The Hidden Technological Labour

of the Hero(in)es of the Everyday

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Abstract: Digitalisation has transformed work, jobs, and working environments. Research has paid a lot of attention to topics such as "industry 4.0", gig economy and digital employment. However, it is often overlooked how digitalisation has also affected the (often female-dominated and generally underpaid) occupations of the service sector. Which (hidden) technological labour do retail employees or mobile care workers perform on a daily basis?

This was the research question guiding an interdisciplinary research project in Vienna, Austria. Our project brought together feminist perspectives from social, spatial and technological sciences. We shared the aim to place explicit focus on the rarely visible technologies and digital competencies that service workers already employ in their service provision. By bringing their often hidden efforts to the frontstage, we seek to contribute to political debates on revaluating these often underrated and underpaid occupations.

Our work started at the same time as the pandemic hit central Europe. The lockdowns initially drew a lot of attention to the very sector which we set out to investigate. Suddenly, the workers were classified “system-relevant”. However, the wave of gratitude and applause from the balconies faded soon again without initiating any actual benefits for the workers. On the contrary, we observed in our work several ways in which the pandemic put them not only in risk and under stress but also caused them additional technological labour.

This paper reports on our qualitative research findings that are directly related to the particular challenges of “this moment in history”. We reflect on the competencies that we saw frontline workers to employ in order to keep supermarkets and chemist’s shops open and to ensure that old people in the need of care receive services at their homes of best and risk-free quality as possible. Based on our data, we highlight the workers’ impressive degree of commitment, underestimated skill and technological adaptiveness. In the discussion we raise important questions about taking action and what might be needed to actually improve the status of the often female-dominated and generally underpaid system-relevant occupations of the service sector.

Keywords: hidden technological labour, female-dominated low-wage work, digital competencies, digital skills

Introduction

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Our work happened to start just before the COVID-19 pandemic hit central Europe. The lockdowns initially drew a lot of attention to the very sector which we had set out to investigate. Suddenly, the workers were classified "system-relevant". However, the wave of gratitude and applause from the balconies faded soon again without initiating any actual benefits for the workers. On the contrary, we observed in our work several ways in which the pandemic put them not only in risk and under stress but also caused them additional technological labour.

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Related Work on Hidden Technological Labour

In this research we took an interdisciplinary approach to defining the scope of "technological labour". That is, we combined multiple sociological definitions of work, technoscientific reflections on invisible work and the multidisciplinary research team members' viewpoints on their interrelations based on their respective backgrounds.

In the social sciences literature, we found that the most direct approach to defining technological labour is to circumscribe how exactly information and communications technologies (ICTs) become part of work practices. For example, Flecker (2017) summarises several ways in which work is digitalized both in terms of the employed tools and the environments in which it takes place. He mentions the introduction of digital tools into work tasks and work places, using ICTs as means of communication and collaboratively processing data, utilizing the internet as a virtual work place or the means to distribute work tasks (ie. microjobs in crowdsourcing), employing ICTs to manage company work flows and collaboration processes at scale, and producing digital products and maintaining their quality. In our research on the technological labour in stationary retail and home care, we focused on those work practices that were performed in physical spaces (at least to some degree). This meant our work placed mostly emphasis on the various ways in which ICTs were used as work tools. According to this, a worker would perform technological labour whenever they use digital technologies and need to employ digital competences. This approach conceptually frames work as rational practices of systematically acting people (Böhle, Günter, & Günther 2010).

However, we also noted alternative approaches to defining work as the product of collaborative interactions (Dunkel & Weihrich 2010). Rammert and Schulz-Schaeffer (2002) described these interactions as sociomaterial interrelations in that they not only refer to the intentional exchange between human actors but also comprises interactions with things and symbols – such as ICTs. This means that technologies also have the capacity to affect work on a more structural level. Hence, we sought to also include nuances of technological labour where technologies organised work processes or interactions between co-workers, clients and other stakeholders.

Building on these reflections from work sociology we define technological labour (as part of paid employment) as (1) any professional activities employing digital tools or (2) any work-related interaction which are impacted by digital technologies.

