risk research conduct in midst of the pandemic. The project did not undergo any formal assessment by an ethics committee since the team did not have access to such an organisational body. Instead, we took several informal actions to ensure a responsible research practice. We discussed ethical aspects within the team and combined best practices from our various disciplines and institutions in such a way that no team member felt conflicted about. For this we also drew on the external means of guidance we had available. The team members from the non-academic research institution were members of a European evaluation standards organisation and sought to comply with a defined set of principles related to the rigour, viability, data management and ethical conduct of empirical research. The first author also drew on the available advisory services regarding research ethics at her academic institution (which is in the progress of piloting an ethics board yet so far only offers a voluntary peer review service).

In the interviews we talked to ten employees at one of the major health and beauty chains in German-speaking countries. This involved workers in different departments and job levels (shop staff, local and regional management, IT) to gain a wider picture of the role of computing in this company. Additionally, we also interviewed two members of the labour union and employees from other trades of retail with insight on current debates on the digital transformation in retail. The interviews were recorded with approval of the participants and transcribed for further analysis.

Ethnography was done in the form of twelve participant observations at the shops of the same chain and others (cf. [9, 28, 50]). We also conducted some visits to supermarkets to compare. At the outset of the study, we had prepared a list of questions that aimed to guide our observations. The visits were documented in reflective field notes written afterwards based on the researchers' memories. Sometimes these notes were written in response to the guiding questions, other times the notes were written in an unstructured ways - especially when we happened to encounter particularly interesting situations.

The analysis of online content involved critical inspection of websites, online shops and posted job advertisements related to three companies (cf. [18, 22, 27, 38]). We looked at how the companies presented themselves and their services, and tried to speculate on which of the online services also might affect the routines of in-store workers (e.g. click and collect shopping service). Moreover, we scanned the job advertisements for details that referred to any digital skills being explicitly or implicitly required from applicants. We also compared the ways that job advertisements relating to shop assistant positions and IT jobs were written differently.

We note that we did not track any demographic data such as the gender, age or race of participants. Our set of methods did not scrutinise to which degree service workers in health and beauty shops present an underpaid female-dominated group of workers. However, our sample still provided such an impression: All three interviewees who were service workers in health and beauty shops identified as female. While this could have been a coincidence, we also encountered almost exclusively female shop workers in the twelve observations (that is only three out of the 39 mentioned persons in our notes were male). Furthermore, the job advertisements we analysed as part of the online data also indicated the expected salary. According to this data, a shop assistant in a health and beauty shop could expect to earn about 1,400 Euros net/month for full-time work. This is slightly more than what has been reported in the above mentioned income statistics [6], yet still stands at approximately 17% less than the average income in Austria.

All data was collected in text documents that were shared among the research team for cycles of analysis. All this work was done in German and the quotes presented in this paper were translated by the authors. We decided to take an analytical approach that looked for any traces of workers employing digital skills in their work routines and to use these as markers for technological labour. Each team member went through the data individually, categorised traces of digital competencies deductively according to a digital

competence framework (DigComp 2.2 AT) [36] and also performed inductive open coding to highlight and group additional skills that are not covered by the framework. We also looked for any indications of technological labour being hidden, ignored or downplayed - either by explicit mentions of participants or implicitly embedded in the ways the interviewees were talking about technologies at work. This is where our ethnographic understanding from the participant observations and website analysis proved useful (cf. [50]).

4 FINDINGS

We found that the technological labour in health and beauty shops takes various forms. We observed workers operating different hardware, using systems for processing data, drawing on software as tools in their customer support, training each other on the systems or assisting customers in using digital services, communicating online within the team and staff from other branches, and dealing with technical issues of equipment.

This variety is often surprising from the point of view of customers. In an interview a shop assistant said that *"many people don't look behind the scenes. I think it is generally the case in retail that this is not seen. Many people are not aware of the technological potentials in this domain"* (interview 3). In some ways this hidden technological dimension of this work seems wanted (for example to maintain an image of "natural beauty" or "working with people and not with machines"), in others it can become problematic: *"Well, the customers might think that our staff members only play on their smartphones, but that's not the case"* (interview 4). This quote points to issues of stereotypes and the perceived low status of the occupation in wider society that not necessarily accepts the idea of these workers to perform tasks with high-tech tools.

