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RESEARCH ARTICLE

"No longer morally justifiable" temporal dynamics of care, or how AI made waiting unethical

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Abstract

This article explores the impact of Artificial Intelligence on professional caregivers in a Scandinavian hospital, drawing upon an ethnographic and interview-based study that focused on time experiences in relation to cancer diagnoses and treatment plans. The AI system produces detailed radiographic drawings faster and more accurately than its human counterpart, leading to more accurate diagnoses and treatment predictions. I examine how this technological development changes radiologists' temporal perspectives, identifying three themes: (1) how their perception of a 'tolerable' waiting time for an accurate diagnosis evolves; (2) how AI's speed transforms the caregivers' moral responsibility towards their patients, leading to a sense that they should work faster. Time-saving technology therefore does not necessarily reduce workloads, which I understand through (3) the power of techno-imaginaries, where beliefs about AI's inevitability shape current healthcare practices. Because the increased use of AI is seen as the only and inevitable way to mitigate rising and 'unacceptable' waiting times, caregivers were adopting riskier practices, related to their use of the new technology, under a new moral imperative by which good care was understood in terms of avoiding keeping patients waiting.

Keywords: Techno-imaginaries; Artificial Intelligence (AI); time and temporality; healthcare and medical anthropology; medical decision-making; technology and society

Introduction

As we neared the conclusion of our hour-long Zoom interview, filled with complex technical discussions that had left both myself and the postdoctoral researcher on my team feeling tired from concentration, the two radiologists on the other side of the screen made a statement that jolted me into complete alertness. We had been discussing the Artificial Intelligence (AI) system they had implemented a year earlier in their department in a hospital in Scandinavia, for diagnosing breast and pelvic cancers. This technology identifies conditions using various radiological images and subsequently marks the relevant organs in a 3D model for physicians and surgeons. The extreme

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level of detail in the AI-generated drawings supports more accurate diagnoses and improves predictions regarding the outcomes of surgeries or other treatments (Kelly et al., 2022). Moreover, this AI completes its analyses in approximately fifteen minutes – far faster than the four hours required by a human doctor. Both patients and clinicians benefit from this increased speed and clarity, leading to a more efficient and potentially successful treatment process.

> One of the radiologists remarked, 'Now that we know how quickly the AI can work, it's simply not morally justifiable to wait for a human doctor.' I contemplated those words, trying to understand what the phrase 'not morally justifiable to wait' meant, when his colleague added the comment that shook me: 'And the drawing training for new doctors must eventually stop. Now that we know how quickly AI can work, it's simply no longer morally justifiable to wait for a human doctor. We can't keep doing this to our patients.'

To understand why this comment was so disconcerting to me, it's important to recognise that the radiologists and their colleagues supposedly play an evaluative role in relation to AI. To fulfill this supervisory role, they must be well-trained in interpreting radiological images and have hands-on experience drawing organs and cancerous cells. As I will explain later, drawing is a critical method through which early-career radiologists learn to read the body and recognise anomalies. This requires extensive experiential knowledge, particularly in drawing the organs. Such skills are developed during the training process. The two radiologists we were interviewing were far from naïve or reckless in their views on the digitalisation of healthcare. They explicitly stated, several times, that the AI could never fully replace a human doctor. They acknowledged the cautionary tales about over-reliance on technology and understood that human oversight was essential to identify potential errors made by the AI system. Although the AI system is remarkably adept at creating detailed illustrations of cancerous areas in the breast or pelvic region, it can still make mistakes – in later interviews, no longer online but in the hospital ward in which the radiologists and their colleagues work, they would offer recent examples of errors made by the AI.

To ensure capable human supervision, the radiologists we spoke to emphasised that their department currently mandates all co-assistants to frequently practice reading and drawing radiological images during their initial months of work at the hospital. They commonly reflected on the skills that professional caregivers need to acquire through the introduction of new technology, and what they should not unlearn: the intuitive 'feel' that something is not right with a patient's health, and the ability to visualise where cancer cells are located – forms of knowledge that can only be built through embodied practice, through speaking with thousands of patients, through reading hundreds of radiological images, and through making dozens of drawings of organs, cells, bones. The radiologists considered this training so important that they themselves usually accompany all early-career radiologists in the hospital for months. And yet, the majority of our interlocutors believed that the drawing training for new doctors would stop in the future, and while most of them indicated that this would introduce ethical risks, many of them also believed that it was an inevitable and even justifiable thing to occur. After all, they explained, now that it was known how quickly AI can work, it would 'no longer be morally justifiable to wait' for a human doctor in the nearby future.