However, our assumption was that parts of this labour were “hidden”. Hence, we decided to keep this definition open for further exploration. In terms of literature, we referred to additional reflections from technosciences to extend our understanding of technological labour. In particular, we drew on the fields of Human-Computer Interaction (HCI) and Computer Supported Cooperative Work (CSCW) which have a long tradition in exploring the impact of digital technologies on work (S. E. Fox et al. 2020).

HCI research experimented already in the 1960s with computer-assisted work technologies such as graphical user interfaces, the computer mouse or text editing programs (Myers 1998). Thereby, it significantly contributed to the design of the very hardware and software that started to equip many offices in the1970s/1980s. As digital key technologies came to revolutionise more and more workplaces, HCI research increasingly placed focus on such as “office information systems“, “computer-mediated communication” and “office automation” (Schmidt & Bannon 2013).

In the 1980s, CSCW was formed as a specialized (interdisciplinary!) research community to address the digital transformation of work (Schmidt & Bannon 2013; Suchman 2011). As the title indicates, particular focus was placed on the collaborative character of work processes in groups (Bødker 2015) and to further explore the social complexity of work practices (Schmidt und Bannon 2013; Suchman u. a. 1999).

Within the work-related HCI and CSCW literature we note a growing body of feminist work (cf. Bardzell 2010; Rode 2011; D. Rosner 2018). This work has not only criticised multifaceted issues with patriarchy in technosciences and industry (D. Rosner 2018; D. K. Rosner, Shorey, Craft, & Remick 2018; Strohmayer et al. 2018) but also expressed a pronounced motivation to put research into the service of social justice (Dombrowski, Harmon, & Fox 2016; S. Fox et al. 2016). For example, recent feminist research dealt with the implications of digital work that emerged from economically disruptive tech companies and designed new means for the workers to solidarize (Dombrowski, Garcia, & Despard 2017; S. E. Fox et al. 2020; Irani & Silberman 2016).

However, there has been significantly less focus in this recent feminist HCI and CSCW research on the impact of digital technologies on “traditional” occupations. This is where our work tries to tie in and reduce a general blind spot for the digitalization in female-dominated service professions. Having said this, we draw in this work on some CSCW work that has addressed the invisibility of some work and its feminist dimension. Balka and Wagner (2020) for example conducted a historical literature study to elaborate “invisible work” as a classic theme in studies of women’s work. Besides addressing such as unpaid housework and reproductive work, they 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 (eg. Hatton 2017) which notes that the status definitions 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.

Invisible work has also been a key theme in the work of Susan Leigh Star (1995, 1999; Star & Strauss 1999) who reflected on its relation to technology design. According to her, invisible work can not only be found through the question which work is paid and which not, but also through other revaluation processes that surface through the development of technical systems. A large part of her work dealt with sociotechnical infrastructure which she emphasizes 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“ (Star 1999, p. 380). According to Star, this invisibility of infrastructure enables people to make use of it intuitively on a daily basis without needing to deal with its properties or configurations. It’s only in cases of (technical) problems that the infrastructure comes back into their attention. This implicit character of infrastructure makes it relatively difficult to identify problematic aspects therein (such as for example institutionalized social divisions). This is also the case for invisible work that Star understands to be an inherent part of sociotechnical infrastructure (Star 1999). Moreover, she notes that both infrastructure and related work would in fact be visible if one only looked for it and that it is their social status that renders them “functionally invisible” in society’s perception (Star & Strauss 1999).

The synthesized definition of technolocial labour based on social sciences literature and the HCI and CSCW reflections on invisible/hidden work presented the theoretical context for our work. We used the term as a conceptual placeholder that we sought to continuously refine through our empirical work and continuous reflective discussions within the multidisciplinary research team. In this way, we provided some conceptual space for further developing the concept of "technological labour" beyond just obvious instances when it involves the visible use of digital tools.

