Frictions in Automating Routine Data Work: A Human-Assisted Robot in Datafied Healthcare in Finland

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Abstract

This article explores the implementation of an Robotic Process Automation (RPA) -based robot designed to automate one small phase of data validation in primary healthcare. Drawing on ethnographic fieldwork conducted in a Finnish wellbeing services county, we investigate the complexities involved in the implementation and use of RPA technology. Theoretically, the article uses and develops the concepts of breakdown and friction to examine how the robot performs its mundane data tasks. In this case, technical breakdowns and repair work were relatively minor compared to persistent frictions and the ongoing need for human assistance. We identified four sources of friction that hindered the robot's ability to complete the assigned task: technical failures, legislation and national guidelines, austerity and cost savings, and organisational complexity and hierarchies. The robot is described as a human-assisted technology to highlight the support it required to function. The findings suggest that alongside breakdowns, frictions deserve attention when examining digital technologies and their everyday use.

Keywords: Friction, Healthcare, Data Work, Robotic Process Automation, Ethnography

Introduction

In healthcare, data are increasingly used for the often-conflicting needs of care, administration, innovation, and research (Hoeyer, 2023). Making high-quality data available requires labour and has created new forms of so-called data work across the public sector. The concept of data work refers to "any human activity related to creating, collecting, managing, curating, analysing, interpreting, and communicating data" (Bossen et al., 2019a: 466). A combination of technology hype and pressure to achieve cost savings has driven public healthcare organisations to seek technical solutions—such as robotic process automation (RPA) and speech recognition—to reduce routine human office and data work. However, the automation of healthcare data work is not without challenges (Hoyer, 2023; Morrison et al., 2013).

In this article, we explore the complications and complexities involved in implementing RPA in a public healthcare organisation in Finland. RPA is one of the latest forms of (office) automation. RPA is an umbrella term covering several light-weight IT solutions. RPA robots are often called 'digital workers' or even 'colleagues' who can be assigned mundane routine work. Automation is supposed to free human workers to perform more important tasks and to reduce the risk of human error (Dhatterwal et al., 2023). Typical software robots mimic the actions previously performed by human workers, such as clicking, copying, pasting, navigating, and sending emails or text messages (Kedziora et al., 2024: 1630). RPA can only handle structured digitised data. Cognitive RPA can apply artificial intelligence (AI) and machine learning (ML) to enhance its ability to capture and process information. (Lahtinen et al., 2023: 250; Venigandla, 2022: 33). Even though increasingly intelligent automation has become available in healthcare and public sector more generally, where accountability and transparency are required, RPA retains its value through its ability to build rule-based software robots that interact with various information systems and applications (Hofman et al., 2020; Loi and Spielkamp, 2021).

Previous studies reveal that RPA typically addresses specific tasks rather than complete, end-to-end value chains (Kedziora and Smolander, 2022: 6208). While automation transforms work, it does not eliminate it. Paradoxically, automating a certain phase of work can increase work elsewhere in the organisation (Kedziora and Smolander, 2022: 6208; Hoyer, 2023: 50; Vikkelsø, 2005: 19). Nevertheless, public sector organisations often hold high expectations that robotisation will result in substantial efficiency improvements, making it a valuable tool for enhancing organisational processes. This assumes that organisations can always find ways to improve their operations by streamlining work processes (Kedziora et al., 2024; Stock and Nguyen, 2019). Prior research has shown that despite the high expectations up to 75 % of organisations do not reap "the full benefits of their automation" (Asatiani et al., 2023: 110), and 30–50% of all deployments fail due to misapplication stemming from inflated expectations that can lead to misunderstandings of RPA's potential and result in operational disruptions. (Kedrioza and Smolander, 2022: 6209). It has also been shown that automation can feel like an "additional burden" for healthcare staff, because automation solutions are not error-free, and the risk of additional work is high, especially during the initial implementation phase (Kaitosalmi and Ratia, 2024: 251).

In what follows, we focus on an RPA robot implemented to automate a tiny task of data validation in one of the 21 wellbeing services counties in Finland. Wellbeing services counties were established at the beginning of 2023 as an outcome of a major administrative reform in which the responsibility for organising health-care, social services, and rescue services was transferred from municipalities to these counties.[1] The studied RPA did not use AI or ML because the organisation was very cautious about the legality and data protection implications of the data-driven solutions as we will explain later in detail. Because the RPA deployments have a high failure rate (Asatiani et al., 2023; Kedziora and Smolander, 2022), we analyse in detail how the robot coped with its tasks in practice and whether, and what kind of human assistance it needed. Our analysis is based on two-and-a-half--year ethnographic fieldwork conducted in a wellbeing services county. Theoretically we use the concepts of breakdown (Graham and Thrift, 2007) and friction (Edwards et al., 2011; Bates, 2018) to examine the robot, because from the start it was obvious that the robot did not fully suit performing the task assigned nor achieve the set goals. Because prior research has shown that automation and RPAs can lead to an increased amount of work, we call the robot a *human-assisted* technology to make visible the work that it required to operate.

We contribute to the body of research on automation in public sector healthcare by addressing a noted gap especially in the literature concerning the use of RPA in healthcare contexts (Ratia et al., 2018; Patrício et al., 2024). First, we provide novel empirical insights into an RPA robot in action and the sources of friction encountered during its use. Our results help to critically evaluate the exaggerated expectations and promises associated with public sector automation. Second, we contribute theoretically by demonstrating that the concept of friction is fruitful for providing a nuanced understanding of why technologies do not necessarily meet expectations. Third, we introduce the concept of human-assisted technology, which could be useful for highlighting the human work that RPA and automation more broadly can require.