In this article, I examine the beliefs of a sample of radiologists from Scandinavia and the Netherlands regarding their work in relation to the recently implemented AI in their workplace. Key among these beliefs is the notion that the

future of their profession will inevitably be dominated by AI, as well as the conviction that, since AI has the potential to expedite certain aspects of their work, it 'must' be utilised – even if this entails certain risks. Indeed, for the radiologists included in this study, failing to use AI is deemed morally irresponsible, as this would result in patients receiving slower assistance than they would with AI's aid.

It is crucial to scrutinise these beliefs for two reasons. First, they offer valuable theoretical insights into how future imaginings, or what Jasanoff and Kim (2013) call techno-imaginaries, influence present practices. I argue that physicians are reifying technology in their daily work based on their visions of healthcare's future. Hence, with their techno-imaginations regarding the as-yet-undefined future, comes powerful agency. Following Hoeyer (2023), p., I argue that it is the faith in the future 'inevitability' of AI that paves the way for key decisions made in the present. The article explores the underlying causes of this effective belief, placing particular emphasis on the workload that radiologists experience, the promises made by the tech-industry to alleviate this workload, and the hope my interlocutors harbour for technology that promises not only to enhance care but, more importantly: to provide them with more time.

Secondly, it is pertinent to examine these beliefs as such hopes may be naïve. While AI may indeed outperform radiologists in performing certain important tasks, other scholars working on technology and healthcare have shown that new technology also frequently introduces new responsibilities. Moreover, new technology often brings to the fore new normative ideas about what constitutes 'good care', and a changing experience of time and work pressure. I discuss the relevant literature below, and show in my analysis that in this particular case, AI alters the expectations and norms of radiologists surrounding patient waiting times; their ideas of how quickly diagnoses should be made and treatment delivered to patients. Moreover, the introduction of AI creates both less, and more tasks in their work days.

Methods and ethical considerations

Interviews took place between 2021 and 2024 and were part of an ongoing international research project on the future of healthcare, which I conducted with a team of PhDs and a postdoctoral researcher in seven different countries. The aim of the project was to understand how professional caregivers increasingly collaborate with non-humans (AI and simpler algorithms), and how this affects their daily work, as well as the effects it has on our healthcare. Interlocutors had expertise in a variety of fields, ranging from dermatology to radiology and cardiology. They worked in public hospitals and were all experienced in working with AI and other algorithms. Although the interview described above took place through Zoom, almost all other interviews (the research is still ongoing at the time of writing; so far, we interviewed 50 physicians) were conducted in person. We used a semi-structured in-depth interview style, with fixed open questions but room for other urgent or relevant issues that the interlocutors brought up. Interviews were recorded alongside with consent; transcripts were analysed in Atlas.ti to look for patterns and recurring themes. During weekly meetings, the team discussed what they learned in the interviews and observations in hospitals, to contrast our findings and sharpen our thoughts. For the privacy of our interlocutors, we do not mention their names, nor the names of the hospitals in which they work in our publications; in order to respect the privacy of patients, we never included any patient-data into our notes.

Interviews were held in hospital corridors, or staffrooms with lockers, where staff would leave their hospital shoes and white uniform at the end of their shift and change into their own clothes and shoes. Alongside the interviews, the anthropological work that forms the basis of this article particularly involved observation. On few occasions, we were able to watch how radiologists used professional memory through skilful interaction with medical imaging technology. Often, though, clinicians were too busy to be disturbed or distracted by researchers, so we ended up watching doctors and nurses walk back-and-forth between reception desks, waiting rooms and offices – them with their iPads in hand, us with our paper notebooks and pens. We heard them ask hospitalised patients (in shared rooms with no doors) to describe their pain level on a scale of 1 to 10; we saw them fetch the result of blood samples from the lab, ask co-assistants to go and see a certain patient and to measure their blood pressure, and then, during interviews, were told that all that data had now been transferred into computer systems that made algorithmic calculations and predictions for our interlocutors to use, resulting in a diagnosis or a treatment-plan. Our informants pointed to their screen during interviews: the computer says that this patient needs more glucose, that this patient is currently at high risk of heart problems.

Most of all we sat in hospital waiting rooms, where our interview appointments with the on-duty doctor were often delayed, as there was always too much work to be done by our interlocutors, and more important people than us were waiting; patients. I highlight this observation about the busyness of our interlocutors because for many of them, the future promise of time-saving technology was a crucial lifeline to hold onto their own profession. Confronted with exhausted healthcare systems in Scandinavia and the Netherlands, full waiting rooms, and packed schedules, and echoing a popular narrative about the current and future health crisis and the new ways of care delivery that are needed within it, many of them clung to the promise of technology.