Methodological Background

This paper builds on a research project which was conducted over the past two years in Vienna, the capital of Austria. It was funded by the digitalisation funds of the Austrian Chamber of Workers which has a pronounced interest in protecting and strengthening workers' rights in the face of the technological transformation of labour. The presented research aligned with the funders' interests through an outspoken feminist motivation to revisit debates on the digitalisation of work and highlight particular issues of social inequality in relation to female-dominated service professions. More specifically, this work sought to make visible the (often) hidden dimension of technological labour provided by the (mostly female) workers in this sector and thereby contribute to political debates on revaluating these often underrated and underpaid occupations.

The research project involved a team of four researchers who shared a strong interest in feminism but who differed in their respective disciplinary expertise (social research, architecture and informatics/Human Computer Interaction). In this way, our project brought together feminist perspectives from social, spatial and technological sciences. Furthermore, we collaborated in a decidedly interdisciplinary manner that was based on frequent and continuous discussion and reflections.

Our data collection was conducted over the past two years and included two case studies. The first focused on technological components in the daily work routines of shop employees in supermarkets and health and beauty shops. The scope of the second was on the technological labour provided by mobile care workers. We focussed here on home care assistants in the job role of "Heimhilfe" (home helper). In contrast to "Pflegeassistenz" (care assistant) home helpers do not require a diploma in Austria. We chose to place particular focus on them because the lower qualification requirements for this profile tends to be reflected in lower income levels and also because we had the impression that workers in this roles were often left out by most revaluation debates and digitalisation initiatives within this sector.

Our data collection in the two cases entailed a variety of research approaches and methods. We conducted semi-structured interviews with workers and experts, ethnographic observations (both in physical spaces and based on online resources) and documentary research analysing policy documents. This mix was partly due to the researcher's different methodological training by discipline, partly due to ensuring a low-risk research conduct in midst of the pandemic. Altogether our data collection gathered first-hand perspectives both from retail employees, home care assistants, IT staff and management and also from expert opinions from educators, trade union members, and other members of special interest groups. The ethnographic components involved such as going to supermarkets and looking for any form of technologies, inspecting the website of a health and beauty retail chain for their offer of online services which might affect the work of in-store employees and reading online job ads for home care assistants closely for any indication of any required technological skills. We documented our experiences in detailed field notes and discussed them with the research team. Altogether, this pragmatic mix of methods enabled us to collect an extensive and multi-faceted set of empirical and experiential data.

We analysed this data with an explicit focus on the rarely visible technologies and digital competencies that service workers already employ in their service provision. We employed a qualitative analysis approach that coded the data in several rounds. That is, we first identified

digital competences according to the DigComp framework. We also highlighted parts of the data that referred to workers needing additional competences which were not covered by the framework. Moreover, we listed all technologies that were explicitly mentioned. Based on this analysis and our in-depth findings for each case we speculated on hiding mechanisms which might contribute to hide or downplay the technological labour of the service workers in both professional areas.

In this paper, we revisit our findings on the (hidden) technological labour of service workers through an explicit focus on how the research data related to the COVID-19 pandemic. That is, we searched our data for any quotes that mentioned "corona virus", "COVID", "face masks", "social distancing" and other pandemic-related terms. We also included some quotes that indirectly related to the pandemic in the wider context of the interviewee's narration. We reflected on the resulting data subset in terms of which kinds of technological labour were added to or increased in the daily service provision of the workers. Our analysis of the (hidden) technological labour of the heroines of the everyday was hence just as much informed by our previous research findings as it was channelled through the qualitative data subset. We group the identified instances of pandemic-related technological labour in three thematic categories and present them below in the Findings.

Findings

The study provided rich qualitative insights on the amount and also the variety of hidden technological labour that service workers are in fact performing. All findings can be found in the project report (REF). This paper narrows its scope now on findings that are directly related to the particular challenges of "this moment in history". In the following we group the (hidden) technological labour which was added to or increased in the daily work routines of the hero(in)es in three categories. We title them digital work, compensation work and safeguarding work:

- Digital work is defined by the workers' use of high-tech tools to carry out their professional tasks.
- Compensation work refers to workers operating at the intersection of technological systems and complex social situations. When something unanticipated happens, workers often need to improvise and take mediating actions on a sociotechnical level in order to get things back on track.
- Safeguarding work comprises all professional actions the workers take to manage the safety of clients/customers, their employers, and themselves by using technology.