Theoretical framework

In science and technology studies it is often assumed that breakdowns will reveal the infrastructures and networks that compose technologies (Latour 1987; Star, 1999). However, opening this 'black box' is a complex matter (Pinch, 1992). In the literature, breakdown is described as a typical feature of the world in general and of technological infrastructures in particular (Graham and Thrift, 2007; Jackson, 2014; Mol et al., 2010; Tanweer et al., 2016). Graham and Thrift (2007: 4) state in line with Lotringer and Virilio (2005) that to invent the plane is to invent the plane crash. In other words, the potential for various breakdowns, failures, and malfunctions is inherent to technology. As Jackson (2014: 230) notes, "breakdown disturbs and sets in motion worlds of possibility that disappear under the stable or accomplished form of the artifact". The concept of breakdown refers to prosaic moments when a technology is broken and fails to work. In a world of constant breakdowns, continuous maintenance and repair are required. Breakdowns can also lead to new innovations (Graham and Thrift, 2007; Jackson, 2014).

Informed by the concept of breakdown, we initially paid attention to moments when the robot under study was broken. However, we soon noticed that, in addition to breakdowns, there was something more at play that the concepts of breakdown or failure did not capture. Even when the robot worked as intended, it did not fully automate the small task of data validation which prevented data workers from concentrating on their other tasks. Therefore, the robot did not bring the expected relief to these workers. We use and develop the concept of friction to understand the robot in action. In science and technology studies, the concept of friction has been used to describe interruptions, deferments, and forces that oppose and resist data flow (Edwards et al., 2011). The concept of 'data friction', a special form of friction, was developed in the context of science studies to capture what happens when data move between people, disciplines, organisations, and machines. Data friction refers to the costs in energy, time, and human attention required to collect, store, move, receive, and access data, hampering the movement of data from one system to another. (Edwards, 2010: 84.) Each interaction between groups, organisations, or machines serves as a potential point of resistance where data might become distorted, misinterpreted, or lost. Data friction produces heat, that is, conflicts and unruly processes. (Edwards et al., 2011.)

Prefixes other than 'data' have been added to the term 'friction'. For instance, as a continuation of data friction, Edwards et al. (2011) developed science friction and metadata friction. The first concept is a consequence of data friction and refers to difficulties in interdisciplinary research, and the second refers to situations where "as with data themselves, creating, handling, and managing metadata products always exacts a cost in time, energy, and attention" (Edwards et al., 2011: 673). Furthermore, Bonde et al. (2019: 559) use computational friction to denote "the work of combining and turning data into useful information", and Tomalin (2023) speaks about online or e-friction. When friction resists and impedes, Tomalin (2023) argues, in the context of the ICT industry, that some forms of friction can also be beneficial. For example, in online stores, e-friction is beneficial if the payment system requires strong authentication or prompts the user to confirm the transaction. If there is a risk of disclosing sensitive information, implementing verification steps and prompts can help mitigate this risk. Therefore, a 'frictionless' technology would pose a privacy threat, and friction acts as a gatekeeper (Tomalin, 2023: 2).

Data frictions, following Bates (2018), can be understood as sites of negotiation rather than merely obstacles to overcome. Building on this, we conceive frictions not as discrete events, but as persistent rubbing that cannot be easily resolved or repaired. Just as the concepts of data-related friction emphasise that data does not move without friction, we use the concept of friction to analyse and identify factors that contributed to the robot's difficulties in automating the work task and freeing data workers to perform other tasks. As prior research has shown that frictions can be generative, causing 'frictional costs', that is extra work (Edwards et al. 2011: 673; see also, Bonde et al. 2019), we highlight this labour-consuming feature of friction by calling the robot a human-assisted technology. Furthermore, we use three categories of factors that Bates (2018) identifies as constitutive forces of data frictions when analysing the factors that caused them. Bates' analytical categories are based on Kitchin's (2014) theorising about complex data assemblages. The first category comprises data-sharing infrastructures and management (e.g., technical infrastructures, data management practices, organisations, and materialities). The second consists of sociocultural factors (e.g., systems of thought, forms of knowledge, subjectivities, communities, and institutions), and the third includes regulatory frameworks (e.g., legalities, policies, and standards).

Bates' three analytical categories sensitised us to different constitutive forces of frictions and enabled us to identify the dynamics of friction when the robot did (or did not do) the simple data work task assigned to it. At this point, we refine our research questions as follows: Which forces, and sociotechnical dynamics form and shape friction around the robot? What kinds of human work or assistance were needed because of the frictions? Because we investigate an RPA robot, we use the concept of friction. However, we also use the concept of 'data friction' to explain the organisation's choice regarding where to implement RPA, as we will show.

