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Abstract. This paper investigates the design of electronic services for patient-healthcare provider interactions. Empirically, the paper draws from two cases on electronic health appointment management within the Norwegian healthcare system. We investigated the realisation of these new electronic services through the lens of service design adopting a process approach and following their evolution over time. Our findings suggest that the design of services for patient-provider interactions requires a) reconsideration of the whole relationships going beyond the digital solution part, b) flexibility that allows user-defined tailoring of digital solutions after being introduced to use, c) support of continuity in user involvement, d) creative exploitation of the regulatory constraints.

Key words: electronic services, healthcare, service design, patient–healthcare provider interactions, design directions.

1   Introduction

Electronic services for patient-provider interactions can contribute to the improvement of health, the enhancement of quality and the reduction of costs for healthcare services (National Information Board 2014). They can give patients and citizens more control over their health and wellbeing while reducing the administrative burden for care professionals (idem). The introduction of such electronic services can support a shift from an institution-centric to a patient-centric model (Demiris et al. 2008). However, although there are mature technologies available, it seems that "technological opportunities offered have not been taken-up in everyday practice" (McLoughlin et al. 2012). The slow progress can be related to the sensitivity of existing

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patient-healthcare provider relationships, the diversity of professional practices, the spectrum of differences among patients and the institutional complexity. Such issues have been identified in previous research on IT in healthcare which explored digitalisation challenges (Ancker et al. 2014; Cresswell and Sheikh 2013; Grisot and Vassilakopoulou 2011).

In this paper we go beyond the identification of issues by providing design directions that can facilitate and expedite the introduction of electronic services for patient-provider interactions. Specifically, we analysed two cases from Norway on the design of electronic services for health appointment management. The new electronic appointment services aim to improve the accessibility and expediency of conventional (i.e. non electronic) appointment services and to contribute in overall efficiency improvements. In both cases the technical development part can be considered as technically straightforward but the overall service design involves a complex chain of transformations for existing arrangements that create the need to rethink and renegotiate interactions and exchanges among actors involved. The actors include patients with diverse needs and healthcare providers that are part of specialised communities of practice, are supported by advanced information technology applications and have roles within regimented institutions. We investigated the realisation of the new electronic appointment services through the lens of service design adopting a process approach and following their evolution over time. The service design literature oriented our attention to processes of co-creation where actors engage in a collective construction of novel ideas and renegotiate the social relations entailed in the service (Kimbell 2011; Saco and Goncalves 2008).

In addition, we want to draw the attention of Information Systems research to processes of digitalization that are based on continuity, gradual progression, and stepwise changes. Recent IS research has pointed to the transformative power of digital capabilities in the digitalisation of the service economy (Barrett et al. 2015; Nambisan 2013; Tilson et al. 2010). Digital capabilities trigger the rearrangement of tasks within organisations and also present new possibilities for creating experiences, relationships and processes (Yoo et al. 2012). However, researchers have often analysed cases of radical or disruptive innovation through complex technical solutions, while less attention has been given to more mundane and stepwise interventions. This latter type of interventions is critical for the digitalisation of healthcare where there is a tradition of introducing novelty after a series of cautious trials ensuring that safety and reliability are not compromised.

The remainder of the paper is structured as follows. First, we give an overview of the empirical background for health electronic services, then we lay out the theoretical background and we describe the method used to collect and analyse our data. Subsequently, we present our findings from each case and our analysis across the two cases. Finally, we discuss insights from our analysis pointing to the contributions of this work, its limitations and possible directions for further research.

2   Health related electronic services

During the last decade, health related electronic services have spread rapidly within the commercial domain. A multitude of electronic services have been launched, typically addressing the patients' side without linking to the institutionalised healthcare provision side. A survey

of smartphone apps performed back in 2010 identified 5820 medical, health and fitness apps available for download (MobiHealthNews 2010). The surge in health apps availability is such that the European Commission's General Directorate for Communications Networks, Content and Technology (DG CONNECT) provides guidance to patients for finding useful and reliable apps by endorsing a list of 200 health applications recommended by patient groups: the "European Directory of Health Apps 2012-2013" (PatientView 2012). The strong interest for health related electronic services is not only observed on the supply side, but also on the patients' demand side. A survey among smartphone owners in USA back in 2012, revealed that one in every five has downloaded an app specifically to track or manage health (Fox and Duggan 2012). Nevertheless, despite the increasing number of solutions being released, the frequency of healthcare providers' involvement in electronic services offered is not increasing (Rosser and Eccleston 2011) and the services being offered are mostly focused on self-monitoring (blood pressure, heart rate, glucose levels etc.), self-health management, facilitated access to medical references, and in general, individual use with weak or no integration with the existing information infrastructure in the healthcare sector.