The following sections aim to extend the common limited gaze that tends to grasp only the tip of the iceberg and usually ignores a wide range of tasks that fit into our definition of technological labour. Given the complexity of this work and the continuing technological changes in equipment (as well as the page limit of this paper), we cannot provide a comprehensive description[1]. Instead, we report here on three different work situations that illustrate instances of technological labour and several of its key aspects.

4.1 Technological Labour at the Checkout

- *"I rarely see any interactions between shop staff and customers today. Only at the checkout I see them talking directly to each other. It seems that customers do not seek any advice and quickly gather their shopping. Maybe this is down to the time of the day (it is lunch break)."* (observation)
- *"Well, the workplace at the checkout has massively changed, and a second big area of digitisation is inventory management. Which is of course connected with the electronic cash register system, well yes, that actually came along together, and there is also something in customer support."* (interview 7)

Most customers at health and beauty shops only interact with staff at the checkout[2]. They might see the workers use an electronic point-of-sale system (part i of our working definition), yet they often do not consider that even this supposedly automated procedure involves several human tasks: scanning the products, a quick discreet look at brought bags to prevent shoplifting, asking customers to present their loyalty card (if they have one), occasionally advertising selected products on sale and finally taking the payment. Even the payment itself turns out to be more complex on a closer look since the shops accept both cash and cashless payment methods; they take various debit and credit cards, as well as voucher cards and sometimes also stored-value cards; they offer different payment modalities through using the card reader slot or contactless payment methods with cards or apps. Besides knowing what forms of payment are accepted, the workers also frequently need to deal with situations when the chosen payment methods do not work as expected. This can require troubleshooting as well as emotional labour as the following observation describes: *"A young man attempts multiple times to pay with card. He places his card repeatedly on the card reader and the device responds each time with a loud beep. (...) The man is annoyed and turns to the shop assistant to complain about the little blue box. The assistant asks him to wipe his card and try again. This works and the payment process is successful. (...) The man silently mutters some angry words and begins packing his shopping into his backpack."* (observation).

The checkouts are designed differently for the different companies, however all of them embed a mix of hardware and software. Some companies use a very modern set up with both stationary and handheld scanners, a large screen for the worker and a small screen for the customer to see the total and the list of the items that are about to be purchased. Other companies use checkouts that look simpler with a small rather old-fashioned looking LCD display, yet they usually require a similar way of operation as other checkout setups.

4.2 Technological Labour at the Shelves

- *"Most of the time we work with the smartphones and the laptop in the back office. And of course the checkout display as far as we talk technical devices. Apart from taking payments, it is possible now to do a lot of the work in different places."* (interview 2)
- *"Previously, it was a very time-consuming process to check when products expire and remove them from the self in time. We got together then (with the IT services) and they developed this app which was rolled-out (last summer). And everyone is absolutely thrilled!"* (interview 3)
- *"I noticed an occasional bell sound in the shop. On a closer look, it seemed to be a signal when a customer was waiting at a vacant checkout. However, it was not clear to me what exactly triggered the bell. Is there maybe a sensor? I looked at the checkout desk but could not find anything. Anyway, the shop staff reacted quickly to the bell sound, called out that they are coming and interrupted the work at the shelves. Hence, the*

[1]The project report provides an attempt of a slightly more comprehensive description and is publicly available on the research funder's website [7].

[2]Self-checkouts are not common in Austrian shops. They can be mostly found in selected supermarkets part of large food store chains, but we have not encountered them in any health and beauty shops.

bell triggered by some invisible technology sets the rhythm of their work." (observation)

Technological labour at the shelves first of all concerns tasks of inventory management. Workers need to check the stock, replenish items and change price tags. In many shops we observed them working with handheld scanners and printed lists, however one company introduced company smartphones which are also used by their workers for managing the inventory. There the smartphone has become a multi-functional tool for the staff. It is not only used for work at the shelves but also for HR processes, training and assistance in customer service: *"Or for example if a customer wants a fluoride-free toothpaste. (...) I am sure we take our smartphones at least 50 times a day. Because I can check if a customer asks me something and I can see if we have a product in stock or if it's still in our warehouse or alternatively in which other branch it is still available. It even tells me the distance to the other shop. Or I can check all the product details if a customer wants a product that I don't know yet."* (interview 1)

