AI CHANGES WHO WE ARE – DOESN'T IT? INTELLIGENT DECISION SUPPORT AND PHYSICIANS' PROFESSIONAL IDENTITY

Research in Progress

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Abstract

The impacts of intelligent systems on the future of work, society, and life in general are important topics of our time. In healthcare, particularly Intelligent Clinical Decision Support Systems (ICDSS) have the potential to enhance medical care by suggesting diagnosis or treatment plans(Agarwal and Dhar, 2014). However, one wrong decision can have fatal consequences. Hence, these systems require active users which have to handle the output of these systems. At the same time, ICDSS challenge physicians' professional identity by being autonomous and potentially superior in decision-making. These systems can be threatening to physicians' self-understanding or be perceived as enhancement to traditional roles. Our research aims to explore how ICDSS change the professional identity of physicians and which different strategies physicians use to deal with upcoming changes. We are currently developing a mixed-method research study combing quantitative and qualitative data from a survey and in-depth interviews. In this research proposal, we present a literature-based framework, our research approach, and preliminary qualitative results. Understanding how the co-construction between ICDSS and physicians' professional identity looks like will help to understand how intelligent systems change our understanding of our work and how this change can be actively shaped.

Keywords: Artificial Intelligence; Intelligent Decision Support Systems; Healthcare; Identity Construction

1   Introduction

Since IBM's Deep Blue defeated world chess champion Garry Kasparov in 1999, artificial intelligence (AI) has been considered the new future of decision-making. This is particularly important for medical decision-making because of its large practical significance: one wrong decision can have fatal consequences for the patient's life. A recent report identified medical errors as the third leading cause of death in the US after heart disease and cancer (Makary and Daniel, 2016). Intelligent clinical decision support systems (ICDSS) can support physicians in decision-making and reduce medical errors. ICDSS can evaluate large sources of diagnosis information from electronic health records (EHR), medical databases, as well as scientific publications and so identify high risk-patients (Lin et al., 2017). Moreover, ICDSS can increase the quality of care and improve health outcomes (Agarwal and Dhar, 2014). However, in order for ICDSS to successfully support the decision-making process of physicians, doctors must first of all accept the ICDSS and secondly incorporate the machines' decisions into their own

reasoning (Triki and Weisner, 2014). In order to exploit the full potential of these systems, physicians have to actively interact with them.

However, by taking on core tasks of the medical role such as medical diagnosis and treatment decisions, ICDSS threaten the professional identity of physicians and are likely to become object of physicians' resistance (Liberati et al., 2017). The identity perspective is especially relevant for health professionals for two reasons: Firstly, they have a strong sense of professional identity formed through long socialization, high autonomy and firm professional values (Pratt et al., 2006). Secondly, physicians generally show strong resistance to new technology (Romanow et al., 2012). Prior work has shown that resistance evolves when physicians perceive the new technology threatening core aspects of their professional identity, such as having a personal relationship with the patient (Lomotan et al., 2012), making independent autonomous decisions (Esmaeilzadeh et al., 2015; Walter and Lopez, 2008) or their authority and high standing in the hospital (Jensen and Aanestad, 2007; Lapointe and Rivard, 2011). However, new technology can as well be perceived as an enhancement to professional identity, leading to more usage (Carter and Grover, 2015), better assimilation (Mishra et al., 2012) and more effective use (Stein et al., 2013). While previous research has only argued that new technologies are evaluated as congruent or incongruent with professional identity, leading to either an enhancement or threat (Mishra et al., 2012; Nach, 2015), little is known about the determinants of this evaluation and the underlying process of identity construction.

The objective of this *research in progress* is therefore to develop a process model that explains how physicians construct their professional identity in connection to ICDSS. Therefore, this paper aims to answer the following research questions:

1. How do ICDSS change the professional identity of physicians?
2. How do physicians actively perceive and manage these changes?

By answering these questions, this research contributes to identity research in information systems (Carter and Grover, 2015) in developing a process of identity construction. In addition, this research contributes to technology adoption research by adding the identity perspective to the explanation of different usage behaviours (Venkatesh et al., 2011). Finally, this research develops a context-specific theory (Burton-Jones and Volkoff, 2017) and provides an understanding of the social and individual consequences of AI in the context of healthcare.

This paper is structured as follows. First, the theoretical background will be elaborated and a first process model of identity work will be presented. This is followed by our research approach with preliminary results. The paper concludes with an outlook on the expected contributions.