Data and methods

We draw on ethnographic fieldwork conducted in Finland in one of the 21 wellbeing services counties. Our research design was inspired by institutional ethnography (Smith, 1987; Devault, 2006), a method that enables researchers to use the everyday experiences of the research participants as entry points to explore power dynamics. Guided by institutional ethnography, we explored how the robot settled into its tasks starting from below in the complex hierarchical organisation. We shadowed an all-female data team (DT) from early 2022 for two and half years, although the first author has been in the field since early 2019. The DT worked on the entire process of producing standardised data to ensure data quality for secondary purposes, such as knowledge-based management at the organisational and national levels, the production of statistics and health research. The DT has been reorganised several times since it was founded less than ten years ago. To protect the team's anonymity, we do not provide the exact years and other figures in our case description. Further, the DT's foreperson has changed a few times, as has its composition. The DT has varyingly consisted of about 10 members, including the foreperson, half of whom had training and work experience in healthcare (e.g., as enrolled nurses, practical nurses, midwives, or specialised nurses), while roughly half had vocational business and administration training and work experience for instance as ward secretaries. Some had acquired further qualifications by completing a vocational degree in data processing. Half of them had worked—often in addition to their own duties—as the main users of client and patient information systems in different units and organisations[2]. Most team members were aged between 50 and plus 60 years.

Our data consist of 15 interviews with 13 interviewees and fieldnotes taken at the DT's weekly meetings. The interviews conducted via a videoconference tool lasted from one to one and a half hours. All interviews were recorded and transcribed verbatim. Between January 2022 and December 2024, we observed more than 70 weekly meetings. These meetings were held on a videoconference platform because the team had primarily worked remotely since the pandemic. The weekly team meetings lasted from one hour to ninety minutes, during which the DT discussed ongoing issues and went through the week's programme and upcoming events, such as training sessions. They also discussed issues and problems encountered with client and patient information systems and other information systems, external system suppliers, the in-house company and the robot. As our research permit did not allow audio recording of the team meetings and collaborative meetings, we took detailed written fieldnotes (for a more detailed description of the fieldwork, see Alastalo and Lehto, forthcoming). Since both of us participated in most of the meetings, we compared our fieldnotes to gain a comprehensive understanding of working with the robot, as we had focused on and wrote down slightly different things at times in very fast-paced meetings.

As is typical of ethnographic practice, our fieldwork, the making of analytical observations and systematic analysis of the produced data were intertwined. Our research and analytical process proceeded as follows. The robot caught our attention during the DT's weekly meetings, where the team frequently discussed the robot's failures and other issues they encountered with it. These moments served as an invitation for us to investigate it further. As the first phase of the analysis, we read through the fieldnotes and interview transcripts from the first round of interviews (five of which dealt with the robot) and collected all the episodes and interview sections where the DT members discussed the robot and the implementation of AI solutions more generally. Since failures do not reveal all the associations and relationships in the assemblage (Tanweer et al., 2016: 4), we decided to interview again those who worked with the robot to get a more comprehensive understanding of it. Before new interviews, we collected all the questions regarding the robot, for which we could not find answers in the existing materials. After that, we conducted four interviews: two with three team members who worked directly with the robot (in one of the interviews, two of the team members participated together) and two with senior managers who were directly involved in acquiring the robot and had decision-making authority regarding it.

In the second phase of the analysis, we focused on breakdowns and frictions as well as the human labour and attention required to repair, assist, support, and substitute for the robot. This phase led us to conduct six more interviews with the main users of the patient information system, whose workload was expected to be alleviated by the robot. They worked as nurses, practical nurses, and secretaries; one of them even held a full-time position as a main user. In the third phase, after the supplementary interview materials were analysed, we categorised all excerpts concerning breakdowns and frictions into four categories, namely, technical breakdown, legislation and national guidelines, austerity and cost savings, and organisational complexity and hierarchies.

Case: The robot and its milieu

Promoting a culture of experimentation in the public sector in Finland was one of the government's key goals in the late 2010s; it aimed to enhance public sector efficiency (Leino and Åkerman, 2021). Additionally, in public healthcare and social welfare a strategic goal was set to enhance digital and data-driven technologies to boost the effectiveness of healthcare and social welfare services (Sosiaali- ja terveysministeriö, 2018). More recently the wellbeing services counties have been encouraged to introduce advanced digital technology with a strong expectation that the workload of the staff will be reduced, and health and social services will be organised based on effectiveness data (Ministry of Social Affairs and Health, 2024: 21).

When we look at the studied organisation and its RPA robot, we can identify three drivers behind the decision to acquire the robot. Firstly, the organisation had adopted a national culture of experimentation, secondly, it aimed to improve its data quality, and thirdly, it sought to enhance its operations. According to one DT worker, 'a desire to get it (a robot) into something' was the starting point for acquiring the robot. This desire materialised in the senior management's assignment to 'consider the automation of some process in some manner'. As a result of this request, the organisation implemented two RPAs—one for primary healthcare data validation and another for recruitment services. According to the DT's foreperson, one small part of the healthcare data validation process was assigned to the robot also because the organisation wanted to 'leave no stone unturned' to improve the quality of its primary healthcare data.

High-quality healthcare and social welfare data are crucial to the organisation and used at both the local and national levels. For example, data collected from different information systems are needed to support knowledge-based—or, rather, data-driven—management. According to the national legislation (Laki Terveyden ja hyvinvoinnin laitoksesta, 2008), the organisation is also obliged to deliver these data to the national register maintained by the Finnish Institute for Health and Welfare. The register is used to guide and monitor healthcare provision, and, most importantly, to allocate state funding to the wellbeing services counties. Moreover, it is used in national statistics production and research.

Healthcare staff are required to record specific types of data in a specific standardised way in the patient information system. However, incorrect data entries that is friction in the data (Bates, 2018; Edwards, 2011), were frequently identified when the DT validated the data by checking for inconsistencies and missing entries, for instance, by comparing different reports. The struggle to reduce incorrect and missing data entries had continued for decades even though the DT workers and main users had trained, guided, and advised healthcare staff on structured recording. Additionally, the main users had the rather unrewarding task of reminding staff about missing or incorrect data entries. The management believed that having a robot would reduce the workload of both the main users and the DT, as no one would need to manually inform healthcare professionals about their incorrect data entries. In this case data friction (Edwards, 2010; Bates, 2018) together with an attempt to reduce the number of erroneous data entries, served as a generative force that partly influenced the implementation of the RPA.