In this article, I elaborate on the relationship between these aspects of my research introduced above: AI, techno-imaginaries and the promises of technology, and shifting normative ideas on what constitutes good care and 'acceptable 'waiting times. I build my analysis on three streams of literature. The first is insightful anthropological writing on time and temporalities, allowing me to think about the relation between technology and the experience of time (Harris, 2021; Sharma, 2013). The second is literature that highlights the agency that lies within techno-imaginaries: how do imaginations about the future, impact the now? Third, I discuss literature around the embodied knowledge work of radiologists, where knowledge is regarded as an ongoing process embedded in individuals' everyday work practices that emerges from its social and organisational context (Lave and Wenger, 1991; Suchman, 1987). Researchers have been studying how knowledge work is impacted and reconfigured with the introduction of new technology, which is among the set of social and organisational factors that facilitate and shape knowledge work (Cetina, 1999; Latour, 1987; Zammuto et al., 2007). However, it is unclear what effects AI will have on processes of knowledge production and evaluation; this article contributes to these debates.

To offer context, in the below, I sketch the perceived and anticipated pressures under which many radiologists, including our interlocutors, have been working.

Context: experienced and anticipated workpressure in radiology

A 2024 study in the American Journal of Roentgenology reveals that over one-third of radiologists worldwide are experiencing burnout, largely due to staffing shortages. The Future Health Index report indicates that 77% of healthcare leaders report care delays linked to these shortages, resulting in backlogs that risk missed diagnoses, particularly in cancer treatment, which has become distressingly routine in healthcare systems like those in the U.S. and U.K. In line with these findings, in interviews our interlocutors consistently expressed experiencing stress. Notably, this pressure seemed not just created by their daily work in the present, but by an anticipated future health crisis. Nearly all of our interlocutors would express their concerns about the amount of patients with cancer *they expected to be treating* in the near future. Nobody knew exactly how many more patients would find their way to the hospital in the next decade; precise numbers were never referred to, and when probed, our interlocutors would indicate they did not know, exactly, what to expect. Interviews with radiologists revealed pervasive concerns about future patient loads, especially regarding cancer cases, leading to a sense of impending crisis due to anticipated staffing challenges.

A Chief Innovation & Strategy Officer at Philips encapsulated these sentiments, stating in a blog on their website that in today's climate of increasing patient demand and chronic staff shortages, 'time has become the most precious resource in radiology – and there's never enough of it.' Published in November 2024, the article emphasises the pressure radiologists face, linking their burnout to the predicted healthcare crisis and the growing need for AI assistance. The article argues that AI investments can help radiologists 'reclaim time' and enhance efficiency in healthcare. In a similar vein, the 2024 Future Health Index report notes that 85% of healthcare leaders are planning to invest in AI within three years, believing it will lead to time savings for both radiologists and patients.

Our interviewees largely agreed with this investment trend, recognising the untenable situation looming if current staff levels and workflows remain unchanged, particularly with an expected influx of patients. They expressed a shared sense of urgency for transformation, highlighting the impending challenges.

These narratives resonate with the observations of anthropologist Klaus Hoeyer (2023) in the Danish healthcare system. Attending medical conferences, he noted a common theme among professionals: an impending health crisis that could only be mitigated through AI adoption. While views on AI varied – some caregivers voiced frustrations about technical issues, while others acknowledged its potentials – there was a widespread belief in the dominance of AI in the future of healthcare. This consensus is driving current investments in AI, shaping algorithms, and adapting educational curricula to foster digital literacy among new healthcare professionals.

In the literature section, I will elaborate on this topic through the concept of 'techno-imaginaries' (Jasanoff and Kim 2019), which I combine with case studies by Hoeyer (2023) and Pols (2012) that offer insight about the difference between common differences that arise between future expectations of new technology introduced in healthcare settings, and present, unexpected outcomes.

For a substantive discussion of that literature, it is sensible to first briefly revisit the Scandinavian hospital that we discussed earlier in this paper – the one in which the radiologists work whom we interviewed over zoom. They told us that, although the early-career radiologists in the ward were currently still encouraged to practice drawing extensively, both they and their seniors typically did not believe that this

practice would remain relevant for many years to come. One reason was the speed of AI's ability to perform tasks and its associated ethical-temporal implications not earlier; another was that interlocutors believed that the role of AI will grow inevitably larger in the future. When discussing the future of this training and the practice of drawing with us in interviews, here too, narratives about an anticipated healthcare crisis were commonly shared, mostly accompanied by the remark that AI is crucial in the battle against such a crisis.