2 Theoretical background

2.1 Intelligent Clinical Decision Support Systems

There is no uniform definition for decision support systems (DSS). However, they are generally referred to as systems that support and improve decision-making (Turban and Aronson, 2005, p.104). DSS were developed to solve context-specific problems by providing information to decision makers. Its core properties include only decision support, while the human being still remains the decision maker and in control (Turban and Aronson, 2005, p.107). Clinical decision support systems are DSSs that are used in clinical context and improve care by providing filtered, patient-specific information (Lomotan et al., 2012). Compared to traditional DSS, intelligent decision support systems (IDSS) can further improve decision support capabilities (Turban and Aronson, 2005, p.538). They can aggregate large amounts of data to draw conclusions (Lin et al., 2017). Furthermore, these systems are able to learn and integrate feedback, which further improves their reasoning (Meyer et al., 2014). This means that they can generate new knowledge and extend predefined rules. ICDSS can use this knowledge base to make predictions, for instance, about the further development of a disease (Lin et al., 2017; Meyer et al., 2014). Furthermore, the systems possess a degree of autonomy and agency (Turban and Aronson, 2005). From all

these characteristics, we conceptualize intelligent clinical decision support systems (ICDSS) as systems that improve medical decision-making using algorithms (e.g. neutral networks). For this purpose, they aggregate large amounts of data, continuously expand their knowledge base, create new medical knowledge and learn from feedback. Moreover, they autonomously draw medical conclusions and predictions.

Research analysing the impact of technology on physicians' identity has mainly focused on automation technology like EHR and not specially considered the implications of ICDSS or even DSS on physicians' identity (see e.g. Bhattacherjee and Hikmet, 2007; Jensen, Kjaergaard and Svejvig, 2009; Venkatesh, Zhang and Sykes, 2011; Mishra et al., 2012; Gagnon et al., 2016). From a professional role perspective, EHRs influence routine tasks of physicians such as medication prescription. However, ICDSS are addressing more complex decisions in an autonomous way and take over physicians' core competencies: developing medical diagnosis decisions and treatment suggestions. Literature shows that ICDSS pose a greater challenge for physicians than EHR. For instance, Walter and Lopez (2008) demonstrated that the professional autonomy is more threatened by CDSS then by EHR. The authors argue that the codification of knowledge by CDSS leads to a higher threat to professional autonomy. Pope and Turnbull (2017) argue that CDSS threaten especially expensive knowledge experts and specialists with replacement by less expensive personnel. ICDSS present physicians with further challenges because of the characteristics of artificial intelligence. One way of seeing intelligent systems is in the strive to resemble human capabilities in sensing, inferencing and learning. Moreover, these systems are intended to execute actions (e.g. communicate the results, make diagnosis decisions) in an autonomous way. Therefore, Russell and Norvig (2010) defined intelligent systems as agents which make "rational actions". For ICDSS there exist different system categories focusing on different tasks such as deriving diagnosis decisions based on the analysis of CT pictures (Takahashi and Kajikawa, 2017), predicting patient development from data in EHR (Lin et al., 2017), or optimizing the clinical workflow (Osheroff et al., 2007). Especially systems of the first category are challenging for professionals, since they interfere directly with physician's key competence of making diagnosis decisions. Nonetheless, physicians have to actively monitor the systems' decisions to both ensure that the decision is correct and integrate the output into their decision-making process (Jensen et al., 2010; Triki and Weisner, 2014). However, the characteristics of AI as being autonomous and potentially superior in its decision-making capabilities is challenging to physician's professional identity and forces physicians to readjust their concept of professional identity. Consequently, a better understanding of the process of physicians' identity construction is needed to better understand what the professional role of physicians should be in relation to ICDSS.

2.2   Identity Theory and Identity Work

Identity can be defined as a relatively stable set of self-relevant meanings guiding individual's attitudes and behaviours (Burke and Stets, 2009; Stets and Burke, 2000). Individuals have multiple, hierarchically organized identities that are activated depending on the situation (Burke and Stets, 2009). For instance, individuals can identify with social groups (Tajfel and Turner, 1979) or with social roles (Burke and Stets, 2009), specifying which social norms to follow or which behaviour to display. Professional identity can be understood as a subset of meanings referring to the individual in the working environment, and is defined as "an individual's self-definition as a member of a profession and is associated with the enactment of a professional role" (Chreim et al., 2007). Furthermore, professional identity refers to the status, privileges, duties and self-image of the profession itself and on the individual level to behavioural norms (see McNeil et al., 2013). Professional identity of physicians is the answer to the question "What does it mean to be a physician?". For instance, Mishra et al. (2012) defined the professional identity of physicians as a caretaker identity – a role which is reinforced by patients and the professional community.