Contrary to the situation with electronic services addressed solely to the patients' side, the introduction of electronic interactions between healthcare providers and patients has not followed the overall trend and the progress in the domain has been strikingly sluggish. In 2013, a large-scale survey of General Practitioner (GP) offices around Europe (with the participation of 9196 GP offices) identified that only 26% of GPs provide patients with electronic services for appointment requests, 23% for requests to renew prescriptions and 9% for referral requests, (European Commission DG Communications Networks Content and Technology 2013). The survey also revealed that within Scandinavian countries the situation varies significantly. In Denmark almost all GP offices were found to offer electronic services (94% for appointments, 96% for prescriptions, 80% for referrals), Norwegian and Swedish GP offices lag behind, although they are above European averages (Norway: 66% for appointments, 65% for prescriptions, 31% for referrals; Sweden: 47% for appointments, 75% for prescriptions, 3% for referrals), while Finland was found to be close to European averages (17% for appointments, 24% for prescriptions, 10% for referrals). In hospital settings, electronic interactions between patients and healthcare providers are even less widespread. The eHealth benchmarking Hospital Survey revealed that there is no considerable progress in patient online access and 90% of hospitals do not offer such services (European Commission Joint Research Centre Institute for Prospective Technological Studies (JRC-IPTS) 2014, p. 10). This survey covered 1653 hospitals across Europe (~30% of the total). More specifically, for the Scandinavian countries the findings showed a very uneven situation. Although 62% of Danish hospitals provide patients with online access, the same holds true only for 17% of Norwegian hospitals, 8% of Swedish, and 4% of Finnish ones. The lack of progress is striking because hospitals are in general better equipped with information technology infrastructures than other sectors; nevertheless, they show weaknesses in the introduction of information technology for interacting directly with patients (idem: p. 19).

3   Theoretical background

We investigated the realisation of electronic services through the lens of service design (Dahlbom 2002; Kimbell 2011; Saco and Goncalves 2008). Researchers of service design, service innovation and service enabling information technologies, have argued that service conceptualisations that are imported from economics tend to reduce service to just an intangible type of good or a unit of output, and are not useful for understanding the unique aspects of services. Hence, new conceptualisations that bring forward a relational, interactional, co-creative perspective have been proposed (Vargo 2009; Vargo and Akaka 2009). Following this line of thinking, service has been conceptualised as 'socioeconomic exchange' (Aubert-Gamet and Cova 1999), 'co-creation of value' (Prahalad and Ramaswamy 2004; Vargo and Akaka 2009; Vargo and Lusch 2004), 'Actor to Actor processes' (Holmlid 2009; Vargo and Lusch 2011).

The adoption of such a relational perspective makes evident that electronic service design goes beyond the design of interactive artefacts (Holmlid 2007) or information systems (Dahlbom 2002). Although the employment of interactive artefacts is required for the realisation of electronic services, service design requires a wider view that covers also the social relations (Hultgren and Goldkuhl 2013). This creates the need for active engagement with service actors' practices (Kimbell 2011). Actors involved in services are not mere service-producers and service-recipients, but can be rather viewed as resource integrators within a network, and thus, all of them can contribute perspectives that are instrumental for service re-conceptualisation, innovation and the co-creation of value (Lusch and Nambisan 2015).

One way to embrace and accommodate the multiplicity of actors while reconceptualising services is through design thinking, which is a problem solving approach that can support the development of insights and the identification of opportunities (Brown 2008). Service designers use design thinking principles and approach their work as an enquiry in which they and others would construct an understanding of what the service is (Kimbell 2011). This collective construction of understanding is "not just a question of formal consultation in which professionals give users a chance to voice their views on a limited number of alternatives. It is a more creative and interactive process which challenges the views of all parties and seeks to combine professional and local expertise in new ways" (Cottam and Leadbeater 2004, p. 22). Hence, service design goes through iterative learning cycles (Saco and Goncalves 2008) that require users' involvement (Alam 2002). During learning cycles existing constraints can be investigated for the identification of opportunities: "constraints are limitations on action. They set boundaries on solutions. Yet, those boundaries have the potential to inspire" (Vandenbosch and Gallagher 2004, p. 198). Embracing constraints may allow "serendipitously inventing new and valuable elements in the design" (Boland et al. 2008, p. 22).

The theoretical conceptualisations related to service design informed and guided our research. We approach the digitalisation of health services as a relational, co-creative process between service actors that goes beyond the design of interactive artefacts. This co-creative process unfolds through iterative learning cycles, therefore, the understanding about the service keeps evolving as long as there is continuity in actors' involvement. This theoretical understanding led us to the methodological choice to adopt a process approach following the evolution of the services.

4 Method and overview of empirical studies

4.1 Case Selection

For our study on electronic health services for patient-provider interactions we decided to investigate web-based services related to health appointment management (booking and changing appointments). Our study does not cover acute care medical encounters that are not pre-planned. The management of health appointments seems similar to existing electronic services in the travel industry context (managing bookings for flight and hotel stays). Nevertheless, when considering the specifics of patient-healthcare provider relationships and the wide variety in appointment types and criticality, we realise the inapplicability of most well-established logics that are currently inscribed in commercial booking services; e.g.; yield management or simply first-come-first-served. We selected the specific type of service as representative that can reveal the particularities of designing electronic services for patient–healthcare provider interactions. We followed two different cases, one for primary care and one for hospitals. The two cases relate to two different healthcare contexts and also, represent two different design trajectories: the first one is a top-down initiative motivated by national strategies while the second one is a bottom-up initiative that started with the aim to resolve one particular problem within a hospital.