> 'Imagine you are that patient, sitting there waiting', a radiologist said to me once, as we walked through the waiting room in the Oncology Department. She raised her chin slightly and pointed to the light green, plastic chairs. Some of those chairs were occupied; a young woman was sitting with her hand on her lap, held by the hand of a man; a mother sat, watching her toddler play with a toy house in the corner of the waiting room. The radiologist and I turned the corner of the hallway, and only when we were out of sight of the waiting patients did she continue speaking. 'You wouldn't want to sit there any longer than necessary. You get completely crazy from waiting. Waiting too long is inhumane, so we do everything we can to provide clarity as quickly as possible.'

In the weeks and months that followed, we would hear many more similar statements from physicians about waiting time. We consistently recorded these statements in our notebooks because they, in our opinion, captured the emotional involvement that many caregivers feel towards their patients. Only later, when I entered the word 'waiting' into the software analysis program to search for telling quotes, did I start to see a different pattern emerge. The word 'waiting' was almost always described as having a relative value, with situations involving 'waiting too long' or 'unnecessarily long waiting'. While I do not question the good intentions of this radiologist and her colleagues, and while it must often be a terrible feeling for cancer patients to be sitting in that waiting room, waiting for a diagnosis or the percentage chance of successful treatment, I do want to raise critical questions about both the logic underlying her statement – that waiting 'too long' is inhumane – and the accuracy of these words. Literature about the experience of time helps me answer the first question; literature about future techno-imaginaries helps me consider the second theme.

Literature discussion

Time and temporalities

Time is a complex and often elusive concept that has not received extensive attention from anthropologists and social scientists, despite its significance (Adam, 2013; Duclos et al., 2017). While time is a pervasive experience, it is also subjective and context-dependent, shaped by various factors such as culture, historical periods, demographics, and the introduction of specific technologies.

Numerous scholars have examined how time is experienced differently across contexts. For example, Bear (2016) notes a 'temporal turn' in anthropology, investigating how capitalist societies shape temporal experiences. This body of literature defines temporality as how humans perceive, measure, and use time to structure their lives and cultures (Adam, 2013). David Harvey's work on time-space compression (Harvey, 1990) highlights how capitalist globalisation fosters increased connectivity and the impression that life is accelerating. Schivelbusch (1986) discussed how railroads transformed perceptions of time and space, while Harris (2021) analysed how aviation technology has

contributed to 'shrinking time.' Koselleck (2004) similarly explores how modern societies experience acceleration, conditioning future possibilities. Eisenstein (2021) points at the agency of people in managing their time, through an example of women in Uganda strategically timing their entry into married motherhood.

The term 'timeless time' (Bromley, 2009) encapsulates the rapid pace of life affected by digital technologies, blurring boundaries between work and leisure. This hyperconnectivity, as described by Virilio (2010), facilitates a faster-paced world and alters social relations (Rosa, 2003). As Wajcman (2008) notes, new technologies do not merely speed up existing processes; they also change their nature and the cultural practices surrounding them, resulting in new socio-spatial-temporal relations.

Kitchin (2023) argues that we now experience time qualitatively differently due to digital technologies. He examines how these advancements impact daily temporalities, including immediate access to information and alterations in mobility through time management apps and locative media. This high-speed digital time has become a significant aspect of lived experiences, warranting ethnographic investigation (Boelstorff, 2008; Boyer, 2013). However, the notion that the world is universally speeding up is challenged by scholars like Sharma (2013), who explores the uneven temporalities of everyday life, particularly for individuals whose occupations involve time management. She introduces 'power-chronography' to illustrate the disparate politics of temporality.

These studies collectively underscore that experiences of time are unevenly distributed and deeply influenced by the technologies individuals and groups engage with. They provide a nuanced understanding of the intricate relationship between time and technology within the context of contemporary global capitalism. The following section will build on these insights, connecting them to future imaginations regarding technology's role, the agency these techno-imaginations hold in the present, and their tangible impacts on professional caretakers in their daily interactions with new technologies.

Techno-imaginations: expectations and outcomes

In her study of Nepal's aviation industry, Harris (2021) illustrates how aviation staff contribute to temporal inequalities through their perceptions of Nepal's future and the role of aviation technology therein. Staff often feel increased time pressure during international flights, which they view as prestigious and vital for the country's reputation. While the global aviation industry is frequently celebrated, Harris reveals that progress is uneven, as employees in Nepal negotiate daily to effectively manage air traffic. Her writing helps readers grasp the differences that can exist in the experience of time for individuals or groups, and the impact thereof on societal dynamics.

Bear (2016) connects these differentiated experiences of time to anticipatory futures, exploring how people prepare for events such as security threats and societal instability. She identifies three main analytical areas in anthropological research on time: technology (methods of time management), knowledge (understanding time), and ethics (the values and norms influencing time decisions). Bear advocates for a framework called 'timescapes,' which emphasises the dynamic interplay between these areas, viewing time as shaped by material practices.