According to the Identity Theory (Burke and Stets, 2009), individuals are constantly engaged in an evaluation process in which they match their perceptions of stimuli with their current self-understanding aimed to uphold a positive self-image. Stimuli can be behaviours, experiences, attitudes or new technological artefacts (see e.g. Stein et al., 2015). The identity evaluation process can lead either to congruent

or incongruent outcome (Nach, 2015). A congruent evaluation means that the appraisal of the stimulus preserves or benefits the identity (benign/positive) or holds potential for identity gain/ growth (challenge), while an incongruent evaluation means that the stimulus harms the identity (harm/loss) or holds a potential to harm identity (threat) (Petriglieri, 2011).

In order to maintain self-integrity, individuals manage their identities and engage in so-called identity work with the aim of restoring balance between their perceptions and identity (Brown, 2015). Identity work is one element of identity construction and is commonly referred to as "active construction of identity in social contexts" (Pratt et al., 2006, p.237). It is an active process in which physicians integrate the evaluation of ICDSS into their definition of being a professional. According to Petriglieri (2011), professionals' identity work after perceived threats can be categorized into two categories: First, individuals may engage in 'identity-protection responses' aimed at actively influencing the source of threat. Secondly, individuals may engage in 'identity-restructuring responses', changing their identity in relation to the threat. Identity protection can be seen as first step dealing with identity threats delaying resolution of the threat itself. If the threat remains, individuals engage in identity restructuring to redefine their identity. In this research we focus on the process of identity construction, i.e. the restructuring of the identity facing ICDSS and the integration of ICDSS into the new professional identity. This process occurs not only if ICDSS are perceived to be an identity threat but also if it is perceived as enhancement. Hence, we expand the scope of the research by Petriglieri (2011) to include professional identity enhancements.

Although research has shown that technology leads to identity construction for a variety of professions, such as scientists, media and library professionals (Lamb and Davidson, 2005; Serrano and Boudreau, 2014; Utesheva et al., 2016) the choice of physicians as unit of analysis follows two reasons. Firstly, physicians are considered to be the 'prototypical profession' (Pratt et al., 2006) since the profession was formed during a long historical period and long individual socialization and education, and the members are considered to be highly identified with their professional group (Reay, 2017). Physicians professional role is defined by high autonomy, status and control over resources (Mishra et al., 2012). Their professional identity is formed early in their career as students (Pratt et al., 2006) and they have strong commitment to their role treating patients (Venkatesh et al., 2011). For this reason, the developed professional values and attitudes are hard to change resulting in a motivation to oppose change (Murtagh et al., 2012; Reay, 2017). Secondly, physicians have a high influence and control over the implementation process of the technology and it has been frequently observed that they have strong resistance against it (Liberati et al., 2017; Romanow et al., 2012; Venkatesh et al., 2011).

In a case study Kyratsis and colleagues (2016) analysed various strategies of identity work that allowed physicians to successfully redefine their professional identity after the fall of the Soviet Union, forcing a transition from specialized to generalized care. The authors noted that for a successful transition to the new identity, the identity threats to status, core values and the community have to be overcome and the new institutional logic has to be integrated in one's own self-understanding. In contrast to societal changes, technological changes can still be influenced by physicians by actively resisting against it.

3 A framework of Identity Construction

Prior research showed that the implementation of a new technology changes not only the tasks physicians perform but also the interdependencies between professionals (Haland, 2012), the required skills (Alvesson and Empson, 2008) and the working processes (Lapointe and Rivard, 2011). As a determinant, technology can threaten different aspects of professional identity: professional autonomy (Esmaeilzadeh et al., 2015; Walter and Lopez, 2008), authority and status (Jensen and Aanestad, 2007) and the control over resources (Alvarez, 2008; Bhattacherjee and Hikmet, 2007). Considering the functionalities of ICDSS, ICDSS do not only affect how physicians deliver care to patients and how they function as social group (Mishra et al., 2012) but also the decision-making process and their status as knowledge experts. Technology can also strengthen physicians in their identity (Mishra et al., 2012; Nach, 2015) by enabling them to be better in their current role. According to the categorization of Carter

