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On the Value of Design Thinking for Innovation in Complex Contexts: A Case from Healthcare

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Abstract. This paper discusses the use of different approaches to design in complex contexts, exemplified through a case from healthcare. Specifically, the value of Design Thinking (DT) for understanding of a problem at hand is discussed. The paper argues that a design approach based on a holistic understanding of problems constitutes a prerequisite for innovations in *complex contexts* where problems are open, complex, dynamic, networked and have a wicked character. The argument is made for the importance of differentiating design approaches with respect to their ability to support broader and more open explorations of the *underlying problems*, especially those in complex contexts. A case from healthcare illustrates the value of DT and is used to discuss the importance of avoiding what I refer to as *deceptive problems*. The potential of DT to increase the relevance of innovations through a better understanding of underlying problems is discussed.

Keywords: Design thinking, deceptive problems, complex contexts, HCI, innovation, healthcare

Introduction

In the past decade, a designerly way of thinking has increasingly been employed beyond the design of artifacts or services. The term *Design Thinking* (DT) [1] is commonly used when discussing design from a process or innovation perspective [2] and is increasingly being adopted as an approach to innovation. This can be seen in areas such as e.g. management [3, 4], business [1], society [5] or healthcare [6, 7]. DT can be described as being concerned with strategy for radical change, rather than incremental improvements [1].

It is difficult to give a specific definition of Design Thinking, e.g., [4, 8, 9]. It may, however, be described as a mindset rather than a step-by-step methodology [10]. The UK-based Design Council refers to DT as a way to "get to the heart of the problem quickly and suggest radical, innovative solutions" [11].

Characteristics of DT include (but are not limited to) a human-centered focus, a holistic view, and that DT is highly generalist in preparation and execution [9]. A questioning attitude [1] and the ability to be able to resolve paradoxes [9, 10] are merits that are often ascribed to DT.

DT, as an approach to design where a holistic perspective on the design problem is encouraged, may be contrasted to design approaches that have, to a greater degree, a

delimited or restricted problem space. In this paper, I distinguish two approaches to design with respect to the degree to which a holistic perspective is encouraged: A) *holistic* design approaches that entail a more open problem space and B) *non-holistic* design approaches that entail a more restricted problem space. For non-holistic design approaches, a designer's problem solving space is limited from the outset by the character of the problem at hand or the approach that is needed to solve it, and these limitations are not challenged throughout the design process. Such limitations might be, for example, an idea of what a possible type of solution should be, or an a priori understanding of what the problem needs to address. Limitations may also include use of a specific technology, as is often the case in the field of human-computer interaction (HCI) [12], or, as observed in the fieldwork in healthcare, routines and practices. Both these limitations will be explored in the case presented below. Holistic design approaches, on the other hand, are not confined by any specific limitations at the outset of the design process and are, thus, better suited to thoroughly question initial assumptions, preconceptions and presumptions. Non-holistic design approaches will typically aim for a solution to the problem at hand, while holistic design approaches may question the initial conception of the problem.

The two approaches to design are closely related, as holistic design approaches also will include phases of restricting the problem space. For example, though a holistic approach is typically encouraged within DT, this is not taken to mean that the problem space will remain open throughout the design process. Rather, the design process will move through phases where assumptions are challenged, and phases of working within a more limited problem space. Hence, the two approaches do not differ with respect to whether or not restrictions are imposed on the problem space during the design process. The two approaches differ with respect to the degree to which a holistic perspective and the questioning of initial limitations is encouraged.

The distinction between design approaches in terms the openness of problem spaces is reminiscent of other distinctions made in the design literature. For example, Dorst [10] discusses how experienced designers systematically change their understanding of the problem space through framing the design problem at hand.

This paper argues that the more *holistic* approach to design, where the problem space is seen as more open at the outset of the design process, has qualities that make it more relevant *in complex contexts*. In such contexts, supporting the task of exploring and understanding the problem in depth, including how it affects other elements of the contexts, is essential.

On the other side, working within a more restricted problem space from the outset of the design process, may be beneficial for rapidly exploring potential solutions for the problem at hand. The difficulty lies in understanding when to apply a more restricted problem space and when to encourage a more holistic perspective.

This work discusses the challenge to come at problems that might not yet be known or that might not yet be defined as such. While one problem may be perceived as known, it may be that fixing this specific problem might introduce new problems elsewhere. It is thus important not to solve merely the immediately perceived problem, often deceptive, but to understand the problem situation holistically and try to identify and address the underlying causes.