Digital Work with High-Tech Tools

> *"We have to do them, those trainings, again and again… yes, but everything is different in corona times. No team meetings, no skill development trainings, no gatherings, nothing."(interview mobile care)*

Digital work refers to all work that is performed with digital technologies. It is presumably the most visible form of technological labour since it involves the physical presence and active operation of high-tech tools.

In our study we encountered that many employees are already equipped with company smartphones and are required to use them for their work tasks. In some retail companies smartphones have already replaced scanning devices for managing the supply stocks and inventory the shop shelves. Beyond this, we were told that the smartphone also assisted the shop staff in customer service situations. For example, if a customer asked if a deodorant contained any aluminium, the shop assistant could quickly search in their database and skim a list of all ingredients for each product. In the second case, we found that mobile care assistants use their smartphones with a provided set of apps to plan their travelling routes to clients, receive personalized instructions for their clients, and document the provided services.

Instead of needing to write down reports on paper, the workers could often automatically generate their reports by just ticking off the tasks from a list in the app and occasionally add new information when needed.

While many of the workers expressed that they perceived the smartphones as tools that supported them and eased their work, they also expressed a concern that it might not be easy for all their colleagues to work with these technologies. They mentioned a certain pressure to develop the skills that are needed to operate these technologies. In our study we referred to the DigComp 2.0 AT framework to analyse the digital competence areas and skill levels. Indeed, the workers tended to employ a relatively high level of digital competencies. Besides searching, processing and creating data, one key area here was using technologies for communication and collaboration purposes. This is where the effects of the pandemic have been particularly noticeable.

> *"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. And in relation to Corona we have also seen how important technology is to stay in contact." (retail interview)*

The frequently changing safety measures decided by national government and the particular ways in which different companies decided to implement these in their shops, increased the amount of information that needed to be communicated to the employees. Digital communication tools provided the infrastructure that was needed for a productive information flow.

> *"We keep each other up to date (in Teams), when work stops for the day. And that is great. (…) Due to Corona, we were flooded by infos and the person who received new information on the day just passed this on the others in the group. It is also easier on Teams when you need to contact another branch and ask if they still have some products in their stock. You see who is offline and who is online or who is in a meeting. This is great to work with." (retail interview)*

This also led to a sudden change of communication channels and structures. In fact, many interviewees described that they experienced a "digital fast forward" due to COVID. Suddenly, they had to move a large part of their professional conversations to communication tools such as MS Teams or Zoom which they previously had not used or even heard of.

> "Yes, (Zoom was) also difficult for me, I didn't know it before this year… yes, when *it's only for talking, just the voice, then it is not that complicated." (interview mobile care)*

> *"I am eager to keep private things separate from everything professional. Hence, we switched to Teams as much as possible and only use our WhatsApp group for private and funny stuff. This was important to me and that's why it was also important for me that every staff member starts using Teams even though it was very difficult at the beginning and some didn't know how to use it. But at the moment, everyone uses it." (retail interview)*

> *"In the regular team meetings that happen every three weeks (on Zoom), 2 hours, we discuss all clients and everything new. This is sound only…, you do not have video. All microphones are muted and if a person wants to say something they activate their microphone. This works actually quite well." (interview mobile care)*

Digital communication tools helped the workers to deal productively with many practical challenges in their professional routines and ensured that everyone was sufficiently informed to carry on with their work individually. Yet at the same time, they also introduced a certain threat of workers being alienated from their co-workers.

> *„Previously, we had team meetings with 30 participants and then you see who else is in the company, who you are working with and so on. And now everything is reduced. Now there are 6 people in the team meetings, we are distributed on different groups, and now it is even worse on the mobile phone. (…) I don't think (this is going to change). The situation will stay as it is. I don't think life will be back to normal, as it was before. (…)*

Okay, maybe we will get rid of the face masks, but for the future, no, I don't think we will get it the way as it was in the past. Because everything is digitalized, everything is at home and on the mobile phone, and everyone works from home now… and it is cheaper when people stay at home and work than paying for an office for them." (interview mobile care)

Moreover, we noticed certain constrictions in regard to the workers' professional development. In many cases, the sudden move to digital communication technologies meant that workers had less training options available and often also less structured support available for their personal skill building. We were also told by some workers that the quality of their training was affected by the tools they had available.