and Grover (2015), technology can be seen as determinant of identity, forcing changes to the professional identity. Technology can also be a medium or a consequent of identity. As a medium, it serves as identity expression and as a consequent, user's identity shapes technology use. For instance, Stein et al. (2013) found that different professional identities influence which features of a technology are used and how technology is perceived. Carter and Grover (2015) demonstrated that technology can also be integrated into the identity leading to positive identification with the technology and more elaborate and frequent usage. However, Carter and Grover (2015) do not elaborate on the process of how technology is integrated into the identity. We argue that technology is first a determinant of identity and gets subsequently integrated into the professional identity. First ICDSS can force individuals to redefine themselves. But this also requires individuals to actively integrate the technology into their professional identity. This process can be called identity construction (see Kyratsis et al., 2016).

An example of a process-related view on identity construction by physicians is provided by Nach (2015). He elaborates on different types of identity resulting from the introduction of an EHR. The system is perceived as either congruent or incongruent with the current professional identity of physicians, resulting in positive emotions and a validated identity or negative emotions and a threatened identity. In response to identity threats, physicians can either readjust their identity or neutralize the IT threat by developing an anti-identity. Moreover, the construction of the professional identity influences which features and functionalities are used. For instance, a self-understanding as someone who 'utilizes artefacts' leads to a greater use of features that show accountability (e.g. last edited marking) while an understanding as someone who 'translates artefacts' to the use of features that explore the artefacts' capabilities. (Stein et al., 2013).
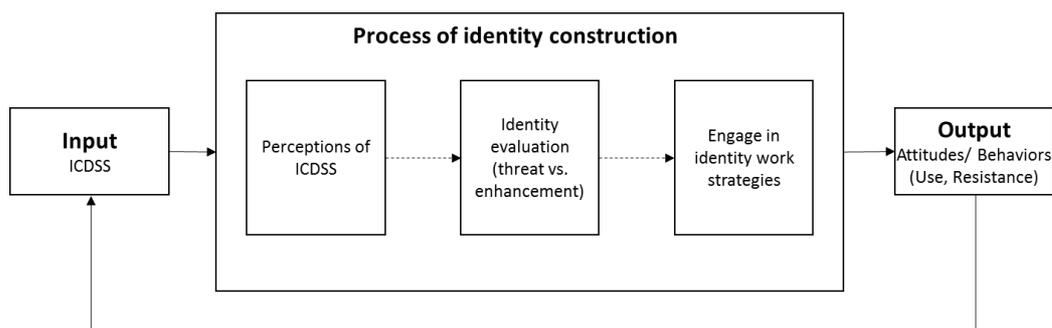

Figure 1.   Theoretically derived process of identity construction.

We derive the following research framework (Figure 1) from a process perspective and based on work by Kyratsis and colleagues (2016) and the Identity Theory (Burke and Stets, 2009; Nach, 2015). First, the ICDSS is perceived as a stimulus (see similiar reasoning Beadury and Pinsonneault, 2010; Stein et al., 2015). Secondly, the ICDSS is affectively evaluated with regard to the current professional identity with congruent or incongruent outcome. After the evaluation, various identity work strategies are applied to restore a positive image (Burke and Stets, 2009), possibly integrating ICDSS into the professional identity or resisting its implementation (Carter and Grover, 2015; Lamb and Davidson, 2005; Leclercq-Vandelannoitte, 2014; Stein et al., 2013).

4   Research Goals and Research Design

The provided framework derived from identity literature decomposes the process of identity construction into three different steps: perception of ICDSS, the evaluation as threat or enhancement and finally identity work strategies. However, prior work represented in this framework leaves open which different strategies exist, how they are developed and how these strategies influence usage behaviours. In order to close these gaps, this research aims to achieve the following research objectives:

1. identify the different identity work strategies applied by physicians facing ICDSS

2. understand how physicians derive different identity work strategies from their perceptions of the ICDSS functionalities and their evaluation as threats or enhancements to their current role

> *3. explain how different identity work strategies lead to behavioural outcomes such as reliance on ICDSS' suggestions or resistance against ICDSS*

To reach our research goals, we plan to apply a mixed method approach proposed by Venkatesh, Brown and Bala (2013). First, we will use qualitative data from a survey of 182 medical students to derive different preliminary clusters of identity work strategies and link this data to quantitative measures. This allows us to exploratively examine on a broad scale what different types of identity work strategies exist. The results moreover serve as pre-test to develop an interview instrument. Secondly, we will deepen our understanding of the different categories and the behavioural consequences by in-depth interviews with physicians using ICDSS. For the latter, different groups of physicians using ICDSS will be considered (such as radiology or internal medicine) since the impact of ICDSS on professional identity also varies depending on the importance of technology for the professional identity and the amount of patient contact.