My focus, specifically, concerns the use of DT to address the *problem* as a starting-point in the design situation and how understanding of the problem is

constituted as part of the design process. I address, in particular, DT in complex contexts, exemplified here by a case from healthcare. My discussion could, however, be illustrated by any other complex issue, such as sustainability or poverty.

The Challenge of Understanding the Problem

Getzels, in his presentation of a classification of problems, starts out with a quotation from Einstein of high relevance for our topic: "The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science", [13]. According to Getzels, problems range from the ones that are known, and where the solver knows how to solve it, to problems that do not yet exist (the problems may need to be initiated in order to exist) and where a method for solving them is not known. The problems of particular relevance for DT are those which Getzels classify as a problem that "exists but remains to be identified, and no method for solving it is known to the problem solver or to others", [13].

Today, there is a growing awareness that conventional approaches to problem solving are no longer sufficient. Conventional problem-solving approaches are acknowledged as sub-optimal due to changing understandings of the character of problems [10]. In particular, there is an increased acknowledgement that problems pertaining, e.g., to organizational or societal issues may be characterized as *wicked* [14]. That is, may be seen as *complex*, rather than *complicated*, challenging traditional methods to problem solving. "Traditionally problems were seen as *complicated* challenges that could be solved through breaking them down into smaller and smaller chunks – like fixing a car", [15].

Wicked problems require new ways of dealing with them, in order not to solve the problems we *do* understand and which might be able to be solved by conventional approaches. Such problems also lack clear boundaries, consist of many elements and relationships, change over time, and are intertwined across organizations. In short, problems of particular relevance today are more *often* seen as *open, complex, dynamic and networked* [10].

In recent years there has been an increasing interest in involving designers to tackle complex problems [1] and the notion of Design Thinking (DT) is commonly proposed as an applicable approach to address these [2, 4, 8].

Innovation

In the context of this paper, the definition of innovation is based on West and Anderson's [16], with slight modification by Wong et al.: "Innovation can be defined as the effective application of processes and products new to the organization and designed to benefit it and its stakeholders", [17]. This definition, thus, includes effectiveness rather than novelty, while it at the same time refers to benefitting not only the organization itself, but also other stakeholders.

I wish to emphasize that this definition of innovation encompasses a new application of *previously known ideas*, as Van de Ven describes this: “As long as the idea is perceived as new to the people involved, it is an "innovation", even though it may appear to others to be an "imitation" of something that exists elsewhere.” [18].

When discussing innovation at an organizational level, Sangiorgi [19] lays out what Watzlawick et al. [20] refer to as 1st and 2nd order change. “First-order change was related to adjustments and fluctuations within a given system, while second-order change implied qualitative changes to the system itself”, [20, cited in 19].

This relates well to the notions of incremental and radical innovation [21]. Whereas incremental innovations relate to 1st order change by addressing innovations on a level that resides *within* a system, the radical innovation embraces changing the system itself (2nd order change).

This conceptual framework does not imply a hierarchy in possible impacts of an innovation; an incremental innovation may well have substantial impact. However, it makes it possible to distinguish between innovations with respect to *type*, meaning that the radical innovation largely addresses problems on a more holistic level, whereas the incremental innovation rather addresses specific, restricted parts *within* a system.

Design in HCI

Design in the HCI literature is often restricted to the development of artifacts or systems [22–25]. Despite the field’s nomenclature with the term ‘computer’ in ‘Human-Computer Interaction’, the field has evolved towards ever more ubiquitous technology.

User-centered design is a design philosophy that pays close attention to better understanding of users’ needs and desires in order to base design activities upon them [26, 27]. However, when understanding needs and desires in a demarcated realm as, for example, in relation to a technology, this may limit the possibility to understand needs beyond the ones that in some way relate to this demarcation, as discussed in Thies et al. [12]. Design in HCI, hence, can be seen as being conducted within a restricted problem space where the assumption of new technology as a means to resolve the problem is not questioned.

In research and development within technology-intensive fields, the use of technology is rarely questioned. Indeed, a dichotomy in technology development that is often alluded to is that of *technology-push* (tech-push) vs. *technology-pull* (tech-pull). Whereas tech-push describes development based on the possibilities technology offers, tech-pull denotes the opposite, when technology is used to close an already identified gap or need. Tech push is thus opportunity-driven, whereas tech pull is needs-driven [28]. Nevertheless, in a context where technology is ubiquitous, it is easy to overlook situations that might be better catered for without technology. Moreover, tech-pull is difficult to employ if there are uncertainties concerning what the (possibly hidden or underlying) need or problem might be.