Customer service can also involve an element of tech support when customers have issues with accessing digital shop services. For example, we made an interesting observation of a staff member professionally assisting a customer when using the photo printing service: *„(A young man) briefly investigated the (photo printing terminal) and started to swipe on the touchscreen (one of the three machines). He didn't seem satisfied with the information on the screen (...) and decided to approach a shop assistant (who was working at a shelf close-by). It took few unerring screen inputs for the worker to display the price list which the customer was looking for. However, the man required additional explanation of the prices because he wasn't sure if he understood their terms correctly. (...) The shop worker ran him through the general process of photo developing jobs so that the customer could better understand the differences in prices."* (observation)

In most shops workers need to switch between tasks and constantly move between checkouts and shelves. In our observations we later noticed a hidden infrared light sensor installed opposite to the checkout desks that was used to notify staff whenever a customer was waiting (see quote above). This is a prime example of an invisible technology that structures the technological labour (part ii of our working definition). While the frequent bell ringing might be disruptive to getting the work at the selves done, it also needs to be mentioned that many interviewees expressed a positive attitude towards such technologies in that they saw them serving as little helpers. In case of the bell, it took away some of the physical effort in that it relieved the shop workers from walking over to regularly check if customers were waiting at the checkout.

4.3 Technological Labour Dealing with Issues

- *"(In the bugtracking system) I can report for example if we don't have a product in the ECR system. Or if a printer isn't working. You don't need to write an e-mail, instead you do that directly on this portal and you can also upload photos there."* (interview 1)
- *"I first try to solve issues myself. But if for example a smartphone isn't connecting to the WIFI, I can use another smartphone to access the service portal and enter the name of the person whose phone isn't working. I also enter a brief description of the issue. Then a technician calls and if we can't get the smartphone fixed, I call headquarters and I get a new one."* (interview 1)
- *"I have to say it was difficult in the beginning. We constantly lost WIFI connection and we got tech support on the phone. It was often not easy to understand what the technician meant."* (interview 1)

Technologies are designed to rationalise and optimise work processes – however, in reality workers are often confronted with unanticipated situations that are not covered by these systems. Whenever something does not go according to plan, workers need to improvise and resolve these situations. If a product is missing in the database of the ECR system, a shop worker needs to react. The quote above refers to entering a ticket in the bugtracking system, but beyond that the worker also needs to quickly find a way to still process the customer waiting to pay. This means, in the face of gaps in the systems workers operate as sociotechnical mediators between work technologies and complex social situations. We note that this is a special form of technological labour since it is of an unplanned improvised character. It also plays a special role because it is of particular importance when technologies completely break down. The quotes above list several examples of technical issues that workers needed to mitigate in order to keep the shop open and running. Hence, we refer to this instance of technological labour as *compensation work*.

Compensation work can employ a variety of strategies for productively dealing with issues. One key approach seems to be flexible coordination within the shop team and the wider company: *"I might write to a coworker if I couldn't finish something and ask if she can take over tomorrow. We keep each other up to date (in MS Teams) where we stop at the end of our shifts and that is pretty neat."* (interview 1) This example also points to the workers' capacities of being creative in their use of work tools to improvise "quick fixes". For example, during the pandemic health and beauty shops were rendered part of system-relevant services and shop employees needed to address sudden changes in customers' buying behaviour. This required not only manual adjustments in the ordering system but occasionally even "quick fixes" by contacting other branches: *"Our system orders automatically and we needed to increase some order items because there was such a demand. Teams was used then to improve our communication and information exchange because our workers are not there every day."* (interview 3)

We reported elsewhere on various other instances of such compensation work performed during the pandemic [34]. Here we want to note that the special situation of the pandemic brought to the fore the key role of compensation work in keeping the shops open and satisfying the needs of customers. We found that workers take much responsibility for the overall success of the service provision and that they tend to improvise with a high level of integrity when they fill in for any shortcomings of technologies. This has certainly already been the case before the pandemic, however the mentioned examples worked particularly well to highlight this special form of technological labour.