For the qualitative interviews, we will follow the guidelines for interpretive research by Klein and Myers (1999) and we will analyse the narrative construction of professional identity from physicians following the guidelines for the narrative research process developed by Adler and colleagues (2017). We will use physicians' narratives, the ideal stories about how physicians describe themselves related to ICDSS, as cases. Stein, Galliers and Markus (2013) related narratives to specific patterns of identity use in the back office of a Big 4 accounting firm and demonstrate that narratives are a proper means to understand the co-construction of technology and identity. With the interviews we will enlarge and deepen the content of the theoretically and empirically (with the pre-test) identified identity work strategies. Moreover, we will code and observe usage statements and behaviours of physicians encountering ICDSS at both system and feature level. At the system level we will investigate different statements related to forms of user resistance such as passive or active resistance and adoption behaviours following the framework of Van Offenbeek, Boonstra and Seo (2013). At feature level, it is important to understand if physicians rely or suspend the ICDSS decision and how the AI-specific functionalities are used (Triki and Weisner, 2014; Woolley, 2011). This offers us an understanding how and if the process of identity construction is related to technology usage and which additional identity work strategies are developed to integrate ICDSS into professional identity.

5 Preliminary results

In a first survey, 182 medical students received an opening vignette of 'Sherlock' paralleling the features currently of IBM Watson. Participants were asked in an open question what changes in their professional role as physicians they expected from systems like 'Sherlock'. As a sample frame, medical students have several specifics that make them interesting. First, they already have a strong sense of professional identity through their education (Pratt et al., 2006). Second, they are more open to technological innovations than more experienced physicians (Laumer et al., 2016). Third, medical students are forced to decide about their specialization, which will determine their future career since changes in specialization are rarely possible later on. Therefore, considerations about the choice of specialization also lead to considerations about the future development of AI and how it plays potentially dramatic roles in their preferred specializations. Hence, this group of professionals is already confronted with the upcoming technological development and engaged in different identity work strategies.

Drawing from a broad literature base on identity work in organizational and management science (see for a review Brown, 2015; Petriglieri, 2011; Pratt et al., 2006) and literature from psychology (Sherman and Cohen, 2006), we derived an initial set of six theoretical categories specifying six identity work strategies applicable for ICDSS. For our analysis, we focus on the construction of the professional role in the light of ICDSS, excluding identity work strategies such as neglecting or denial of upcoming changes. We coded the students' answers in retrospect to these categories (see similar method by Nach, 2015) to understand which different identity work strategies they applied. These categories set the starting point for developing clusters of students understanding which perceptions and evaluations lead to a specific strategy. Further categories and a more in-depth understanding of different strategies will be derived from interviews with physicians using ICDSS.

	Identity Work Strategies	Adjusted definition	Evidence from preliminary data
ICDSS as identity threat	Meaning change (Kyratsis et al., 2016; Petriglieri, 2011)	Change the meanings associated with a threatened part of the identity. Reframe the potential loss as positive	'Physicians don't have to be 'Gods in white' anymore' or 'As physician you don't have to have so much knowledge anymore, but, you still have to make decisions with given information and live with the consequences'
	Identity exit (Petriglieri, 2011)	Abandoning the threatened part of the identity	Resignation by being 'just assistant of the machine' or 'the role of the physician will be more passive, since decisions will be automated' or 'physicians will depend upon ICDSS'
	Splinting (Pratt et al., 2006)	Adapt a part of identity to strengthen a weaker one	Moving from being a decision maker to be a care provider and focus on soft skills: 'change of physicians' tasks and responsibilities'
	Authenticating (Kyratsis et al., 2016; Sherman and Cohen, 2006)	As reaction to perceived threats, focus on core values of physicians' profession (taking care of the patient, comforting)	Being better a care provider by using ICDSS, e.g. 'these systems can support and help physicians to have more time for patients' or 'these systems help to make better decisions to save patients lives'
ICDSS as identity enhancement	Enriching (Pratt et al., 2006)	Basic understanding remains the same, but understanding of what it means to be a physician deepens	Integrate ICDSS to a new, enriched understanding of professional role: 'Physician as control instance of the ICDSS' or 'Reliance on ICDSS for decisions in standard cases and physician focus on Kolibri cases'
	Patching (Pratt et al., 2006)	Patch up "holes" or deficiencies in the understanding of the professional identity	ICDSS serves as patch for the deficiencies of own identity: 'Feeling more certain with own decisions', 'Especially good for uncertain assistant physicians' or 'faster decisions' and 'reduce medical errors'