4.2 Overview of the two cases

The first case analysed is about the design of a national service for booking appointments with General Practitioners (GPs) within primary care in Norway. This is a new functionality for the Norwegian national e-health platform which patients can access over the internet (Vassilakopoulou and Grisot 2014). This platform was launched in June 2011 with the aim to provide secure patient-oriented electronic services (Norwegian Ministry of Health and Care Services 2012). The activities related to the design of the booking service officially started in 2012 with a preparatory study. The outcome of the study was the specification of four key services: booking of appointments, renewal of prescriptions, electronic contact for administrative purposes, and e-consultation. These four services were grouped into a single project which was named the 'eDialogue' project and started in the spring of 2013. We followed the entire project from its start till early 2015 but in this paper we report only on the trajectory followed for the booking service.

The second case analysed is about the design and development of a hospital-based service for appointments with different clinics. This service was initially developed for the specific needs of a child clinic and was included in the patient-oriented web portal named MyRec introduced by a Norwegian hospital (Grisot and Vassilakopoulou 2013). The first functionality within MyRec was launched in 2006 and the portal keeps being expanded and improved till this day. It offers to patients general functionalities such as message exchange with clinical personnel, access to selected EPR documents; e.g.; discharge letters; in addition to more tailored functionalities for specific conditions. For instance, patients with hemophilia who are requested to report their use of blood coagulant drugs, can use a special online form; patients needing medical equipment;

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e.g.; pumps or catheters; can place an order in a web shop-like environment. Data on the case were collected in three stages (September 2010 - September 2011, March 2012 - December 2012, March 2014 – June 2014) and cover the overall evolution of MyRec although in this paper we report only on the appointments service part.

4.3   Data collection and analysis

For both cases data collection entailed interviews with the people involved in the design and development of the services, observations during meetings and design workshops, and document analysis (internal reports, presentation material for various audiences, policy documents, laws, and articles from specialised Norwegian journals). Our interest was to collect information on the evolution of activities and the involvement of actors. During meetings and design workshops we observed how different actors contributed their perspectives, how the service concepts were defined and redefined and the emergence of technology challenges and opportunities. During interviews we asked each initiative's participants to provide us with their own accounts of the unfolding events and to discuss specific documents related to the electronic services being developed. The observations during meetings and workshops allowed us to obtain information on the interactive dynamics among the different actors involved and on the collaborative processes of meaning making and gradually concretising the new services. The interviews allowed us to obtain more detailed information on specific issues raised during meetings and workshops and to familiarise ourselves with the different actors' interpretations. Overall, the research reported in this paper is based on data collected using a combination of fieldwork and document analysis (Table 1).

Source	*Description*
Interviews	28 semi-structured interviews for 1st case 15 semi-structured interviews for 2nd case
Observations during meetings and design workshops	49 weekly meetings, 1 design workshop, 5 thematic meetings for 1st case 3 design workshops for 2nd case
Document analysis	Norwegian Healthcare Strategic Planning Documents; Policy, Regulation and Standards Documents; Project Documents

Table 1. Data Sources.

All interviews were fully recorded and transcribed. During meetings and workshops we did not record but we kept detailed notes (that were subsequently typed) and also, we photographed whiteboard sketches, and collected presentation material. Most interviews and observations were performed with the simultaneous presence of two researchers that both kept notes. Interviews were performed throughout the study period (from the beginning of our involvement with each case till the end). All three authors were involved in interviews and observations.

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We analysed our data by focusing on design decisions, taking a process approach by which we examine how things change over time (Pettigrew 1997). In particular, our analysis was focused on taking stock of how the new electronic services were gradually concretised, what inquiry processes were taking place and how the contributions of multiple participants shaped the services. We have adopted an interpretive approach (Eisenhardt 1989; Klein and Myers 1999; Walsham 1995) and foregrounded the participants understanding and reasoning during the design process. These were then read in the light of the service design perspective which allowed us to focus attention to the temporally evolving processes of collectively constructing understanding and (re)conceptualising healthcare interactions and to foreground actors' engagement.

5   Empirical findings

5.1   Health appointment booking in Norway

Before presenting the specific empirical findings from the two cases we provide baseline information on how appointment booking for primary care (GP offices) and hospitals is organised in the Norwegian healthcare system. This information is useful for making sense of the case accounts that follow.

In Norway, GPs act as gatekeepers to specialist health services. This means that patients can book an appointment with their GP office by themselves, but they can only be granted an appointment in a hospital department after being referred by their GP. Usually, the GP would send a referral letter directly to a hospital, which then processes the request and informs the patient about the appointment time. In order to assign a patient to an appointment slot, GP offices and hospitals perform some screening and prioritisation. A GP office secretary will ask the reason for which the patient requests an appointment to assess its seriousness and urgency. Patients requesting routine GP appointments are getting them as early as possible and normally within five working days. Similarly, the referral letters received by hospitals are screened and prioritised before appointments are assigned. There are variations between different sites related to the nature of services, types of patients etc., so, a hospital department can have multiple categories of patients and treatments each with its own urgency. A hospital department may assign patients to timeslots, or can reject the appointment request and forward the referral to another provider. Once an appointment has been defined and communicated, it can be changed by the patient if he/she notifies the healthcare provider and negotiates a new time. Usually, patients can communicate with GP offices and hospital departments using the phone during defined telephone hours. Email communication cannot be used since Norwegian law prohibits the usage of email for communication around health.