4.4 Categories of Technologies Part of Technological Labour

"In general, (technology) is really important. Because we depend on it. Both at the checkouts and in the ordering systems. Many work processes depend on it." (interview 3)

The three exemplary work situations give an impression of the variety of technologies that the workers employ in their daily work routines. To summarise it, we group them in four categories:

(1) **Work tools** (e.g. computer integrated in checkout desk, smartphones, hand-held scanners, a stationary PC in the back office):
Shop assistants do not spend their workdays at the desk or a computer workstation, yet this does not mean they would not be using any digital tools. Some technologies are embedded in the shop's equipment in a fixed position such as for example the checkout which is in fact a computer with a more or less reduced system interface. We were also told that there is actually a stationary PC in the back office, however this is only used for few specific tasks such as printing price tags. For their work at the shelves, workers are equipped with mobile technologies such as smartphones and hand-held scanning devices. These are not only used for data processing and documentation tasks (checking the stock, ordering products that are running out, etc.), but also as important means of communications - within the team, the wider company and also for consulting customers if they have special requests.

(2) **Work Infrastructure** (e.g. WIFI, sensor-bell-alert at the checkout):
Similar to the integrated computer at the checkout desk, many technologies are embedded in the shop equipment. Altogether they create a technologically well-equipped work infrastructure that is essential for the smooth performance of the technological labour. A good example is the router which provides WIFI both for workers (as the network for their data processing work) and customers (as a free service). The device itself tends to be concealed from the customers' view in the shop space and hence remains a hidden part of the infrastructure.

(3) **External Technologies** (e.g. smartphones owned by customers, photo printing station provided by supplier company, PCR test kit service):
There are many situations when the workers are confronted with technologies which are not part of their retail company's ICT systems but part of a wider ecology. Examples of such external technologies comprise systems provided by external suppliers (e.g. the photo printing station) and the private devices of customers through which they use digital services of the shop (e.g. click and collect shopping).

(4) **Background Technologies** (e.g. algorithms for personnel planning):
The final category comprises a layer of particularly well hidden immaterial digital technologies that operate in the background to structure and organise the work. This involves internal company IT systems that manage work processes and algorithms that are designed to optimise these. While the workers might not even be aware of these, they become the framework for their tasks and shape their work conditions. For example, we note systems aimed at efficient manpower planning that analyse data from the checkouts on customer frequencies and accordingly suggest staffing shifts. Such systems are not transparent in the automatic decisions that are made during this planning and are clearly in the service of the companies who benefit from minimal personnel costs.

4.5 Hiding Mechanisms

Our study illustrates the diversity of tasks that add a substantial technological dimension to the daily work in health and beauty shops. Yet this work is generally perceived as "nontechnical". The reader might rightfully ask now why all this technological labour remains hidden – especially since it can be "discovered" if one only looked for it. In reference to the work of Susan Leigh Star [51], we rephrase this question: What makes this work "functionally" invisible? The findings from the previous section now put us into the position to explore the hiddenness of the encountered technological labour and to compare it to concepts of (functional) invisibility in the literature.

Our analysis placed focus here on implicit parts of the labour. That is, we looked closely at those situations related to aspects of digital transformation in which some work routines were not attributed as work or played down. Through this we could identify both willful and subliminal hiding mechanisms which are described in the following.

4.5.1 Willful Hiding. A part of the hiddenness stems from wilful and (partly) self-directed management of visibility. Stationary retail (and in particular the line of health and beauty shops) is a sector that presents itself to be rather "technology-free". Retail companies deliberately create corporate images that forefront "simplicity" (supermarkets) or "naturalness" (health and beauty shops), and digital technologies do not fit into these profiles. Likewise shop staff tend to envision themselves as professionals who "work with people" (and not with machines). Thereby, they foster an occupational profile which places emphasis on interpersonal relationships. Parts of their work that is based on technological labour, on the other hand, are willfully kept invisible or at least toned down. In related literature, we find the term *backstage work*. Star and Strauss [51] used it to refer to athletes, musicians and actors who perform a large part of their work in training or rehearsals. In these professions there is an obvious distinction between frontstage- and backstage work for aesthetic and performative reasons. In our study we found a similar management of visibility which is related to cultural perceptions of health and beauty shops as "technology-free" spaces.