The robot and its development were purchased from a large international company in 2023, but responsibility for the robot and its maintenance were later transferred to a company owned by various public sector organisations. The robot worked in conjunction with a checklist that scanned the patient information system's database and checked the data entries daily. Members of the DT and the IT team within the organisation had built the checklist to identify errors, such as missing information about the reason for seeking care. The checklist listed all incorrect entries and was updated daily. Every Sunday the robot sent an email notification to staff members who had made incorrect data entries or had not completed the necessary entries. The notification contained a request to make corrections and a tally of the incorrect entries.

The team discussed the number of errors several times during the weekly meetings, as they had observed that, despite the implementation of the robot, the number of errors had not significantly decreased. The team wondered whether the robot's message was difficult to understand or misleading, so the staff did not react to its request for that reason. The team decided to slightly modify the message content. This modification required human assistance from both the DT and the company responsible for the robot's maintenance. The DT rephrased the message and then sent it to what one interviewee termed the 'robot gurus' of the IT company, as the DT could not technically change it. After the message was recoded, the robot was put to work again. Rephrasing the message did not have a significant effect on reducing the number of errors.

Findings

In the following section, we address each of the four sources of friction and the related human assistance. First, we look at technical failures; second, we focus on legislation and national guidelines; third, on austerity and cost savings; and fourth, on organisational complexity and hierarchies as sources of friction.

Technical failures

Especially during the first months of its existence, the robot occasionally stopped doing its work, namely, sending email notifications to healthcare professionals who had made erroneous or incomplete entries in the patient information system. There were various reasons for the robot's 'vacations', as the DT called its technical failures. For instance, the robot did not send notification emails because of problems in the mail server's certificates, or the outgoing messages were stuck in the email outbox and had to be released manually, or the robot was unable to read the checklist correctly. According to prior research, most technologies go through a period during which their components are unreliable and fail to integrate smoothly (Graham and Thrift, 2007: 10). Similarly, most of the robot's technical failures likewise occurred soon after it was deployed, but the organisation had to be prepared for the possibility that failures could occur at any time. When failures occurred, the DT's foreperson had to ask the IT company to resolve the problems, as shown in the extract from the fieldnotes below:

> DT foreperson says "[T]he checklist robot is on the mend. [….] [Robo] will start soon". She explains that the robot had just had three weeks of vacation and is about to function again and send error . Two DT workers ask if their foreperson has two minutes after the meeting to chat about the robot, "what to do with the robot, now that he was on holiday". The data workers list the number of errors and unfinished data entries in the patient information system. They emphasise the magnitude of the number by saying "that's a lot". One team member defends the robot: "it's not the Robo's fault people need to be more careful." (DT meeting Oct 2023)

The robot's technical failures or breakdowns were not fatal for the organisation, even if they lasted for weeks, because they did not affect the provision of primary healthcare, as would have happened in the case of—for example—a breakdown of the patient information system. The DT's foreperson had to manually check whether the robot was working because there were no direct notifications of its malfunction. Since the robot's functionality was not a primary factor to be monitored, on one occasion when the DT foreperson was on holiday, a breakdown went unnoticed for weeks.

The technical breakdowns affected the main users and DT workers who oversaw the data quality and provided help in using the patient information system. While the robot was out of order, humans substituted for it and sent emails on its behalf. Therefore, the robot's reliability and efficiency as a co-worker and its role in reducing human labour were questionable. The team's foreperson expressed her frustration with the robot as follows: "I think I'm going to fire the robot, it plays up, lies with its legs stretched out" (DT meeting March 2024). The 'firing' was tinged with humour. Although it has been argued that technology is always breaking and that breaking can generate productive cracks in the system (Jackson, 2014), at the grassroots level and in the robot's case, frustration indicates friction as there was no room for continuous breakdowns in the daily data work routines carried out with limited resources. The robot's vacations also confused healthcare staff, who sent enquiries to the main users and the DT, wondering why there were no emails from the robot. Responding to these enquiries—that is, assisting the robot—increased the main users' and the DT's workload by generating extra email correspondence. Therefore, the robot itself caused friction when it disrupted their workflow (cf. Tomalin, 2023). The data workers whose tasks the robot was supposed to lessen gave it the name *Ruttunen*, which resembles a human surname and means 'dented' in English. They also added the suffix 'small', commonly used in surnames.

Repair illustrates the importance of human labour, even though it is not necessarily the case that breakdowns, malfunctions or failures can be easily fixed and repaired (Graham and Thrift, 2007: 4). Identifying and repairing the robot's technical breakdowns was not complicated, but the repairs only enabled the robot to return to work without bringing the expected relief to data workers. In other words, from the perspective of the DT and main users, the robot did not correct or repair the main problem, which was the ever-growing number of errors in the data. Although some main users found the robot to be somewhat beneficial, the DT and healthcare professionals were dissatisfied with the robot even when it worked.