5.2 Designing a national electronic service for appointments with GPs

In August 2012 the regulation for General Practitioners (GPs) was revised by the Norwegian Ministry of Health; among other changes, a new passage was added where it was clearly stated that GPs shall offer online appointment booking services (Norwegian Ministry of Health 2012). Within the same year, activities related to the design of a national electronic booking service for the national e-health platform were initiated with a preparatory study. The idea was to offer a new service that would be potentially used by all patients and by all GP offices. The final report from this preparatory study pointed to the generic nature of the services envisioned:

> "[T]he various care professionals and health institutions have largely similar needs for secure digital dialogue with their patients as bi-directional communication, and the processes around appointments, e-consultation and document/form exchanges are generic processes that can be transferred from a care professional or professional area to another."

The project participants that worked for the preparatory study visited several GP offices and discussed with doctors and administrative staff. Furthermore, they had access to a patients' panel that was already in place for informing the design of the overall national e-health platform. The project team collected information from both users' sides and came up to the conclusion that an electronic booking service would be useful for both sides. The final report indicated that the service would be useful for GP offices because "a main consideration is to save time and to facilitate a working life where both GPs and administrative staff at the office can focus on patients and to ensure high-quality patient care", additionally, for patients, the new service would be beneficial because "they will not need to spend their time on the phone (so they will have more time for recreation or work)".

During the preparatory study it was decided to allow different functionality options in order to offer a service that would be suitable for as many users as possible. So, it was decided that the new electronic service would support two different types of appointment bookings. The first type would give patients the possibility to book by accessing directly the GP office calendar and viewing the hours available for booking. In that case, the patient would make a choice and get an instant confirmation. The second type would give to patients the possibility to send a message to the GP office and ask for an appointment that suits his/her preferences. In that case, the request would be handled manually at the GP office and a confirmation (or a message declaring unavailability) would be received at a later stage. The choice of service type would be made by the GP offices based on healthcare practitioners' preferences, the systems already in place and their work routines. Additionally, a service that would allow patients to view the timing arranged for future appointments and change or cancel them was foreseen.

The project for the detailed design and the development of the booking service started in spring 2013 with a predefined budget and timeline. A project participant told us:

> "[W]ith a limited budget it is difficult to do user involvement as deep as we want. We have created a GP office panel which includes 5 offices that will have meetings every second month through the project period where we will discuss how we should form the solution both from the patients' side and what is important from the doctors' side. It is

doctors from different parts of Norway (…). For the patients' side we probably have to use a lot of questionnaires on line because that is a cheap way to do it. Last year we had a group of people that we hired that came once a month, then we discussed different solutions with them but they are not here anymore."

Additionally to the GP panel, the project team arranged a number of observations at GP offices that were already using electronic booking services (they had adopted solutions developed by private providers).

During the observation sessions the project team identified a number of specific needs from the GP office side, for example, for some appointments to be scheduled it would be important to arrange lab tests before the patient comes to the office. A GP office requested a field for "providing feedback to patients for example requesting testing before the appointment". Also, it was found that some GP offices would like to offer different types of booking services based on differences in the health conditions of the requesting patients. For example, one GP office had given direct access to the calendar but defined different settings for different patient groups: some would get instant automatic confirmation, while others would get confirmation only after their choice was manually approved.

The discussions within the GP panels revealed additional particular needs. Some doctors expressed the wish to differentiate the time horizons available for bookings on the basis of differences in patients' health situation: it would be good to allow bookings over a full year period for chronic patients but to limit the time horizon for all other patients to avoid overbooking by hypochondriacs that are overall healthy. Also, some doctors explained that specific types of lengthy appointments that would require 'double slots' would rather be booked over the phone. Other doctors questioned the practice of informing patients for lab visits beforehand which was identified during observation sessions. After discussions it was decided that although there is sometimes the need to provide patients with specific guidelines on how to prepare for the appointment; e.g.; not to eat, or to bring a urine sample; there is no requirement for developing an electronic service that would cover everything because complementary communication means; e.g.; phone calls or sms messages; could be used for those cases.

The panel participants from the GP offices did not include only doctors but also administrative staff. During discussions the administrative staff that had prior experiences from the use of electronic booking said: "experience shows that office staff spent much time trying to find a time that matches the patient". In order to avoid many message exchanges they proposed that the appointment date and time suggested by the patients should not be in a structured field but rather, it should be expressed as free text allowing flexible descriptions of preferences and constraints. Additionally, they said that the option to simply request an appointment 'as soon as possible' should be definitely included. They also expressed concerns on how patients will be 'educated' to understand that they cannot change an appointment by ordering a new one but instead they need to use the booking change functionality. Another issue raised was related to the cut-off point for the cancellation of appointments. In general, a 24 hour rule could be applied although GP offices might exercise some discretion on the rule's application to accommodate special cases.