4.5.2 Sociocultural Attributions. Societies attach different cultural value to different types of labour [20]. A low social status or a general lack of appreciation of this work might render it less visible than other work [51]. That is, cultural hiding mechanisms tend to ignore, overlook, hide or undervalue this labour. Health and beauty shop workers hold a respectable job yet are potential targets of stereotypes. In our study we noted a categorical underestimation of their skills that was expressed in several ways. Partly it was enacted on the workers in the form of disrespectful customer behaviour: *"In*

the beginning it was confusing for the customers to see us operating with smartphones and sometimes we were bad-mouthed." (interview 1) Partly, it was embodied by the workers themselves in the form of low technological confidence while at the same time the companies did not provide them many opportunities to grow more confident in their digital competences: *"(The online training platform) is received very well, but we just lack the time. You really have to schedule in time. Most often something crops up and interferes with the plan. Like Corona now for example. Sales increased enormously in our branch and we do not have any time really to sit down and look at the (training platform). But when there is some spare time, people like to use it."* (interview 2)

5 DISCUSSION

Given the focus of this paper on matters of HCI supporting work, we want to discuss some sociotechnical aspects of hiding technological labour. We see these interconnected with the previously described practices of intentional hiding or cultural value attributions. The ways that digital technologies integrate into the setting of health and beauty shops also reflect the described tendencies of service workers foregrounding their "work with people" and societies attaching relatively little cultural and economic value to this kind labour. For example, we saw that work tools are usually designed in a way that they are easy to be overlooked: Employee smartphones are small enough to put in the pocket, the desktop computer remains out of the customers' sight in the back office, and the checkout does not look like a computer workspace. We also saw that some digitised work routines had higher priorities than others, especially if these involved direct interactions with customers. Technologies such as the sensor-driven bell assisted the workers to put their "work with people" first.

Based on our descriptions of willful hiding and sociocultural attributions as different ways in which technological labour was not attributed as work or played down within the studied setting, we noticed sociotechnical synergies that add further nuance to these hiding mechanisms. Altogether this points to different layers of invisibility (cf. [51]): Technological labour was physically concealed or functionally invisible; it was deliberately hidden or passively left in implicitness; hiding affected entire work routines or just single elements; it was desired or became problematic in some situations. The mechanisms present a more complex picture than a straight-forward answer to the question: "Who is hiding what from whom?" Nonetheless (or rather for that very reason), they substantiate the persistence of invisible technological labour and various problematic potentials therein.

Based on this, we seek to reflect now on the particular roles that also digital technologies might play in rendering technological labour invisible. The focus of this discussion lies on particular dynamics in that technologies become actors and exert notable influence on work processes - whether by evoking certain expectations in wider society or by adding additional layers of complexity to collaborative work practices. Reflecting on the findings, we identified the following two ways in which digital technologies added to the invisibility of technological labour:

Firstly, we note the influence of society having internalised the pervasiveness of technology. The wide-spread use of mobile devices such as smartphones and tablet computers has made technology a part of everyday life – both in the professional and private sphere. HCI has used the term *ubiquitous computing* [1, 60] to refer to this sociotechnical phenomenon. Our data highlights the extent to which the concept has already been internalised by our interview partners. We found that the pervasiveness of technology leads to generalizing an assumption that everyone would already use digital technologies for professional and private purposes anyway – and this assumption comes hand in hand with a (sometimes problematic) expectation that people should already have the digital competences that are needed to use these technologies. In this way, it hides away the efforts that people need to make in order to obtain these competences while also putting them under implicit pressure to keep up to date. We saw that this can indeed become problematic in the ways that health and beauty shop workers are potential targets of stereotypes. Specifically, this manifests itself in parts of the work not being seen as "real" work, and others being overlooked and not being part of in-depth training or part of job evaluation. For example, digital skills training in this field is associated with high levels of learning-by-doing or peer learning. This also makes it difficult to formalize the competencies and facilitates their non-inclusion in job evaluation as a basis for job classification. Mechanisms to make parts of gainful employment appear as non-formalized components make it more difficult to demand appropriate payment, which in turn benefits capital interests.