Similarly, Jasanoff and Kim (2019) introduce 'techno-imaginaries' to explore how societies envision the future roles of technology. These collective images are influenced

by social values and political contexts, affecting technology development and societal acceptance. They are essential for understanding the science-technology-society dynamics.

However, these imaginations may not always translate into reality. Pols (2004; 2015) examine telecare in the Netherlands, finding that while new technologies promise increased efficiency, they often lead to greater workloads for nurses. For instance, the easier monitoring of patients has resulted in more frequent data collection, counteracting the intended time savings, as nurses have felt compelled to maintain high care standards by conducting additional checks and consultations.

Hoeyer (2023) discusses a similar pattern in Danish healthcare, where AI and new technologies are introduced with promises of reduced workloads and time savings. Instead, healthcare professionals find themselves busier, managing not only additional tasks to adapt the technology but also increased patient expectations for timely care.

In the following sections, I will explore the 'timescapes' of professional caregivers working with AI in the studied hospitals. These timescapes encompass the interrelated aspects of technology, knowledge, and ethics related to time management. I will analyse how AI influences both the time required for caregiving tasks and the caregivers' perceptions of acceptable waiting periods. Additionally, these timescapes shape and are shaped by techno-imaginaries surrounding AI.

I argue that these imaginings significantly impact caregivers' agency, as their beliefs about the future potential of technology drive the interplay between technological impacts on time, their understandings of time, and their ethical considerations regarding patient care. By critically examining my interlocutors' narratives about the future of healthcare, I will demonstrate how these techno-imaginaries inform professional caregivers' navigation of temporal complexities in their daily work. This analysis will highlight how AI is perceived as an essential tool for achieving quality care amidst an anticipated healthcare crisis, while also revealing the new challenges and pressures it introduces into caregivers' interactions with patients.

Findings

Knowledge production in the daily work of a radiologist

Just before the Zoom interview described at the start of the paper with the two radiologists, the Oncology Department where they worked had received significant news about the development of AI in radiation therapy. In use for only about a year, the AI model they had helped to co-develop and were using in their ward had already received interest from other medical institutions in Scandinavia, and it was expected to be utilised by hospitals worldwide after it became commercially available. Although the radiologists were overtly proud of their role in this process, they emphasised several times that the model would not replace the work of a doctor or radiologist, but instead would be a valuable tool assisting them in their work. Similarly, in a newspaper article that was released in the same month of our interview, the clinicians working with the AI systems in this hospital stated that 'in any case where the model is used, the result will be carefully reviewed by a doctor. Necessary corrections will always be performed if indicated'.

Through ethnographic fieldwork, I learned to understand how radiologists' ability to 'carefully review' is developed. As was the case in several of other hospitals I visited, the training of radiologists in this particular hospital appeared to be deeply rooted in two aspects of their work: first, the building up of an individual portfolio of embodied experience

and, second, the collective experiences and narratives that unfold within the radiologists' community. Some of that training is formal, other aspects occur in more informal ways.

During a lunch break in the staff kitchen, a handful of trainee radiologists and their supervisors explained that the development of a stable and effective visual pattern, a specific perceptual order of image interpretation, is a gradual process that takes years of diagnostic experience to refine. It requires extensive practice to accurately identify the exact location of cancer through manual drawings based on CT-scans, and to establish potential treatment options. As Briedis (2020) also noted, part of this practice involves normative learning of abnormalities. Three times, radiologists showed me or a fellow researcher the images they work with, and each time I was reminded of the ultrasound images of my pregnant belly, several years before, and how I could not recognise anything human-like until the gynaecologist pointed it out: 'Look, there's your baby's right thumb, that's the heel of her foot.' When I confided in her that I found it difficult to believe that the white, moving object in the image was my child, she reassured me by saying that she too had taken time to recognise things in the first few ultrasound scans she had seen in her life. 'But you keep looking, and at some point, you start to recognize things.'

This learning process also applies to radiologists, as they explained in interviews. According to them, radiologists-in-training only become able to quickly identify if something is amiss in an image because they have seen and compared 'very many' images. This phrase was frequently emphasised by using the word 'very' with a stretched vowel sound (véééééry many), through repetition (very, very, very many), or in combination with another intensifying word (e.g., really very many). How many images, I asked? Hundreds, they replied – no one could provide an exact estimate. This 'practice in seeing' phase, as I started to refer to this part of the training, occurs during medical school education but also continues after starting clinical practice in hospital settings, and in joint sessions with supervisors and peers, such as case presentations and training meetings. This part of the training is shared: trainees learn normative ideas about how to read what is normal and abnormal on a scan from their seniors.