"(The 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. 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." (retail interview)

"At the moment we also have all our trainings on Zoom with video. This is difficult on the phone… You need a laptop then, or tablet, yes. (Interviewer: Do you get one from the company?) No, we need to use our own devices." (interview mobile care)

Sociotechnical Compensation Work

„It is part of our job. Because we are working with people. And when you work with people -what should I say- you cannot always stick exactly to plan. Things happen that you haven't anticipated. This can always happen, again and again. And then you have to correct all those service entries of course, or improvise." (interview mobile care)

Technologies are designed to rationalise work flow processes – however, in reality workers are often confronted with unanticipated situations that are not covered by these technologies. Whenever something does not go according to plan, workers need to improvise and resolve these situations through their compensation work. This means, workers operate as sociotechnical mediators between work systems and complex social situations. This relates to what previous research has described as implicit articulation work (Star 1995; Star & Strauss 1999; Strauss 1985). In fact, we understand compensation work to be a nuanced form of articulation work. It also refers to integrative tasks that are needed to maintain cooperation structures productive. However, beyond that it places additional emphasis on the ways in which frontline workers take much responsibility for the overall success of the service provision even though they are not part of management. 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 fill in for any shortcomings of technologies.

The pandemic and the need to quickly adapt to the difficult situation required workers to improvise even more than on the usual basis. This can be seen in the ways that they needed to fill all kinds of gaps in the sociotechnical systems part of their work environments. In retail the 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 becasue there was such a demand. Teams was used then to improve our communication and information exchange because our workers are not there every day." (retail interview)

"In (our region) it was asked, which branch has too much and which one has too little stock. There were some shops who got toilet paper delivered and others who did not get any. Or there was a question if we had enough soap. You send this question to all and immediately receive answers. We communicated exclusively on Teams then. Or sometimes

we did half an hour meetings once a week to find out how it's going in the branches and who needs some assistance. (…) This was badly needed in our shop. Sometimes, I received 5 more workers from other branches which were less busy." (retail interview)

We found another remarkable example of compensation work when we observed retail workers distributing PCR corona test kits. In early 2021 the public health services of the city of Vienna started an initiative to provide free PCR gargle test kits to citizens. Everyone who registered on the campaign website could obtain the kits at local stores of a large beauty and health chain, do the test at home in front of a laptop or mobile device with a camera and hand in their test samples at the shop. Noteably, the website of this test service was not an IT-product of the retail company, and it could not be expected that the shop assistants were trained to work with this service. Yet, we observed multiple occasions when shop assistants guided customers step by step to register on the (external) website and receive a barcode so that they could hand out the test kits to them.

The PCR test kits were also mentioned in an interview with a home care assistant who described how these allowed them to save time but also caused stress to some colleagues as using them meant to deal with yet another unfamiliar technology.

"For me, I take all this for granted. But for many it is very stressful when they get a new simple feature. Especially now as we switch to the (PCR tests). (…) Until now, we were obliged by law to get tested at least once a week. (…) It takes not even 10 minutes with the computer at home and then I drop it at (a shop) while I am out and about. This means, I don't have to go (to the innercity office), wait there, get tested , and then travel back… It costs me too much time, even though I would get paid for the time. Still I prefer to have a simple solution. And now (the company) adapted their solution with the tests, so to say, and we got new mobile phones for this. We should have a secure e-mail account. Because of data protection." (interview mobile care)

The last quote addresses various dimensions of technological labour that go beyond compensation work (ie. self-determined learning of digital skills, understanding interrelations of technologies, competence to explain these), however, it is important to note here the high level of integrity that the interviewee expressed. Rather than just accepting that work now involved more (paid!) travelling time, the worker came up with a "better" solution that satisfied all quality criteria (reducing infection risks for clients and ensuring data protection) saved them time and saved money for the company. Compensation work like this is often difficult to "see" because it takes place on a sociotechnical level and 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' (Star and Strauss 1999, p. 10). These decisions are based on the ways frontline workers perceive their practical options at the intersection of their technical infrastructure and their specific situations.