Legislation and national guidelines

The national and EU-level legislation, as well as national guidelines, caused friction and consequently led to extra work. We consider first the national and EU-level legislation, and second, national guidelines for making data entries. To have worked properly from the DT's, main users' and healthcare staff's perspective, the robot's email notification should have included a link to an incorrect entry made by a healthcare professional. However, this was not possible. The EU and national data protection legislation, and the organisation's interpretation of it, did not allow 'Robo' to process personal data, because it was produced and maintained by an external supplier. In the following excerpt, the DT members discuss the robot's limitations:

> R2: But the problem is that the robot is only a messenger at such a low level, so the problem is that you cannot, those patient numbers cannot be given to the robot. Because they are personal data.
> R: Identification data, so.
> R2: Yes, identification data. But why the link cannot [be given], I'm not quite sure what the reason for it is. That the link cannot…

> I2: Have you passed on the request to get the link?
> R2: Yes, and the users have requested it.

The interview excerpt shows that the DT workers were uncertain and spoke inconsistently about data protection issues related to the robot. On the one hand, they knew that personal data could not be given to the robot. On the other hand, it seems that, if it had been up to them—the main users or the organisation's healthcare professionals—they would have included the longed-for link to the incorrect entries in the robot's messages. Therefore, legislation produced a beneficial friction because it helped to protect primary-care patients' personal data from potentially falling into the wrong hands. Regulatory frameworks are created because infrastructure and business models have evolved, and an appropriate amount of legislative friction is necessary (Bates, 2018: 422). The DT foreperson also highlighted data protection issues and referred to the external vendor, explicitly stating that the link could not be inserted 'under any circumstances':

> R: We cannot build a robot that could directly identify that you have [an error] here and there. [. . .] That's what the end users want, to put a link [to an error in the patient information system] in it, but the answer is unequivocal, we won't, because [...] there might be some data protection risk. And then [...] the robot is not our own product, but it is [company name]'s product, so it cannot be done under any circumstances. (DT foreperson)

Although legislation effectively protects patient data, it also required healthcare staff to navigate between different information systems. After receiving a notification email from the robot, healthcare staff were expected to consult the checklist to identify their errors and then access the patient information system to correct them. This process increased both the DTs and main users' workload, as healthcare staff often contacted them for assistance when they were unsure about which errors they had or how to correct them.

> The robot should produce more specific information. It should identify either the date when the error has occurred or the reason for the error. Because sometimes we are contacted by the staff "Hey, what is here, I got this message, and I cannot find [the error]". (Main user)

Consequently, the main users had to act as the 'robot's robot', as one main user described. The amount of 'connective infrastructural labour' caused friction and frustration.

Secondly, in addition to the EU and national data protection legislation, national guidelines given by the Finnish Institute for Health and Welfare for making health register entries further complicated the robot's ability to achieve its goal (i.e., to reduce the number of incorrect and missing data entries) and automate data validation. According to the guidelines, the guiding principle in record-keeping is that register entries, and their corrections cannot be made on behalf of healthcare professionals. For example, a doctor must determine the diagnosis and the reason for the visit, among other details. A nurse can only record a diagnosis if a doctor has made it. (Sosiaali- ja terveysministeriö, 2012: 45, 67.) Due to the high turnover of doctors, there were situations where it was not possible to correct all the entries. It was difficult, and sometimes impossible, to track down short-term temporary doctors and request them to correct their errors. If the doctor had moved on to another organisation before the errors were identified, they no longer had access to the patient information system. Therefore, it was not a matter of the team or main users ceasing their efforts to locate the responsible doctor. Consequently, the robot was inevitably deficient, and the data remained incomplete.

At times, DT meetings discussed both the potential uses of more advanced AI alongside robotics and, in particular, the ethics of AI technologies. During these discussions, the robot was described as the 'dumber cousin of AI' since it did not have any intelligent features. The foreperson wondered whether they should ask for ethical guidelines 'so that we don't head toward the edge of a ravine with a bag over our heads'. She promised to take the initiative to draw up ethical guidelines, as well as guidelines for data protection. The issue had been taken forward because, according to the senior-level manager, the organisation aimed to have key AI policy guidelines by the turn of the year (2025):

> In other words, this AI relates to such big, one might say, unresolved issues, even at the national level. In other words, data protection and security legislation come strongly into play. We have perhaps made a bit of a policy that we are now waiting to see what happens at national level and what kind of guidelines and instructions will be issued in relation to this. (A senior-level manager)

Legislative friction related to robotics and AI is by no means limited to the studied organisation, but is an EU-wide regulatory issue. For example, the lack of algorithmic transparency must be solved before AI is implemented in healthcare (Kiseleva et al., 2022). It is also one of the key reasons why healthcare organisations considering automation have implemented robotics instead of AI. With the ongoing procurement process for the new patient and client information system, issues related to automation and wider AI-based solutions have featured prominently in the organisation.

Austerity and cost savings

The tight financial situation of the organisation was reflected in all aspects of technology implementation and development. Budgetary constraints affected how new technologies were supplied and existing systems were upgraded. Investments in new technologies were piecemeal, because the top management had granted permission only for developments that were necessary to comply with legislation. Consequently, the robot was not developed further after its message was updated.