The initial vision for the new booking service was to build something relatively straightforward having some inspiration from the successful experiences within the travel industry (booking tickets and hotel stays). As the project team engaged with the users' community it became

obvious that the services developed would have to be flexible enough to meet the specific needs of different local GP practices. For example, full self-service would only be one of the choices offered, information exchange through structured data fields would be complemented with alternative messages with unstructured content. The list of possible options to be added in order to provide a fully customisable solution kept growing and the project participants had to prioritise the implementation of the most crucial ones for the first release of the solution. Practically, what started as a general purpose booking service was gradually concretised to a highly customisable solution. This customisability relates to the specifics of healthcare practices and the great variety of patients' healthcare needs. The new service was piloted in 2015 and 2016 in a small number of GP offices and their patients and the feedback collected was used for further refinements.

5.3   Designing an electronic service for appointments with hospitals

The electronic service for hospital appointments handling that we investigate in the second case is part of the web based hospital portal named MyRec. MyRec was conceptualised as a new communication channel between patients and a major University hospital in Norway. The overall vision for the portal was to put in place a way for patients to access quality information, personal health documents, and secure e-mail. A central aspect of the initial concept was the patient-orientation of the solution. An informant said:

> "(MyRec) was from the beginning thought not as just another door into the hospital where to get some information, but it should be a meeting point where also the hospital personnel should meet half ground, and the patient should be able to set the premises to decide how this meeting takes place."

It was important for the initiators that development and evolution was driven by users' needs. Patient-orientation meant also that the solution would have to be customised for different patient groups. An informant said:

> "[T]he idea to tailor to different groups of patients was there from the beginning (…) I am very convinced that one size does not fit all but it should adapt to different users, users' needs and ideally also throughout a life time."

This approach pointed to the requirement to design functionality supporting specific patients' needs on one side, and fitting into the existing work practices of each clinic on the other.

One of the first services designed and implemented was the request to change appointments at the outpatient clinics of the hospital. This service was developed to resolve an actual problem of the children outpatient clinic where patients would too often not show up for their appointments. As already described in section 5.1, in Norway, when a patient is referred by a GP to the hospital, the hospital department that receives the referral letter sets an appointment (day and time) and this is then communicated via post to the patient. Thus, the patient is not consulted when the booking is performed. Often the given appointment does not fit the patient's schedule (or the parents' schedule in the case of the Children outpatient clinic), and there is a need to contact the clinic to ask for an appointment change. According to the clinic's secretaries the

problem of patient no-shows was due to difficulties of getting in contact with the clinic. An informant describes the scenario from a patient perspective:

> "You get home from work and you have a letter in the mail that says that you have got an appointment at the hospital, what do you do with it? You put it in your bag and think that you will call the day after from work. But then you have a very busy day or the phone was busy at the hospital, and then you try once more and then is weekend and then you forget and remember about it only a couple of days before the appointment, then you really have to be persistent and call saying you cannot come."

The problem from the clinic's side was related to handling peaks in the demand for contact during the day. Parents would often try to call during lunch break since this would be the time of the day that better suits their schedule. However, the clinic would have limited personnel to answer phones. One of the informants said:

> "It is also a very busy department working on high tempo so it is difficult to allocate persons (to answering phone calls), and they also have to eat so what happened was that a lot of people did not get through on the phone and tried and tried and gave up, and a lot of those phone calls were about cancelling an appointment."

In addition, it is not allowed by law to communicate via ordinary emails. The result of this situation was that many parents were not able to notify the clinic that they could not come to the assigned appointment. On the side of the clinic, this situation meant that appointments were lost resulting in a waste of time and resources.

In this situation, the head of the secretaries at the Children outpatient clinic took the initiative to contact the IT department of the hospital, to ask if there was a way to address this problem. She contacted a person in the IT department that she knew from a previous project, and that now was involved in the creation of MyRec. He recognised the problem as a case that could be addressed with MyRec, and told the clinic that they would have to participate in the design of the solution. The general idea was that MyRec could provide parents with a web-based tool to allow them to send a notification to the clinic independently from opening hours or telephone hours. At that point in time, MyRec was already launched with a secure log in mechanism as required by law when treating personal health information. Thus, a module for requesting a change of appointments was created in MyRec and patients were informed that they could use it through a text message which was added to the letter with the appointment details. The text explained how to log in and make use of MyRec to request a change.

During the early design stages for the appointments module, the option to develop a fully integrated solution linking to the hospital's existing administrative system, which manages the calendars of the clinics was evaluated. However, this option was discarded. One informant said:

> "[T]here were many attempts to get a web-based electronic time management. One could export appointments out on a platform and then into the calendars, but it was so complicated and it was at the end never realised."