Ethnography is commonly referred to as a relevant approach to inform design, also in HCI. However, Dourish [29] criticizes HCI for a limited understanding of ethnography in that it is mainly viewed upon as a means to inform design, usually in

the form of requirements for system development. This may limit the result of the ethnographic investigation by, for example, failing to see what ought not be built.

Baumer and Silberman [30], along the same lines of thinking, argue that although HCI tackles increasingly complex problems "[...] there has been relatively little reflection about where and when not to apply technology, and arguments that technological interventions might not be appropriate for every situation are quite rare" [30]. They use terms such as low- or no-tech solutions and describe an active act of removing technology by the term *technology extravention*.

Even though qualities of DT, as described above, are also important and dominant in HCI, these qualities do reside within the delimitation of the context constituted by HCI, i.e., focus on technology.

"While for a design thinker, the complexities of the "real world" are in focus, the HCI designer have a lot more modest domain of developing innovative technological products or services" [31]. Technology, thus, risks constituting a *fixation,* which may lead to a limitation in a design-process. This may be referred to as *design fixation* [32] or *functional fixedness* [33].

Even though this link to technology is increasingly being questioned by scholars such as, for example, Baumer, Silberman and Pierce [30, 34], the field is still highly dependent on technology, and it is generally implied that ICT is a part of the solution. Technology is, thus, rarely questioned as a vital part in what might be called a techno-centric design orientation, an orientation "[...] based on a model of technology push where technological capabilities and capacities are taken as given and as the principal enabler of change" [35].

Healthcare and the Understanding of Problems: a Case

Healthcare is increasingly applying design knowledge and competence in order to tackle new and existing challenges. In this context I wish to discuss the importance of understanding differences in design competences and methods when applied for the sake of innovation or development in complex contexts such as healthcare. Since complex problems by definition cannot be well defined or delineated, development methodologies asking for such a problem delineation easily fail [10].

The distinction of levels of complexity on which problems reside is crucial when deploying design. Some design-onsets are relevant in more delineable contexts where the problem may be less complex, while other design-onsets are better suited in the context of high complexity. It is thus crucial to set up the design processes with the right onset according to the context in order to avoid applying a type that may not contribute as much as a different one potentially might.

Networked and complex problems that are solved without acknowledging their complex character may, through their inter-connectedness, cause new problems to emerge, ones that did not exist prior to the attempt to solve the initial problems. These types of problems are in this paper referred to as *deceptive problems*, that is, problems that initially may be perceived as relevant to be solved but upon closer inspection are found not to address the underlying cause of the problem. In the worst case, fixing such superficial problems may generate new problems elsewhere.

Participant Observations in Healthcare

During the past five years I have been involved in numerous design projects in the healthcare context, where I have conducted extensive participant observations [36]. Most recently I was involved in a project in primary care, where I was employed as designer on halftime during 15 months. Approximately 200 hours of observations led to more than 50.000 words of field notes. These notes have been analyzed using open coding [37]. See table 1 for a quantitative overview of the observations conducted in the context of a Primary Care Unit (PCU) in Sweden.

Table 1: Quantitative summary of interviews/observations conducted by the author:

35 days of observations at the PCU
200 hours participant observations
40 persons from staff observed individually during 1-2 hours, many several times
50.000 words of field-notes noted and analyzed
15 months on half-time spent in the project by the author
Interviews:
9 deep interviews with 13 patients/citizens (1-2 hours each), conducted at their home or café
9 spontaneous interviews with patients visiting the PCU (5-30 min each)
21 brief interviews with citizens on the street (1-5 min each)
Participant observations at the PCU:
36 observed patient - healthcare-staff meetings
(18 patient - doctor, 10 patient - nurse, 8 patient - nurse assistant)
54 observed telephone consultations
(34 patient - nurse, 20 patient - doctor)
28 internal PCU staff meetings observed
(10 staff meetings 1 hour each, 6 brief morning meetings 5-10 min each, 6 doctors meetings, 6 nurse/nurse assistants meetings)
18 observations of administrative tasks conducted by staff
Other:
78 patient quotes noted
167 staff quotes noted
11 workshops with staff conducted

The participant observations were conducted without a pre-understanding of what problem to address and supported a deepened understanding of the situations observed. Although there were initial descriptions concerning the scope and aim of the project, I was allowed to depart from them and redirect my attention to what during my participant observations emerged to have higher relevance. This type of design process is by Dorst [10] described as "free-flowing design practice". At large, the project thus resulted predominantly in a deeper understanding of prerequisites rather than propositions of possible solutions, as was the initial goal.