Financial constraints were discussed a great deal in relation to the robot. Two of our interviewees discussed the robot and the financial situation of the organisation in the following terms:

> R2: And now that there have been no such development ideas for it. And [it has] also been thought about whether it makes sense to keep it [the robot], so it has been said that let's leave it as it is for now. But it has not been further developed. And [it] will probably not be [upgraded], *given this economic situation, so that's perhaps the main reason*.
> R: And we already suggested to [mentions R2's name] that let's save on the robot, so let's put this one away. It hasn't brought us any help. But now that it's been paid for, it's going to be crawling around here.
> […]
> R: [...] But undeniably it felt like when you look at how much of a deficit we have, and how attempts are being made to cover it, you're never going to get it [covered] by not ordering pencils for us. We have been given those savings goals; we have nothing to save on. I did say in one of the meetings don't order anymore, when [mentions a colleague's name]—our warehouse manager—has been ordering us booklets, so now is not the time to order, let's save on booklets. But we are really short of what we can save on.

The financial situation of the entire public sector also affects the wellbeing services counties. The government has urged the counties to streamline operations and adapt to tighter budget constraints. The DT workers described the difficulties of finding more targets for savings. Since they were not very positive about the robot and thought that it did not help them, the DT workers were willing to give it up due to financial constraints, but it was not abandoned because it had already been paid for. The organisation would have had the expertise to build RPAs in-house; however, it did not have the required resources because a new information system was in the process of being acquired:

> We are no longer paying the [the robot supplier's name]. We can make robots here ourselves if we want to, but our human resources are in this sense scarce. (…) When the new client and patient information system starts, so then the structured recording and everything will probably start to roll in other ways, so it [the robot] will be unemployed, and then we will end the contract. It's not at all expensive, that robot. (DT foreperson)

> We could find more of these items, but we just don't have the capacity to invest at the moment. For example, if you think about the processing of invoices, which run into hundreds of thousands, if not millions, we would have cases, but we don't have the money at the moment. (A senior-level manager)

Friction arises from competing priorities. While the robot was able to maintain its position because it did not *directly* consume financial resources, it faced challenges as scarce resources were allocated to the procurement of a new patient and client information system. The development of this new system diverted attention and funding away from improving the functionality of the robot and other IT systems. As a result of the robot's underdevelopment, friction persisted, and the robot continued to need assistance. This dynamic illustrates how resource allocation decisions can affect the functionality and integration of technologies within an organisation.

Organisational complexity and hierarchies

Healthcare organisations are complex and highly hierarchical (e.g., Essex et al., 2023), and these characteristics also caused frictions and had consequences for the implementation of technology. We recognised three sources of friction in relation to organisational complexity and professional hierarchies. First, the complexity of the organisation contributed to the fragmentation of technology development and complicated technology procurement, development, and implementation. Second, because of organisational complexity and hierarchies, the robot's in/capabilities looked different and were not similarly visible or present for everyone. Third, because of professional hierarchies, the robot and its assistants were at a low level of the hierarchy.

First, the organisation's complexity, as well as its financial constraints, affected the fragmentation of technology implementation and development. For instance, the decision not to develop the robot was also influenced by the decision to acquire a new patient information system. The DT foreperson said in a weekly meeting that "the robot is running and working until [the name of the patient information system] is in use" (March 2024). Although the development of the robot was stopped and the DT questioned its benefits, the organisation was not giving up on it.

Second, the DT workers, the main users, and senior-level management had different understandings and views of the robot's capabilities. A DT worker described to us how the senior management did not know the reality or details of daily practices:

> DW: The higher up in the hierarchy we go, the more they miss how the robot works in practice. The practical competence [...], how it appears in their [main users'] life, what needs to be done. We may see from the eyes of [mentions a name], who introduced Robo, what it looks like. It looks very different and much better [to the management] than it appears to us. The practice is very different to how it is on paper. We didn't have any clue either where this would lead. We are not sure how much Robo has helped our users. From our point of view, well, Robo is up and running.

The DT workers assumed that the top management expected the robot to perform better and had higher expectations than those the robot could ultimately deliver. Our observations confirmed this view, because one of the managers explained how the robot sent customised email notifications to healthcare staff. In the following excerpt, the foreperson discusses the (changed) expectations placed on it:

> I think it met [the expectations] quite nicely. Although I currently think that the use of the robot would have stabilised, we drew a lot of attention to statistical recording, so the media value within our organisation was good. We were able to open up discussions in the domain very well, and having the robot meant we also had some good topics to discuss on the main user days. He was like a Trojan horse. Our goal was to get a qualitatively better end result of structured recording, and yes, it served quite well. Perhaps it was understood from the very beginning that the robot does not automatically solve anything in that way, but it is a way for us to constantly remind people that "Hey, the structured recording is important, the funding depends on it". Then we also had a lot of intranet news about the robot on several occasions, so yes, that's it. As I said, a Trojan horse, if a metaphor could somehow illustrate this.

For the organisation, the robot's value was also seen in its ability to direct attention to recording errors. Like a Trojan horse, it subtly highlighted the importance of structured recording and its significance to the organisation's funding. A senior-level manager noted that better results could not be achieved with the robot. Thus, it appears that the management did not even expect the robot to completely eliminate errors. For the management, the assistance required by the robot went (partly) unnoticed. The DT and main users still had to remind professionals that errors needed to be corrected. One of the main users described his frustration:

> The foreperson of the doctors has stated that he will not correct the errors, as he does not know how to correct them, does not want to learn, and does not have the time to do so. Someone else will do it on his behalf, or the errors will remain uncorrected. If the foreperson sets this example, his subordinates cannot be obligated to act. (Main user)

Higher-ranking professions are able to delegate routine or unpleasant tasks, such as documentation, to other occupations (Bossen et al., 2019b: 877). Some of the main users also understood the doctors' reluctance to correct their errors, because it took time away from patient care. Additionally, some main users were prepared for the possibility that the robot might lack sufficient authority to enforce corrections.