In addition, the hospital's overall information infrastructure was under major restructuring and integration to the administrative system would have meant delays and complications. Thus, it

was decided to create a light standalone solution that the secretaries would have to use in parallel to the heavyweight administrative system.

Another aspect discussed was the user authentication procedure. An informant said: "we have a problem here because if you need to log in it is too cumbersome". The security mechanism in place required to log in with a password and generated code, and this scenario was not well accepted by users. The design team then decided to make the service more easily accessible by having it available as 'open service' without a need to log in. Patients would simply have to fill in a web-form and send it. Specifically, in order to request a change, a parent would have to select the hospital from a menu, then select the outpatient clinic, and enter name, birth date, telephone number, day and time of the appointment, the reason for requesting a change and also preferences. The principle in this case was that patients should enter just enough information to be identifiable by the secretaries, but no sensitive information (for instance nothing about the reason for the visit). The secretaries would then receive the message through MyRec, change the appointment in their administrative system, and send another letter to the patient with the new appointment.

This module was taken into use and within short time improved the situation. Not only parents were able to notify in a more convenient way about their need to change appointments but also secretaries were now able to reschedule time-slots in a more efficient way. One informant said:

> "What we see now is that when people get the letter, and see that the appointment does not fit into their schedule, the same evening (…) they sit down at the pc to ask for another appointment."

In this way the secretaries are alerted sooner than what it used to be in the previous situation, and they have more time to rearrange the calendar. One informant said: "This is something we did not predict, this side effect, that they would be alerted a lot earlier". These immediate benefits drove the spread of the solution in the hospital. Other clinics soon requested MyRec team to implement the request for changing appointment module also for their patients. Many clinics had a similar problem in managing phone calls about appointments, and wanted also to implement a new channel for patient communication. When designing the module in collaboration with the Children outpatient clinic, the MyRec team understood that the module had the potential to be used also for patients in other clinics. Thus the design features where kept either generic or adaptable to specific needs. For instance, the web form was designed in way that allowed the easy addition or elimination of fields. So, it offered the possibility to include specific information for each of the clinics. For instance, a clinic added text to inform patients that they should send their request at least 24 hours in advance, or the appointment missed would be charged.

In the clinics new work practices were defined around the use of the new electronic service and the handling of the requests. New practices were also defined for how to handle patients' requests. For example, if a patient would provide a reason considered not acceptable; e.g.; asking to postpone surgery because of a kindergarten carnival party; it was decided that the secretary would call the patient on the phone. In another clinic it was agreed to have the policy that if a patient requested to change an appointment more than three times he would lose the right for

the visit, and would need to have a new referral letter from the GP. In this case the secretaries decided to call the patients at the second request for change to alert them.

6 Cross Analysis of the two cases—identification of design directions

The two cases followed different trajectories but both reflect a process where the relationships entailed in booking were gradually explored and the requirements for putting in place an electronic service to support these relationships were progressively defined. In the case of MyRec, the technological capabilities developed were gradually generified starting from an initially clinic-specific functionality. The process followed did not include phased and sequentially decoupled design, development and implementation, but an iterative process of experimental development and ongoing deployment which allowed ongoing inputs from the clinical users. The national GP booking solution was developed in a setting that was away from healthcare practice. Differently to MyRec, the project had to use formal processes in order to engage with healthcare providers and patients (surveys, user panels, consultation meetings, one observational study). The engagement with different types of actors allowed the team which was working on the development of the electronic service to recognise that health appointment booking activities cannot be fully predetermined. Therefore, the requisite technical capabilities need to allow discretion. For example, the expectation that fully structured information will be exchanged was challenged: GP offices prefer to receive free text messages that allow flexible descriptions of needs, preferences and constraints in order to have as rich information as possible for their decisions about appointment timing. Therefore, both coded fields and free-text fields had to be included to support relational, interactional, co-creative booking processes. Both initiatives end up with a realisation that the developments that are underway are not about a simple tool that facilitates a selection among a closed set of options (similar to the booking of airplane tickets or available hotel rooms) but rather, about contouring spaces within which different types of actor to actor processes will have to unfold. In other words, the teams were not engaged in the design of interactive artefacts but rather in the shaping of complex interactive relationships. This realisation has significant repercussions for technology design. In the paragraphs that follow we present the analysis of findings across the two cases. The analysis has been informed by theoretical work on service design (presented in Section 3). Specifically, insights from theory served as sensitizing devices and guided us in the process of consolidating our findings in four specific design directions. At the end of the section we include a table where we link our consolidated findings to theoretical concepts used (Table 2).

Technical capabilities do not need to be 'all inclusive': beyond digital touchpoints. For each specific booking the two parties involved (patients and healthcare providers) have to engage in activities that go beyond the digitally mediated touchpoints that the new electronic services may provide. The MyRec service is not a complete (end-to-end) booking solution, but it is supplemented by other electronic tools; e.g.; the hospital's patient administrative systems where the schedules are kept; and by the telephone and postal system for letters. The MyRec solution

complements the pre-existing arrangements by offering patients a new way to notify the hospital that the assigned time slot does not fit their schedule. The national booking solution for GP offices is also not covering the whole range of patient – GP office interactions that might be required for the actual booking. GP offices have to go through their own routines and tools for prioritising appointments and in some cases to use supplementary means to coordinate with patients about taking blood tests in advance, bringing urine samples, or fasting. In order to design the electronic service an understanding of what the whole service is about had to be developed. This allowed the design team to make sense of the parts of the relationship that would need to be electronically facilitated and of processes that will remain outside the digital touchpoints.