Safeguarding Work at the Frontline

"(Keeping some distance) can be a good thing sometimes. Even before, without the pandemic. When people don't keep distance, when they literally stand on your colleague's feet, and maybe they spatter a bit when they speak… This can be horrible." (retail interview)

Safety measures have been a core topic on any level of the COVID-19 crisis management and they also affect the technological labour of the heroines. Safeguarding work refers to the ways in which the workers become corporate instruments to ensure safety at the frontline. It is all work that is performed to manage the safety clients/customers, themselves and their employers. During the pandemic this most obviously involved implementing safety measures to protect the health (and wellbeing) of all people physically present at the frontline – such as such as the use of protection face masks and increasing the physical distance whenever possible. In our study, we also noticed a number of additional work steps employing

technologies that were intended to reduce health risks. In the shops, for example, customers were adviced to use NFC card payment instead of cash or card payment with pincode – a technology that had not been used as widely before the pandemic. With the increased frequency of customers using this way of paying, also shop employees needed to sufficiently support customers in using it. They needed to know which area of the card reader is designed to read NFC signals and onto which they need to guide customers to place their card, and also what to do when the reading process happens to fail.

However, in other pandemic-related examples, some technologies rather happened to pose additional risks to the health and safety of the workers. For example, when the design of a technology made it difficult to keep distance, such as for example self-checkouts which make it difficult for supervising staff to keep distance to the customers. In this case, we also found a particular risk of needing to deal with upset customers since working at the self-checkout puts staff into a double role. On the one hand, they shall support customers whenever these "fail" to operate the systems. On the other hand, they shall act as instruments of surveillance and ensure that no customer leaves without paying. This creates a specific potential for conflict and tension.

> *„When I am working at the checkout, then I have the conveyer between me and the customer. And now there is even a sheet of acylic glass between us. This means that there is a certain distance between me and a customer who maybe happens to be annoyed, okay? But this distance falls away with the self-checkouts. (…) I think the irritation of the customers possibly affects me more when they stand right next to me." (retail interview)*

Safeguarding work is also performed to protect the employers. Companies create health and safety procedures – not only to protect their employees but also to define their liability and to protect themselves from such as customer complaints – this is practice even up to the sociotechnical level of data protection

> "This is why we really need to document thouroughly. Also keeping the records for 30 years. Because that's as long as (clients and their relatives) could sue us. This is such a long time for safekeeping… (Interviewer: Isn't this also to protect yourself then?) Yes, it is a proof for us and thereby a protection. And they need to sign it. This means, until Corona every client needed to sign themself and confirm all the details. Now during Corona we omitted this since it wasn't smart for reducing contact. During this time the home helpers signed for them." (interview mobile care)

In the study, we found that workers tended to execute health and safety procedures to the best of their knowledge. That is, they took great care to adapt many details of their professional practices to the instructions they received from management. Moreover, we noticed some situations in which the workers were required to take even more of the responsibility than before.

> „Usually the clients should sign themselves in (the app) (…) and now during the corona time clients do not sign, for health and safety reasons. Now I sign as the worker in duty. When I do that it mentions that I confirm to take the responisibilty. It's only a matter of ticking off the green check. But then (the app) asks me 'why hasn't the client signed themself', and I need to enter a reason. Now we have a code number during corona times. The team leader passed it on to us. Now I enter my number, and when the region manager sees this number, they know that it was because of the corona virus." (interview mobile care)

It is noteworthy in this example that the quoted worker does not seem to question the process that requires them to take the responsibility – and neither opposes to the app being designed in a way that formally pins down this shift in liability.

Discussion

Setting our previous study results into the context of the COVID-19 pandemic opened our perspective for new nuanced understandings of hidden technological labour. Our previous analysis had already highlighted the workers' impressive degree of commitment, underestimated skill and technological adaptiveness. Now, revisiting the data through the lens in specific relation to the COVID-19 crisis added to our findings. We saw that the "general" hidden technological labour was even increased and intensified by specific pandemic-related work tasks.