In addition to the formal curriculum, an important learning process also occurs through an informal curriculum, as described by both Briedis (2021) and Higashi et al. (2013). This can happen, for example, when an early-career radiologist walks from the office where they have just been reviewing images on a large screen to the reception desk where they can search for patient records or scan numbers and, along the way, they encounter a surgeon who reports on a surgery performed on another patient the previous day. Such exchanges also occur in the cafeteria, during coffee breaks, or spontaneously in the corridors. Once I overheard a conversation between a younger and older radiologist in the staff toilets, discussing a radiology image that the younger radiologist had reviewed earlier that day.

In addition to looking and seeing what is amiss, drawing is also a crucial part of the training process. Trainee radiologists practice drawing the organs and the location of cancer cells, based on different radiological images that each show a specific part of the affected bodily area. Drawing is an embodied practice, and interlocutors explained that how well you can do it depends on not only how well you look at images and interpret them but also on how accurately your fingers move and how well your hand follows the line of your eyes. Like looking, drawing is also something that requires 'a lot' or 'very many' hours of practice. However, the estimates of how many hours were significantly lower. Most trainees reported drawing tens of pictures during their training, whereas experienced radiologists who had worked in

the field for decades spoke about hundreds. In the training of a radiologist, drawing is practiced much less frequently than looking because it takes longer. Creating a drawing that is usable for a surgeon can take at least four hours – that's half a day's work – and there is still much other work to be done. Yet, it does happen, and in our interviews, experienced oncology doctors consistently emphasised that it must happen.

I keep coming back to this expressed importance of the training, precisely because of the ambiguity that surrounds it: without exception, according to all the interviewees I spoke to over the years of this research, practicing with looking, recognising, and drawing is a crucial part of the training process that must be actively maintained throughout one's career. And yet, they predict that it will no longer happen in the nearby future – and that is, according to my interlocutors, inevitable because of AI. More than once, an interlocutor corrected my question when I asked if this training was still necessary now that AI seemed to be outperforming humans in quality and speed. 'Not less so, but even more so', they argued. After all, with AI, there must always be a human supervisor, a critical, watching eye that can protect the patient from a possible mistake by a computer. However, consistently, in the same interview and sometimes even in the same sentence, interlocutors added that, despite these regulations, the human training would eventually disappear.

I take these intentions seriously because I did not only come across them in the Scandinavian hospital under study, but throughout the international research conducted for this study. For instance, a similar idea arose during a roundtable discussion I organised in the first year of my research project, which was attended by 30 experienced healthcare professionals who had all worked extensively with AI. We discussed the ethical dilemmas that could arise due to the introduction of AI on the healthcare floor. Until that day, I had assumed that the problem was not so much due to the digitalisation of healthcare, but rather that digital products were often designed by outsiders: corporations and startups that developed algorithms and sold them to hospital boards. However, this turned out to be only half true. Some wards were indeed overwhelmed by new offers for fancy algorithms, designed and produced by outsiders, which often made little sense for healthcare professionals. But doctors were adapting to this trend by co-creating medical knowledge with the industry: several participants shared that they are developing algorithms with programmers they had specially hired to come and work within the hospital. Two professional caregivers wrote their own code or had hired AI-developers to come and work in their wards. This made the new products they launched more relevant to the problems they faced on their work floors, and less dependent on data processing by third-party providers.

According to the participants, the real problem still not solved was the possible decline of human capabilities. They shared stories with one another, about the times they experienced the intuitive feeling that someone in their waiting room urgently needed help. Multiple doctors said they could smell or sense when a patient was seriously ill. How this worked, they did not know, but for them it was true. They said all this to make their point that however good some AI might be, or might become, in analysing and diagnosing based on data, it could never replace a skilled, experienced human doctor. And therefore, those human capacities needed to continue to be developed among trainees, so that in the future of healthcare, human doctors could continue to set up, instruct, and control AI.

In other words, my interlocutors were not naive techno-optimists, and certainly not when it came to AI. Yet, they consistently predicted that in the near future, doctors would be less trained in what they now considered to be crucial skills (like drawing the organs) than the current generation of doctors. Furthermore, they expected that they would let this happen, not because they agreed with it, but because they believed that the future of healthcare would inevitably be characterised by AI, anyhow – they did not recognise any agency for themselves to halt this trend. Moreover, many of them believed that AI was the only feasible solution to an anticipated health crisis. Whether these beliefs are accurate, no body knows – after all, the future is not here yet, and in theory anything can happen. What is clear, however, is that my interlocutors'narratives around techno-imaginaries of the future (Jasanoff & Kim, 2019) closely resemble messages from the industry around AI, as expressed on public blogs and large, international medical conferences. In this article, I argue following Hoeyer (2023), that such collective techno-imaginaries heavily affect the perceived individual agency of professional caregivers, because it is through these beliefs in the present that their future ideas are actualised: it is because of these techno-imaginaries that managers keep investing in more AI, and that physicians anticipate and expect to tolerate a lessening of a crucial training in drawing, even if they think this increases risks to their patients. In the final part of my analysis, I connect these findings to the topic of time.