Initially perceived problem-understandings from before the observations, as well as from the initial phase of them, largely differed from the understanding when having conducted many hours of participant observations in the context. The intensiveness of the observations generated an understanding of *underlying problems* that did not emerge initially. It also gave insights that if the initial problems (as they were initially perceived and/or described by myself or staff) had been solved, new problems would have been generated. The interconnectedness of multiple problems in this complex context did not surface until late in the observations. The extended

period of observations thus overturned initial thoughts concerning the problem-identification.

To illustrate this, an excerpt from the project related to emergence of deeper insights is shared. It concerns the issue of booking an appointment at the PCU.

The Case of Booking an Appointment at the Primary Care Unit

As observed in the case of the Primary Care Unit (PCU) in the County Council of Värmland, Sweden, it was very hard to be able to get an appointment[1] to see a doctor. Normal waiting times for non-acute meetings ranged around 4-6 weeks. Acute meetings were taken care of the same day. However, the number of time-slots per day for acute meetings was limited, which highly influenced the workflow at the PCU, as well as the patients seeking help.

When the PCU was encountered with the problem of too few available appointments, I observed several problem descriptions, which I will discuss by sharing a few examples below. The routine at this particular PCU was that the patients who call the PCU get to talk to a district nurse who gives advice and/or decides whether the patients need to come to the PCU, take care of themselves, or need to be directed elsewhere.

Below are examples from my field notes on the issue of patients calling to the PCU to be helped, from a doctor's, a nurse's and a patient's perspective:

> *[At an internal staff meeting] Doctor points out that too many patients having a too low need for acute care are booked to see the doctor at the PCU. The doctor points out to the district nurses that patients that are too assertive shall be forwarded to the doctor's telephone to be rejected.*

While a nurse has commented on their task to assess patients via the telephone:

> *The phone is a tough task. They [patients] call [to get an appointment], but we don't have any timeslots available. Frustrating.*

A patient, on the other hand, perceived the issue in this way:

> *I find it strange that I get to talk to the nurse for such a long time [on the telephone], when all I want is an appointment with the doctor.*

When the staff tried to address some of these issues, other problems arose. I observed one particular situation where a nurse *did* follow the doctor's recommendation regarding an "assertive patient". The nurse forwarded an "assertive" patient she did not assess being in need for care to a doctor's telephone reception, as recommended in the above doctor's quote. However, this patient was assigned to a different doctor[2]

[1] For a general description of the publicly financed Swedish healthcare system, see Anell [39]

[2] At the PCU the patients that were not listed with one specific doctor (i.e. registred to be taken care of by one specific doctor (e.g. chronic patients, multimorbid elderly)) were distributed between the doctors through a list assigning a doctor to the patient based on the patients birth-date (day in the month). Every week a new list of which doctor was responsible for what range of birth-dates was developed at the PCU to accomodate for variations in scheduling and sick-leaves amongst doctors.

who in turn questioned the nurse's decision to forward the patient since the assessment was a task done by nurses.

The issue of a patient's access to PCU described above brings forward three different perspectives[3]: the doctor's perspective (concerned that the *right* person/patient is granted help), the nurse's perspective (concerned that a particular person/patient is assessed as needing help), and the patient's perspective (that of a *need* for help). Even though one can assume that all three stakeholders do understand and accept certain limitations (e.g. limitations of resources), it may still be difficult to agree upon how to prioritize who will be granted care in the context of limited resources.

A further complicating example concerning the issue to book an appointment surfaced under further observations. Apart from the prioritization of who *may* be booked (you need to be "ill enough" to be defined eligible as a patient [38]), there was also an issue of *how* to book, and *who* should do the booking.