The reader might rightfully ask now why all this work remains hidden – especially since it can be "discovered" if one only looked for it. In reference to the work of Susan Leigh Star, we rephrase this question: What makes this work "functionally" invisible? In our previous work we identified various 'hiding mechanisms', different sociotechnical dynamics that contribute to the technological dimensions of labour being invisible, overlooked, or downplayed. In our project report we describe these as:

- Social attributions and related valuation dynamics
- Wilful management of visibility
- Pervasiveness of technology

Social attributions. We knew from our engagement with related work that there are certain social dynamics at work that result in value judgements on a societal level. These attributions shape sociocultural, -legal and -spatial mechanisms which ultimately might lead to economic devaluation of some forms of work (Hatton 2017) or its low social status (cf. 'dirty work' or 'shit work' in Star 1995). That is, work is devalued due to a general lack of appreciation and that society therefore tends to ignore or hide this work. We learn that visibility of work hence depends on social context and status definition (Star & Strauss 1999).

Wilful management of visibility. Another component of underestimating technological labour in a stationary retail and mobile care work is related to the ways these sectors are presented to be "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. Similarly, mobile care assistants want to be seen as "working with people" (and not with machines) and hence foster an occupational profile by placing emphasis on „interpersonal relationships". In this way, some parts of work are willfully kept invisible. In related literature, we find the term backstage work. For example, Star and Strauss (1999) refer to athletes, musicians and actors who perform a large part of their work in training or rehearsals. In these professions there is a known distinction between frontstage- and backstage work based on aesthetic and performative reasons. In our research we found a similar management of visibility related to cultural perceptions of digital technologies within the specific professional contexts.

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 terms „pervasive technology" und „ubiquitous computing" (Abowd 2012) to refer to this sociotechnical phenomenon. Our data highlights the extent to which the concept has already been internailsed by our interview partners. In particular, the pervasiveness of technology leads to generalizing assumption that everyone would already use digital technolgies for professional and private purposes – 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.

All three 'hiding mechanisms' can also be found at work in the above identified forms of technological labour. For example, digital work with high-tech tools in retail and mobile care work tends to be hidden by a combination of the mechanisms. On the one hand, technical skillsets in these professions are not as forefronted and "anticipated" as in other "technical" sectors (*social attribution*). On the other hand, workers also internalise the assumption that we already live in a fully digitalised society (*pervasiveness of technology*) and play down the

amount of technological tasks they need to fulfil on a daily basis. If they feel overwhelmed by a technology, many feel that a lack of digital competence is their own problem rather than their company's duty to provide sufficient structured training for the tools. In this, we also note a strong component of "backstage work" as health and beauty retail companies try to present a "natural" (=technology-free) corporate image and also mobile care assistants want to perceive their own job profile as "working with people" rather than a computer job (*wilful management of visibility*).

Finally, based on these insights, we now want to raise some important questions about the potential for taking action. What might be needed to actually improve the status of the often female-dominated and generally underpaid system-relevant occupations of the service sector? 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 (Balka & Wagner 2020). At the virtual CIRN conference 2021 we host an interactive panel discussion with experts from different disciplinary backgrounds (labour law, educational science, digitalisation of work) to explore potentials for research projects (like ours) to effectively contribute to the revaluation of the often underrated and underpaid occupations.

At this point, we speculate that action for an actual revaluation of work would need to happen on multiple layers. Firstly, it would require clarifying what exactly "value" means in this context. Most obviously we are talking about pay, however beyond income levels the value of a job is also related to other aspects such as social position, work life quality, legal protection, and rights to professional development. Based on these revaluation targets we could then ask critical questions such as for example:

- What could policies do for the heroines? What is the role of such as collective labour agreements and training regulations?
- How can we create more public appreciation? What might change if our society was less blind to the hidden work of the heroines? Who would be particularly important to make more aware? Does it help to increase the awareness for the technological dimension of their work?
- Could worker rights do anything about the tendency that the heroines are facing increasing work loads and constantly changing work tasks? Could anything be done to better support them in particularly challenging work settings?
- Which role do education, training and skill development play in this context? Would it effect the professional status if the heroines were formally trained in digital skills?

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