Secondly, we note the special role of human *compensation work* in partly automated work processes. Our findings on the ways that workers improvise to deal with issues and other unforeseen situations outside regular work routines relate to what previous research has described as implicit *articulation work* [49, 51, 52]. In fact, we understand compensation work to be a nuanced form of articulation work. It highlights those integrative tasks and creative uses of equipment in particular that are needed to keep cooperation structures productive in the face of unexpected developments. Compensation work hence places emphasis on the ways in which the workers take much responsibility for the overall success of the service provision (even though they are not part of management or formally responsible for business success). It is through their conscientiousness and engagement that they keep things going and ensure a certain level of quality in the service provision. This means they tend to improvise with a high level of integrity when they creatively fill in for any gaps in the system or other shortcomings of technologies. In reference to Star's work [50, 51], we argue that the service workers' engagement becomes part of the functionally invisible infrastructure of health and beauty shops and hence is also prone to be rendered invisible. Compensation work is difficult to "see" because it tends to interconnect a multitude of contextual factors. At the minimum, it requires the worker to make responsible decisions *'in the face of the unexpected, and (modify) action to accommodate unanticipated contingencies'* [51, p.10]. These decisions are based on the ways workers perceive their practical options at the intersection of their technical infrastructure and their specific situations. Feminist analyses point out how service occupations with female connotations are naturalized or undervalued by attributions around so-called female work ability [26, 39]. In this context, it is worth mentioning that in the context of the increasing presence of technologies in stores, the advisory activities of salespersons

tacitly include assistance around technical devices. However, these do not become a visible part of training (let alone payment), but are "included" under the umbrella of advising customers and satisfying problems of all kinds. Thus, solving technical problems becomes a more or less hidden part of a druggist's job.

Our study results resonate with the literature in the insight that different hiding mechanisms tend to intertwine in complex ways. The literature has highlighted several ways in which labour is ignored, overlooked, hidden or undervalued on various intersecting levels [20]: Low status might be quantified in minimized economic value (e.g. paid versus unpaid work), might materialise spatially as work is pushed physically out of sight or become institutionalised when excluded from legal definitions and work regulations. We argue that digital technologies add further sociotechnical nuance to these valuation dynamics as they have the capacity to act in disruptive and catalyst ways. Digital technologies can be designed in ways to keep hidden work (functionally) invisible. Ultimately, this can create new risks for those engaging in forms of work which are already socially marginalised (cf. 'dirty work' or 'shit work' in [51]) or which is seen as work based on "natural capacity", that does not have to be "learned" and therefore has no or few value [59].

6 LIMITATIONS AND FUTURE WORK

We note several limitations to the presented work on conceptual on methodological levels.

The conceptual limitations relate to the synthesised working definition. We defined technological labour as work with digital tools or any work interactions that are structured by technologies. This is a definition that we developed and agreed on within our interdisciplinary group of researchers. It framed the scope of our research around direct and indirect effects of digitisation processes (e.g. ICTs as tools and ICTs structuring work in the background) and less around other forms of technologies. It is assumed that research starting out with other definitions might come to other conclusions.

Methodological limitations relate to the time frame and scope of the case study as well as the impact of the pandemic on our choice of methods. The case study was conducted over a relatively short period of time and depended on the collaboration with the beauty and health shop chain. We note that studies like ours require particular care and an ethical research conduct that ensures that participating workers do not face any repercussions. Given our interview partners were recruited by our company contacts, we need to assume that we predominantly talked to early adopters and supporters of the adoption of digital tools. Our own critical understanding that we built through ethnography might balance these predominant positive accounts to some degree, yet it would be desirable to involve more people with negative experiences in this research.

We also note limitations related to our scope. Health and beauty shops are just one example of an underpaid female-dominated service occupation and also just one subgroup of the wide area of retail. We think it would be advisable to conduct similar critical investigations in other trades such as for example with a focus on such as supermarkets or fashion stores. Based on our experiences from this and another case study which we conducted in the same research project, we expect to find many more nuances of technological labour in other settings as much as other hiding mechanisms. Looking at the particular dynamics that the digital transformation brings to "nontechnical" professions would be an important first step towards being able to develop and refine a robust conceptual model of technological labour that is inclusive to those occupations previously overlooked by research.

The impact of the pandemic on our research also needs to be considered. It was indeed an exceptional situation for conducting our study and we are aware that some findings would likely not have been made in a pre-pandemic period. We noted elsewhere that the COVID-19 crisis was in many regards a catalyst of a "digital fast forward" [34]. Our findings hence included nuances of technological labour related to workers being confronted with technologies that were new to them (for example, many suddenly needed to use MS Teams or Zoom for staff meetings and training). Without the obvious need to switch to online communication, it would have been more difficult for us to see the ways that technological labour can also involve information exchange and coordination between staff. This is not to say that these tasks would not have existed. Rather, our impression is that the "general" hidden technological labour was even increased and intensified by specific pandemic-related work tasks.