Shrinking time and timescapes in the hospital ward

To build my analysis around timescapes, I return to that belief expressed by my interlocutors that I mentioned in the introduction to this article and that shook me up amidst our interview. The radiologist stated that, now that the new AI had been introduced, it would be morally unjustifiable to let patients wait as long as they would have to usually do human hands still made the drawings. That, in the words of my interloctur, would be 'too long'. But what is 'longer than necessary' and when does waiting last 'too long'? There are obviously no clear answers to these questions, but I propose that that my interlocutors' conceptions of what is tolerable or unnecessary suffering (in this case, waiting in uncertainty and awaiting treatment that may potentially remove the cancer and, with it, the ultimate danger of death) are shifting due to the introduction of new technology in their hospital. Since they learned how quickly AI can create a diagnostic image that can lead to a more precise diagnosis and, on the basis thereof, a specific treatment, it starts to feel frustrating to them, indeed even morally wrong, to cling to a slower workflow that was still the standard until very recently. To use the concept as Barbara Adam (2013) introduced in her work on time: the timescapes in which our interlocutors do their work, reflect a dynamic interrelationship between the newly introduced AI system, their embodied knowledge of drawing, and ethics of waiting time. As Bear (2016) concludes experienced time is assembled into technologies of imagination, which are shaped by material practices.

That this experienced time is a subjective and evolving perception becomes clear, however, by the lack of evidence we found to support the claim that radiologists were indeed able to help more patients, quicker, due to their collaboration with AI. What was apparent, is that individual patients could be diagnosed quicker and their treatments scheduled in on the same day; this was different from the period before the AI was introduced, when it sometimes took two days. But clinicians did not see more patients, in the time saved. From their replies in interviews, it became clear that there was a big

difference between the way in which they had expected AI to change their job, and the actual changes on the workfloor.

For example, when asked what they would do with the time saved by AI utilisation, nearly all interlocutors mentioned that they would spend more time with patients. 'If I have AI to help me, I can make small talk with my patients. This is very important, as many of the people I see here are nervous, and one task of a human doctor is to calm them – something AI can never do for me', said one senior radiologist. Similar remarks were made by many colleagues, who talked about making more eye contact, making more conversation, explaining in more depth the treatment, and one colleague suggested that he 'would ask people how their holiday was, or their weekend', if AI would consistently do the drawings in his place. But in reality, this did not happen in the hospital ward. When asked very specifically about what they did with the newly freed up time, since the introduction of the AI, interlocutors often laughed and said they spent it on either checking the AI for errors, or training it. Examples of errors were always instantly offered during interviews: when a patient is obese, the AI draws the organs in wrongly; when a patient lies on her side, errors occur too. Therefore, clinicians check the drawings, which can cost them quite some time if they are in doubt – something which occurs continually in radiology (Lebovitz, 2019). This finding resonates with the work of Pols (2015) and Hoeyer (2023), who also found that new technology, often introduces extra and new work.

Moreover, and perhaps more surprisingly, we found that the clinicians in our study gained yet another task in their work schedule: the training of the AI system. Many of them took turns in what they called the 'AI project', on which they spent several hours per week to upload radiology images from their patients, with the aim of improving the system. The radiologists called this part of their work 'voluntary', indicating that their management did not ask them to do this: they wanted it, because they wanted to contribute to developing a better AI model:

> The more images we upload to it, the more the system can practice, and the better it will get at drawing.

The idea here was that the AI system gets familiar with a variety of body types, and body positions, so that the amounts of errors decrease. This practice reflects the hopeful expectations radiologists put in AI: they put time and effort into helping this hope turn into reality in the near-future. Moreover, the practice shows how technologies such as AI do not simply speed up processes and actions or save time, but can change their nature and meaning, as well as introduce new material and cultural practices, a finding that resonates with the work of Wajcman (2008). In the presented case, radiologists are not simply doing the same things they used to do at a faster pace, with the support of AI; rather, they are performing new kinds of tasks, such as checking the AI for errors, and training it.