Examples of *how* to book concerned usability issues in the IT system, such as for example the complexity of searching for a combined timeslot of doctor together with one of the nurse assistants, or to be able to find two timeslots in succession for consultations asking for more time than the ordinary time-slot. From the field notes:

> *Doctor sits in front of the computer and tries to book an appointment for a patient. Since it is a minor surgery, the doctor needs to be accompanied by a nurse assistant. Doctor tries to find a double time-slot, while at the same time in parallel with one of the nurse assistants. Several minutes (!!!) pass while the doctor scrolls in the time booking system. Only standard time-slots may be searched. Finding two succeeding time-slots requests comparing starting and ending-time of each proposed time-slot. The doctor does not succeed, and decides to book the patient in a time-slot after a break. The patient is asked to come 20 minutes earlier than scheduled (in the middle of the doctors break) in order to accommodate the needed extra time for the surgery. The doctor prints the invitation for the appointment, but prior to sending the letter to the patient, the doctor will personally ask the nurse assistant if she is able to join, since the doctor was unable to schedule her directly.*

This above usability problem in the booking system could be addressed by making a better booking system. At the same time, the example illustrates how one problem (poor usability of the booking system) evolved into an extended problem where the poor usability was addressed by new internal rules, as explored below.

Since the doctor's time had been identified as being the scarcest, an initiative to relieve doctors' work-burden from tasks that did not ask for their specific competence was initiated by the top management for primary care in the county:

> *[The head primary care manager for the whole county] has ordered every primary care unit to put together a cross-disciplinary work-group in order to find ways to optimize the use of the doctors' competence. A goal is to relieve doctors from unnecessary tasks [i.e. tasks that may be done by others].*

The difficulty of booking did thus generate consequences concerning *who* ought to do the booking, since it was apparent that it was a poor use of the doctors' time. So

[3] The use of Activity Theory [40] to more deeply analyze contradictions of this type is explored in Thies & Nouri [38]

the issue of usability of the system was not merely concerned with lost minutes or poor booking, it generated a change of routines at the PCU.

One of the changes that were initiated in order to support doctors concerned the task of booking. The administrators were set to conduct the task. However, one of the observations caught a case (which by staff was mentioned to happen recurrently) where the doctor had a patient, which the doctor decided ought to be followed up within a certain time frame. Whenever this time frame for a re-visit exceeded the average of six weeks' waiting time for an appointment, this was fairly easily bookable by the administrator. However, in this case the follow-up was recommended to be in a shorter time frame of a few days, which rendered complications for the administrator. Since no time-slots were available within the stipulated time frame, the administrator was left with no choice but to send back the booking-request to the doctor.

Since a doctor in contrast to an administrator has the ability and right of re-assessing patients, they may decide on prolonging the stipulated time frame for a patient, increase this patient's priority over other patients, or to re-evaluate the importance of other work-tasks in order to make room in their schedule. This renders doctors with more alternatives for booking than other staff. However, this of course also renders doctors spending time on things they perceive to be of low value. One doctor expressed her frustration as follows:

"There are no [doctors'] time slots to book, because we are busy booking."

Summary Regarding Booking of an Appointment at the Primary Care Unit

When looking at the initial task for this project to develop new services for patients, a better way of being able to get in touch with the PCU was one of the most reoccurring wishes mentioned by patients, and thus set as a focal point during the project. Wishes such as to be able to have a choice of when to come to the PCU, directly book an appointment online, come to the reception of the PCU to book an appointment face-to-face[4] or the possibility to reschedule an appointment easily without waiting in the nurses' telephone assessment queue, were all frequently mentioned by patients, but proved to be impossible or difficult to fulfill due to the internal or legal rules.

The problem of a seemingly simple administrative task to book a time-slot for a patient to be able to be seen at the PCU thus had many more dimensions than what was initially perceived by the author as well as by staff. It encompassed usability issues in the IT-system, which in turn generated organizational changes (e.g. the administrators were given the task to assist doctors to book). The added task for the administrators generated a *new* problem as they were not in a position to re-assess patients as doctors might have been able to do, thus hindering the administrators in their task to support the doctor.

However, it was never considered a feasible way forward to question the *underlying* cause of the problem, namely the problem of having to assess every

[4] This was impossible due to the stipulated need to be assessed by a nurse prior to booking, while the receptionist did not hold the competence of a nurse.

patient before granting care, which claims very much time of the staff. Such initiatives were discussed, but seemed too far out of the confinement within which Swedish primary care is expected to act.

A solution to the problem observed might thus have been delimitated to the improvement of the IT system. This would have enabled the staff at the PCU to be able to more effortlessly be able to book an appointment. However, even if such an improvement might have been beneficial, it would not have sufficed in order to address the problem efficiently. Instead there might be a need for a completely different perspective reviewing the processes of seeing patients. A revised policy for seeing patients may instead radically change an intermittently poor use of medical resources.