Table 1.   Literature based categories of identity work strategies matched with survey data.

We propose that different identity work strategies are the foundation for different behaviours towards ICDSS. In the context of ICDSS, it is essential to understand whether physicians rely on the suggestions if the system is correct and reject the suggestions if the system is wrong. Let's consider the following case. Two physicians accept the ICDSS suggestion for a diagnosis decision. One physician relies on the decision because he or she considers that making a diagnosis is not anymore a core part of his or her work. Instead, he or she believes that he or she should focus on the patient communication instead. Pratt and colleagues (2006) called this strategy 'splinting' – focusing on another part of the identity to overcome the identity threat (see Table 1). In contrast, another physician also may rely on the decision of the system but apply the 'enriching' strategy (Pratt et al., 2006). He or she still realizes that it is important to be responsible for decision-making but deepens this understanding by one important aspect: the physician has to monitor the ICDSS and to be in control over the system. Therefore, he or she relies on the decision after arriving to the conclusion that the suggestion was correct. While the behavioural outcome is the same, the underlying identity construction is completely different. In the first case, the technology is perceived to be dominant and evaluated as threat, while in the second case the technology is perceived as support to the physician's work and as enhancement. In another situation, the first physician would therefore continue to rely on the ICDSS, while the second physician would critically evaluate the output and perhaps even reject the suggestion.

6 Expected contributions and next steps

AI will change how professionals work and how knowledge is accessed and created. This requires professionals such as physicians to redefine their professional role by applying different identity work strategies. Depending on how the process of identity construction looks like, professionals will behave accordingly towards intelligent systems. For instance, if physicians consider ICDSS as dominant in decision-making it will be likely that the systems' decisions will not be monitored and controlled resulting in possible fatal consequences. This research in progress presents a research approach and initial results of different identity work strategies applied by medical students confronted with ICDSS. Our next steps include a deeper analysis of the survey responses by integrating perceptions of ICDSS and the evaluation as threat or enhancement. Furthermore, we prepare for collecting qualitative data by defining the research setting and developing instruments for interviews with physicians using ICDSS.

With our research we aim to explore the process of identity construction resulting from ICDSS. There are currently steps towards a large scale implementation of ICDSS and physicians already facing the upcoming changes and develop different identity work strategies. Understanding the process of identity construction contributes to the identity literature in information systems (Carter and Grover, 2015). Secondly, we contribute to the understanding of technology adoption and resistance in healthcare by adding the identity perspective (Venkatesh et al., 2011). Thirdly, we are one of the first research projects dealing with the societal and individual effects of intelligent decision support systems and are following the call for contextualization of information systems research (Burton-Jones and Volkoff, 2017). Traditional DSS are more threatening to the professional autonomy of physicians than EHR are (Walter and Lopez, 2008). Therefore, the question arises which consequences IDSS will have. Because companies like Google aim to develop intelligent systems that are becoming increasingly autonomous and independent, it is crucial to understand how the new relationship between intelligent systems and professionals will look like. It is particularly important in the healthcare sector that physicians still remain in control over the system preventing fatal decisions. In current discussions, however, it is often stressed that physicians will not be replaced by ICDSS because of their soft skills in patient communication, a strategy we've label as 'splinting'. This strategy is based upon the assumption that the system is perceived to be dominant over humans in decision-making, which may mean that the system's decisions are not called into question (Triki and Weisner, 2014).

Our research opens up the issue of identity construction triggered by AI that also affects other professions such as lawyers, tax advisors or investment bankers – all highly specialized professions with a high level of specialist knowledge. Developers and managers have to consider the impact of technology on our future work practises and on the definition of professional identity in order to successfully implement these systems and create the foundation for active users.

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