It thus appeared that the anticipated time-saving benefits of AI were a hypothetical construct, primarily referring to a techno-imaginary about the future of healthcare. In interviews, discussions of 'waiting too long' frequently alluded to a hypothetical near-future scenario where an influx of a greater number of older patients was anticipated: a healthcare crisis. At that point, physicians cautioned, they would have no time remaining to produce all the drawings themselves. In some cases, 'waiting too long' referred to another hypothetical future scenario: that in the very near future, more patients would be admitted in 'emergency' situations. However, within the context of cancer, interviewees acknowledged that an emergency case would typically refer to

a patient with cancer at an advanced stage, meaning a few drawing hours would probably not make a meaningful difference.

In anticipation of the hypothetical future scenario, where the narrative of an inevitable healthcare crisis is repeatedly emphasised, and where a shortage of manpower and resources to assist the expected influx of older patients is imagined, caregivers in their minds are already taking steps to reduce the waiting process. To put that differently, their present intentions and decisions are affected by collectively held and cultivated techno-imaginaries about (the future of) healthcare and AI. These intentions involve potentially accepting the disappearance of a training program that is currently considered crucial by all stakeholders to enable human doctors to effectively collaborate with AI in a way that is considered 'good' and ethical care. It appears that this techno-imaginary is so captivating that people are willing to make moral compromises. Our interlocutors acknowledged the risk of the disappearance of crucial human skills, but they do not think they can stop it, and therefore do not expect they will try to. Hence, certain risks are weighed against each other and prioritised; an overwhelmed healthcare system versus computers that occasionally make mistakes unnoticed; 'unnecessarily long' uncertainty versus the precise, but relatively slow, work of a human doctor. In particular, radiologists' definition of a 'tolerable' waiting time has been 'shrinking' (Harris, 2021); their timescape has changed, due to a complex interplay of technology, ethical norms, and embodied knowledge that is needed for their job. What was once considered a reasonable delay is now seen as excessive, and hence, what was once considered 'good care' (Pols, 2015), now no longer is. This transformation of time perspective thus has significant implications for the way these caregivers understand and prioritise patient needs, but also shapes their own sense of moral responsibility towards their patients – how they *should* work faster, and so remain just as busy.

Conclusion

There exist multiple books and dozens of articles, many of them authored by doctors, that warn against unsupervised AI. Even well-tested algorithms can and do make unexpected mistakes, and the consequences for individual patients are huge if these mistakes go unnoticed (e.g., Wachter, 2015). All doctors that participated in this research were acutely aware of that, and yet, they seemed to facilitate processes that steer towards a situation in which AI would be supervised by insufficiently trained human radiologists. At present, they actively reify AI, driven by the hope that AI will offer a solution to the anticipated, overburdened healthcare systems they work in.

Our data show that our radiologist interlocuters experienced their jobs as already very demanding – as also evidenced by concerning reports about the high numbers of radiologists affected by work stress and burnout. Our research made clear that a fair proportion of the reported work pressure seemed caused by anticipated, imagined stress about the increasing amount of cancer patients that would seek treatment in their hospital in the future. This idea is partly based on demographics and an ageing population. However, the concerns also reflect recurrent messages spread by the industry, particularly companies developing AI. This future crisis framing has been pushed on international blogs and in other public and professional publications, as well as at medical conferences. The result is a widely shared hope that AI will not just solve the anticipated healthcrisis, but moreso: that AI will help to 'reclaim time' in the worklives of radiologists (e.g. Partovi, 2024).

Drawing on the work of Jasanoff and Kim (2019), Hoeyer (2023) and Bear (2016), p. I argue that my interlocutors' time scapes are changing because of collectively held techno-imaginaries: because my interlocutors believe that the future of healthcare must inevitably be defined by AI, they are willing to 'negotiate with time', as Harris (2021) calls such dynamics. While her research in Nepal found that employees in the aviation industry feared to 'lag behind' new international work speeds, in this article, professional caretakers felt increasingly responsible for making their patients wait 'too long'. These values and ethics were positioned vis-à-vis the potentiality of what they believed would be made possible through AI technology.

What people believe will come to be in the future, already gains power in the present, regardless of whether the imagined or expected future outcomes are correct or not. Hence, I have argued that collectively held techno-imaginaries create specific expectations and make a particular practice or waiting time seem unacceptably long, or in the words of the radiologist, 'morally justified' or not.

The article furthermore proposes that professional caregivers' time experiences are impacted by an AI that makes possible a supposedly more time-efficient way for them to diagnose and eventually treat cancer. My interlocutors evaluations of, and expectations of, the time efficiency of this newly introduced technology did not take into consideration the extra work of monitoring for errors that the AI system demanded; nor did interlocutors count their involvement in AI training, which took away hours of their weekly schedule. My findings thus suggest that the ethics of what is considered 'good care' and acceptable waiting times, are changing in hospitals all over the world, altered by the introduction of new technology, albeit in different ways and speeds in different healthcare contexts. How, and with which effect for our healthcare systems, demands further research.

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