Technical capabilities do not need to be fully predefined: a dual design perspective. A dual design perspective that includes the initial design and user-defined tailoring (Germonprez et al. 2007) was adopted in both cases under study. In the case of the national service for GP appointments the project team moved from a vision of generic electronic services towards the design of technological capabilities that could accommodate the specifics of healthcare practices in different GP offices and the great variety of patients' healthcare needs. In order to achieve this, the team realised that the technological capabilities need to provide all parties some room to manoeuvre. This was achieved by allowing users the flexibility to tailor the digital functionality to their needs; e.g.; by deciding if patients would be provided access to the GP office calendar or not. In the case of MyRec, when new clinics started showing interest for introducing electronic services, the functionality which was developed to match the needs of patients and healthcare personnel of one clinic, was gradually transformed to a configurable template (Bjørn et al. 2009) that could support local practices in other departments. User-defined tailoring allows the creation of specialised functionality out of generic technical capabilities (where functionality is not fully predefined and multiple possibilities are made available).

Technical capabilities need to be open to emerging needs: continuity in user involvement. In both cases we observed how technology design was informed by learning cycles of understanding, framing, exploring, abandoning initial assumptions, reducing and realising needs. For example, in the case of the national service for GP offices the conclusions from the observational studies had to be revisited and reformulated (and in some cases totally altered) after a series of user panel meetings. In the hospital case, the initial choice of requiring patients to log-in before requesting appointment changes had to be abandoned. But this was realised after the service was launched. After consultations with the clinics it was realised that for the service to be completed minimal information would suffice (clinic, name, birth date, telephone number, day and time of appointment, reason for change request) and that there was no need to have in place a cumbersome authentication procedure. Continuous learning allows "enabling the creation of contextually new possibilities and configurations for as-of-yet unknown problems" (Hovorka and Auerbach 2010, p. 3). The importance of ensuring the continuity of users' involvement to allow continuous learning even after launch can be also understood by recalling the unexpected positive side effect of MyRec that was made visible to secretaries after initial use (earlier notifications for cancellation). Unexpected side effects (both positive and negative) open up new arenas. What both teams realised was that it is important to probe for new learnings in an ongoing manner. This entails being open from initial conceptualisation throughout design but also after

Design Direction	Description	Relevant Theory Insights	Empirical Examples
Shifting attention beyond the digital touchpoints.	Designing electronic services for patient-provider interactions does not equal designing digital applications, but rather, entails reconsidering whole relationships. The new digital capabilities need not be 'all inclusive'.	Services as whole relationships: 'socioeconomic exchange' (Aubert-Gamet & Cova, 1999), 'co-creation of value' (Prahalad & Ramaswamy, 2004; Vargo & Akaka, 2009; Vargo & Lusch, 2004), 'Actor to Actor processes' (Holmlid, 2009b; Vargo & Lusch, 2011).	MyRec appointment services supplemented by phone calls and letters.
Adopting a dual design perspective.	Designing electronic services for patient-provider interactions entails delivering solutions that support the current understanding about the service but also flexibility that will allow user-defined tailoring at later stages.	Services as creative and interactive processes that combine professional and local expertise in new ways (Cottam & Leadbeater, 2004) going through iterative learning cycles (Saco & Goncalves, 2008).	The national solution for GP appointments allows users to decide if patients will be provided access to the GP office calendar or not.
Supporting continuity in user involvement.	Designing electronic services for patient-provider interactions entails user involvement that starts at conceptualisation and continues during use. Technical capabilities need to be open to unpredictable emerging needs and unexpected side effects.	Services are reconceptualised with the contribution of perspectives from various actors involved (Lusch & Nambisan, 2015), users' involvement during all stages is pivotal (Alam, 2002).	The national solution for GP appointments was initially prepared to accommodate structured information similarly to travel bookings. This changed after the involvement of GP secretaries.
Exploiting regulatory constraints.	Designing electronic services for patient-provider interactions do not need to be stalled by regulation. Regulatory provisions can provide opportunities for novelty and for going beyond well-established solutions.	Services can be inspired by constraints that can lead to the identification of opportunities (Vandenbosch & Gallagher, 2004). Embracing constraints may allow serendipitously inventing new design elements (Boland et al., 2008).	MyRec appointment services were developed as a reaction to the regulatory restrictions for the use of email.

Table 2. Design Directions.

launching. This finding points to the need to maintain electronic services in a perpetual beta status (O'Reilly 2005) allowing design activities throughout the services' lifetime.