The deceptive problem of the poor usability of the IT system might thus instead need to be replaced by the underlying problem. This may consist of revising the way patients are seen by e.g. elaborating if the need to assess every patient is a fruitful use of resources. Resources consisting of the wellbeing of the staff as well as of tax money but most of all the patients in need for medical help.

If problems are solved within their limitations, the underlying problems largely remain. A non-holistic approach to design, within a delineation of e.g. technology, thus solves problems. However, as long as the underlying causes remain, the solutions developed within the confinement will bring little amelioration.

Conducting participant observations in this complex context led to important insights regarding prerequisites for innovation. However, it was very difficult to arrive at potential solutions considering the confinement constituted by culture, laws and regulations affecting the PCU. The process of generating solutions does thus need to be set outside of this confinement, and constitutes a fruitful foundation for future research and innovation.

Discussion

Innovation cannot be forced to emerge. However, we can support its emergence by establishing prerequisites for innovation. This paper argues that a more holistic understanding of a problem may be such a prerequisite, and that Design Thinking (DT) can play an important role in gaining a better understanding of problems.

The challenge for innovation lies in avoiding solving deceptive problems - problems that are identified and described, but that do not encompass the cause of the problem. Addressing deceptive problems may thus relieve the immediately perceived problem, but rarely its cause. This increases the risk for new problems to emerge due to the inter-connectedness of complex problems.

DT is in this paper discussed as having the potential to arrive at two different but equally important outcomes: 1) The generation of solutions provided that the context is possible to be confined and delineated, and 2) as a tool to better understand underlying problems that in the long run may constitute important prerequisites for innovation.

A more holistic and non-delineated design process, on the other hand, may instead support a more thorough understanding of what the problem to be solved might be.

Unfortunately this may make it more difficult to arrive at solutions than if the context was more delineated. However, this deepened understanding of underlying problems constitutes an important prerequisite for fruitful developments on two aspects: A) The avoidance of generating new problems as well as B) the increased potential and relevance of solving a problem that has been understood thoroughly.

Unfortunately, not knowing in advance what, or if, the design process will result in a solution (rather than "only" a deepened understanding of underlying problems), may complicate the process of applying more holistic approaches to design. It may become harder to detail to financiers, customers or constituents in advance what results may be expected. When expecting solutions, a deeper understanding and a description of more problems may not always be received as a welcome result. However, this helps avoiding solving a potentially deceptive problem. The more holistic onset to DT does thus have a high potential in helping define what problem to address in design or innovation-processes, and may therefore constitute an important prerequisite for innovation. Using a more holistic design approach to understand what problem to address in an innovation-process increases the potential of generating relevant, rather than merely "new" innovations. A patient advocate expressed a concern related to discussion of healthcare innovation[5]: “We need to stop rearranging the deck chairs on the Titanic!”

We need to focus on understanding the underlying factors of problems. Known problems may be compared with symptoms. We may be able to relieve the symptoms, i.e. finding solutions to the problems we know of. However, curing the underlying disease (i.e. solving the underlying problem) is rarely achieved by relieving symptoms (i.e. solving the known problem). It is thus crucial to address not only the symptoms of a disease (or a problem), but to try to cure what causes these symptoms to appear - to try to find the underlying cause [12].

Conclusion

In complex contexts it is difficult to fully overview problems. They are more often wicked in character and oftentimes networked, complex, dynamic, and lack clear boundaries. This renders the importance of understanding what problem to address in an innovation-process crucial.

This paper proposes two different approaches to design in complex contexts. The first being a *holistic* approach which is argued to be crucial for generating better understandings of problems inherent in complex contexts. The second concerns design approaches within more confined contexts where the problem space can be more restricted. This confinement may e.g. be constituted by a predefined use of technology (as done within the field of HCI), or by rules and regulations (as shown through the healthcare case in this paper).

The paper argues that initiating innovation processes that are based on a potentially deceptive problem risks confining the solution to become marginal or

[5] Patient advocate in the audience at an international seminar on "Design in Academic Care" at Karolinska Institute, Stockholm, Sweden, Dec 10th, 2015

potentially even negative. On the other hand, a more confined type of DT may have a higher propensity to achieve results in terms of solutions.

We need to address the right problems with the most relevant competence available. Not thoroughly understanding problems in complex contexts from a holistic perspective risks to address problems that have a deceptive character, implying that if they are solved they may potentially generate other new problems.

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