> And then the robot came. We had a feeling from the beginning that the staff might not go to check and correct [the errors] based on an email [from the robot]. We decided that in our area of responsibility, we will continue to send [error]lists once a month. […] We take care that they will be corrected. (Main user)

Third, as we have already shown, the healthcare staff had to make the required data entries in the patient information system, and the main users or DT workers could not correct erroneous entries or add missing ones for them. Hence, doctors, who were higher in the hierarchy than the main users, the DT, or the robot, should have corrected their errors after getting the robot's email. However, this did not happen because the robot did not have the necessary authority over the healthcare staff, and so human actors started to take the robot's message forward:

> The DT foreperson explains in a weekly meeting that "I crafted a letter for Robot that went out today. I've never written such a furious text in a friendly tone". She explains that she had asked two top managers' blessing for the letter. "You will see a copy of it then." The letter asks (the recipient) in no uncertain terms to correct the errors in the checklist by the deadline. (DT meeting Oct 2023.)

She called the letter she wrote on behalf of the robot using a Finnish word *myllykirje* which refers to letters sent by the long-serving former President of Finland on occasions when, for one reason or another, he was unhappy with someone's actions. The fact that she asked for the top manager's blessing for the letter, despite her position as a foreperson, can be interpreted as a sign that the team was in a rather weak position in relation to the healthcare professionals.

After this attempt, it became apparent to the team foreperson, as well as the senior-level manager, that the robot, even with assistance, was incapable of helping the organisation improve the quality of its data as expected. As a result, the management started to frame error correction as a supervisory issue and transfer the responsibility for requiring healthcare staff to correct errors in health records to managers. In other words, they undertook the repair work. Consequently, the foreperson thanked the DT for a job well done and simultaneously responsibilised it with the correction of errors because the robot was incapable of doing so:

> DT foreperson: You know how to handle domain managers, the supervisory [side], in a smart way. We produce information on how many errors there are and where they are.
> DW: [We] have guided, advised, trained.
> DT foreperson: You've done a tremendously good job, you've done everything you can to send out quality instructions, to respond to service requests. We have done everything we can to address this issue. The robot was the last resort, [but] it's no use, I think it's a burden (laughs). We have genuinely contributed to the issue, this is a supervisory issue, yes.
> (DT meeting June 2024)

Later, in the interview, she noted that, in practice, proper record-keeping is the responsibility of the main users, because the superiors of healthcare staff do not have the time to keep an eye on them. Additionally, she noted that supervisors have official responsibility for their units. Lower-level staff do not have this formal responsibility, although they are asked to carry out 'monitoring work'. Typically, employees can be reluctant to change their work habits or even afraid of learning new technologies (Hindel et al., 2020; Fernandez and Aman, 2019). In this case, the healthcare staff were not expected to adopt new work habits but only to accept the robot as a co-worker whose email notifications should be taken seriously.

Discussion and concluding remarks

We have explored the implementation of a human-assisted robot designed to automate a tiny task of primary healthcare data validation at a wellbeing services county in Finland. The robot was implemented both to improve data quality and reduce the workload of data workers objectives that are typical of RPAs (Berg, 2022: 159). By using breakdown and friction as analytical lenses we studied sociotechnical dynamics that formed and shaped friction around the robot and the human assistance it required. We identified four sources of friction that disturbed the robot's ability to carry out the assigned tasks: 1) technical failures, 2) legislation and national guidelines, 3) austerity and cost-savings and 4) organisational complexity and hierarchies. This is an analytical distinction, as the sources of friction are also interconnected.

1) In our case, technical failures and repair work played only a minor role compared to the constant frictions and the need for assistance. The robot was out of service due to technical breakdowns that required intervention and repair work by the external IT company. In addition to this, technical failures produced frictional costs (Edwards et al., 2011: 673), because human labour was needed to substitute for the robot when it was not performing its tasks. Technical repair work was therefore only one of the activities generated by technical breakdown.
2) Data protection legislation and national guidelines for health record entries were sources of both beneficial and adverse friction. According to the legislation, data protection and privacy must be particularly robust when handling sensitive data, such as patients' health records. The robot was implemented by an external vendor who, due to legislation and the organisation's interpretation of it, was not granted access to the patient information system. While this restriction served as a form of beneficial friction—safeguarding sensitive health data—it also limited the robot's functionality, as its messages did not contain direct links to erroneous data entries, even though such links would have improved usability. In this sense, the robot was designed to fail, since the absence of links was an anticipated limitation. As a result of these frictions, data workers and main users had to assist the robot by answering questions and advising healthcare professionals on their erroneous data entries.
3) Austerity and financial constraints were sources of friction for the robot and the implementation of automation technology more widely. While automation can indeed enhance efficiency, it does not come without cost. In this case, the robot itself was an inexpensive technology, but because of its deficiency, it required human assistance and caused frustration. The organisation could have built the robot in-house, which would have allowed it to add the desired links to erroneous entries. However, due to cost-saving measures and the procurement process for a new client and patient information system, this investment was not made. The robot's development was an obvious target for savings, as it was built on the old patient information system and was likely to become redundant ('unemployed') along with the new system. However, it was paradoxical that the wellbeing services county did not invest in the robot's development given that the data which were crucial for the funding allocated to the organisation were constantly incomplete in part. The data should have accurately reflected real occurrences, such as the number of patient visits and the specific reasons for those visits. Accurate data were also essential for invoicing: if the data were incorrect or incomplete, the organisation could lose revenue.
4) The final source of friction were organisational complexity and hierarchies. The complexity of the organisation and the large number of IT systems made the coordination of their procurement difficult. For instance, when the

robot was bought, the fact that the patient information system would soon be renewed was not taken into consideration. Moreover, employees at different levels of the hierarchy had different expectations and perceptions of the robot's capabilities. Additionally, they were not equally aware of the frictions and extra work caused by it. Data workers whose work was not made easier by the robot felt frustrated and were ready to abandon the non-functional robot. Some main users considered the robot a beneficial addition, although it did not significantly reduce their workload. The management believed the robot was successful in focusing attention on record-keeping, but they overlooked the additional workload it created.