Technical capabilities do not need to be stalled by regulation: exploiting regulatory constraints. Our research is specific to healthcare which is a heavily regulated domain. Regulatory constraints can delay the introduction of new service delivery modes as revising and adapting regulations can be time consuming. By studying the two electronic appointment management cases we found that unconstrained, blue-sky thinking was not necessary for bringing-in novelty and that some of the existing constraints; e.g.; the regulatory restrictions in the use of email; prompted new ideas and offered occasions for restructuring existing services. Actually, combining explicit constraints with domain specific knowledge allowed the generation of novel solutions for patient-provider communications that fit the healthcare domain better than the generic electronic tools for information exchange that are widely available; e.g.; for electronic mail, instant messaging, document sharing.

7 Discussion and conclusion

Digital technologies are changing the way we do things improving the accountability of public services, reducing their cost, giving us new means of transacting and participating (National Information Board 2014). Nevertheless, the introduction of electronic services for patient-healthcare provider interactions has been slow, and it has not followed the overall fast-paced digitalisation trend observed during the last two decades. Against this backdrop, our aim with this study was to develop a better understanding of the requirements for electronic services for patient-healthcare provider interactions and to derive design directions that facilitate their introduction. We studied two cases on the design and development of electronic health appointment management services following their evolution over a period of almost five years. We adopted a service design lens (Kimbell 2011; Saco and Goncalves 2008), and observed how the teams working for the introduction of the new electronic services gradually realised that appointment services require more co-creation activities than initially anticipated. Co-creation in our cases meant that appointment booking services were designed with the contribution of different involved actors. This created the need for sorting out the different actors' concerns and co-designing solutions accordingly. Furthermore, it pointed to the need for delivering flexible enabling technical capabilities that can support continuous adaptations and learning.

This paper provides three important contributions. First, we contribute to the literature discussing digitalization in healthcare. Prior research identified actors' engagement as a major barrier for healthcare digitalisation (McLoughlin et al. 2012). By focusing on co-creation and adopting a service design lens, we oriented our attention to whole relationships that go beyond the digital touchpoints, to the constitutive role of iterative processes that are exploratory in nature, to the contribution of perspectives from various actors during all stages and to the evocative potential of constraints.

As a second contribution, our study adds to the digitalisation theme in Information Systems research. In the past, research has been mostly oriented towards radical service innovation, investigating the potentialities and impact of digitalisation (Henfridsson and Bygstad 2013; Nam-

bisan 2013; Riedl et al. 2009; Yoo et al. 2012). While this literature demonstrates in a powerful way the transformative power of digital capabilities, it fails to account for more gradual digitalization processes. Gradual stepwise processes are pivotal for the transformation of sensitive domains (such as healthcare) where change is rarely discontinuous and most frequently comes out of cautious interventions which unfold over time. This has implications for the design of digital technologies which need to account for continuity by supporting adaptability and learning.

As a third contribution, we consolidated our findings from the two cases and articulated four empirically grounded and theoretically informed design directions for electronic healthcare services for patient-provider interactions. Specifically, the directions identified are the following: a) Designing electronic services that involve patient-provider interactions does not equal designing digital applications, but rather, it entails reconsidering whole relationships. The new digital capabilities need not be 'all inclusive' covering all information exchanges but it is important to keep in sight both the service parts that will be electronically supported and the ones that will not be covered. b) Designing electronic services that involve patient-provider interactions entails flexibility to support evolution over time and adaptation to setting-specific needs. Hence, technology needs to be developed by adopting a dual design perspective allowing tailoring by end users. c) Designing electronic services that involve patient-provider interactions entails user involvement during all stages of the service lifecycle. It is important to support continuity in user involvement. d) Designing electronic services that involve patient-provider interactions do not need to be stalled by regulation. Regulatory provisions may be viewed as opportunities for novelty and for going beyond well-established solutions.

There has been prior research investigating similar electronic services for appointment handling within healthcare (Ellingsen and Obstfelder 2007; Greenhalgh et al. 2014). This prior research pointed to the struggles experienced when the electronic services were introduced to use. The findings of these prior studies show both the complicated nature and the unexpected outcomes of the services. The design directions that came out of our research provide a possible approach for addressing the struggles reported in prior research. From the secondary examination of these past cases we find that supporting continuity in user involvement and paying attention to whole relationships (and not only to their digital part) might have prevented or resolved some of the reported issues.

In the 'Choose and Book' case, it could have been possible to reduce the eventual mismatch between the new system "and the more complex, granular and exception-filled nature of real-world clinical practice" (Greenhalgh et al. 2014, p. 218) by enhancing user involvement throughout design and development. In the case of direct electronic booking of hospital appointments by GPs which was discontinued (Ellingsen and Obstfelder 2007) a shift of attention to the whole service might have revealed earlier the possibilities for opportunistic behaviour (GPs reserving slots before other GPs pick them) and might have helped conceptualising the electronic solution as appropriate for complementing instead of replacing non-electronic booking. Although we can demonstrate that the design directions provided by our research could help address some of the issues identified in prior research on electronic appointment handling, we think that our findings need to be further investigated through follow-up research. Such follow-up research could question, refine or extend our findings by exploring their applicability for other cases of electronic health services for patient-provider interactions.

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