Finally, we note that our feminist research motivation mostly concerned our choice to place the research scope on the work of health and beauty shops and the ways we approached the endeavour methodologically. However, we did not consider gender dynamics much as a category in our analysis. While we observed many aspects that seem to relate a lot to gender aspects, we do not have the data nor the means to speculate on any possible correlation between the investigated occupation being female-dominated and their technological labour being hidden.

We suggest that future work addresses the mentioned limitations and adds further critical investigations on the hidden technological labour in "nontechnical" occupations. In particular, we see a need for more work looking at the impact of digital transformation on "traditional" low-wage jobs. Furthermore, we see valuable opportunities to refine and possibly update classic CSCW concepts (such as functional invisibility or articulation work) by looking at current work routines in service occupations. Lastly, we also would like to make a suggestion related to our feminist and social justice research agenda: We find it important to reflect more on the potential of research like ours for taking action. Just like other feminist research on women's work, our research assumed that making the hidden dimension of it visible might contribute to its revaluation. Now we are in the position to present some first findings, however, how can these results in fact contribute to change? What more might be needed to actually improve the status of the often female-dominated and generally underpaid occupations of the service sector? Which actors have to be addressed with which arguments?

7 CONCLUSION

This paper presents the qualitative results of an interdisciplinary study of the technological labour of workers in health and beauty

shops. It offers a first tentative definition of work shares that should count as technological labour in "nontechnical" service occupations.

Based on this definition, we found a wide range of technologies being employed in health and beauty shops and we saw that these workers indeed perform a noteworthy extent of technological labour. Furthermore, our data demonstrated that this work is more complex than "just using some simple tools". Rather, the workers often function as sociotechnical mediators between customers and systems and this requires them to perform compensation work (which again might mean to frequently make self-directed creative use of technologies).

The paper also shares a discussion of several hiding mechanisms that tend to keep this dimension of work overlooked and undervalued. We related our findings to the concept of functional invisibility. Thereby, we managed to highlight contemporary hiding mechanisms at work in the investigated domain. Our classification of hiding mechanisms indicates that invisibility originates from different social dynamics and accordingly also operate to different degrees on different levels. Having said this, all mechanisms have in common that they result from sociotechnical developments in which not only people (may them be employees, employers, customers or other stakeholders) but also digital technologies become actors in a sociomaterial fashion [37]. Our analysis herein confirms previous discussions of invisible work in that the use of technology tends to either let existing forms of invisible work remain hidden (or even intensifies the hiddenness) or create completely new forms of invisibility. As is so often the case, technology should not be understood to be a neutral entity in this context [29].

With this in mind, we conclude this paper with a careful note on the particular gendered hierarchisation dynamics in relation to the digital transformation of work: Indeed, it mattered that our study was conducted in the context of a female-dominated service employment field. We might not have empiric evidence to prove any correlation between gender aspects and the observed ways in which technological work practices are concealed, however our findings clearly resonate with the theoretical explanations we found in the related literature (as detailed in chapter 2). The key take-away here is that there is a sociotechnical hierarchisation that renders paid employment with a female connotation to have no or little visible elements of technological labour. The framing as "nontechnical" work and the deliberate hiding of technological elements fits well into the sociocultural expectations towards paid "women's work". This is linked to a specific type of work ("female work ability"), for which no specific education or training is needed. At the same time, it ensures that little thought is given to matters of acquisition, evaluation and remuneration of the required but hidden competences. Therefore, we argue for an academic attempt to make hidden technological work elements visible, to reflect on the ways that multifaceted work requirements (including technological requirements) are hidden and to thereby challenge the hierarchising revaluation of work in female-dominated occupations. This presents a possible starting point for further research to unpack the sociotechnical ways in which implicit gender hierarchies are re-established in contemporary work settings (including their digital transformation and revaluation processes). Ultimately, this can and should support the claim of feminist-motivated research to uncover disadvantages based on gender and to contribute to their dismantling.

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