Despite financial incentives to improve data quality, positions of the robot and its human assistants' in the organisational hierarchy remained weak in a hierarchical healthcare organisation. Therefore, the robot lacked authority in many areas and needed human assistance. Had it been a technology more critical to patient safety, its hierarchical position would likely have been higher or, at least, its breakdowns and frictions would have been taken more seriously. Prior studies have shown that the use of RPA may merely address symptoms without resolving the underlying issues, or it may bring about partial improvements (Kirchmer et al., 2019: 12). In this case, the robot did not solve the actual problem, which was that not all healthcare professionals, for various reasons, corrected errors or completed missing information.

Although we have analytically distinguished the different sources of friction above, they are also intertwined. The robot's design remained deficient due to the organisation's interpretation of legislation and cost-saving measures which hindered its further development. During the procurement phase, the upper-level management's enthusiasm for automation overrode the practical concerns raised by data workers regarding the robot's functionality. This, in turn, generated friction: a resource-consuming robot that remained a human-assisted technology, failing to deliver the expected human labour savings or to free up humans for more important tasks. Our findings also indicate that perceptions of the robot's usefulness varied between units. In some units, the robot was considered a helpful addition for sending reminder messages. However, in others, it was perceived as ineffective, as the number of errors had not, according to interviewees, decreased. Instead, due to friction new work practices emerged around the robot. This additional work frequently went unnoticed and unacknowledged by management.

Theoretically, based on these findings, we argue that, in addition to the concept of breakdown, friction is also a fruitful concept in the study of digital automation technologies. Focusing solely on (technical) breakdowns and repair work can obscure the human labour and assistance needed by digital automation technologies, such as RPA, which are expected to free workers' time for more meaningful tasks. The concept of friction (Edwards 2010; Edwards et al. 2011) and Bates' (2018) idea of examining different sources of friction proved helpful in analysing the (mis)alignment between automation technology and its intended task. Furthermore, we suggest that friction can be used to reveal conflicts and controversies (Pelizza, 2016) in the implementation and use of technology. In our case, however, the heat generated by the frictions did not lead to open conflicts or controversies but burst out as frustration. The team, for example, expressed their frustration through humour, joking about 'firing' the robot and giving it nicknames. Frictions—such as those in our case related to legislation, organisational complexity and hierarchies, or cost saving measures—can stem from political or organisational decision-making, or culturally shaped understandings of (professional) hierarchies. These sources of friction are therefore persistent and not easily reduced or removed, for instance at the level of an individual worker, a team, or even an entire organisation. As a result, technical failures may, at times, be more easily repaired than frictions (cf. Edwards, et al., 2011: 684-685 on metadata friction). It is also important to acknowledge that technologies as socio-technical are always accompanied by frictions. Rather than aiming to eliminate them entirely, it is necessary to consider how much friction can be tolerated for the technology to remain viable.

Moreover, the concept of friction offers a lens for considering automation technology critically. It helps to reveal the additional work related to technology even when it functions as intended (see also Bonde et al., 2019). Making extra work visible can also help explain why efficiency expectations are not met. In the context of public healthcare, which operates under tight budget constraints, it is particularly important to strive to assess all costs and resource demands related to the use of automation technology. By examining various frictions in detail, it is possible to assess whether the technology is suitable for the task at all. For example, in our case study, the senior management responsible for implementing the robot may not have fully understood the complexity of the work task to be automated. As a result, instead of being freed for more meaningful tasks, data workers ended up assisting the robot, which was frustrating for them. As Wacjman (2017: 124) notes, "technologies are facilitating not less work but worse jobs".

In sum, we suggest that frictions, as well as breakdowns, should be investigated when digital automation technologies and their usage are examined. Although technical failure or breakdown may explain certain malfunctions, these often fail to capture the full complexity of why a system—or in this case, a software robot—does not perform as expected. Actors must commit time, energy, attention, and resources to overcome many resistive frictions (Edwards, 2010). These cannot be overlooked, since the question of who fixes the devices and systems we use (Jackson, 2014) is not the only one worth asking; consideration must also be given to who provides assistance when frictions occur and who maintains the infrastructure. Our results contribute to science and technology studies by providing empirical evidence of the various sources of friction encountered when implementing technology in complex public healthcare organisations and automating routine data work. Furthermore, we suggest that, in addition to costs—time, energy, human attention, and controversies—also affects, such as frustration, require further attention when frictions are analysed.

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Notes

1 Hereafter, the wellbeing services county is referred to as the organisation, in order to avoid repeating a complex name and to refrain from using an abbreviation.

2 Main users of information systems typically perform their administrative tasks related to system use alongside their primary duties as nurses, ward secretaries or, in some cases doctors. These tasks may include managing access rights within their unit and providing user support and guidance on system use.