

Building an evaluation infrastructure: capturing feedback at the right time and place

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Abstract. Infrastructuring does not happen by itself; it must be supported. In this paper, we present a feedback mechanism implemented as a smartphone-based application, inspired by the concept of infrastructure probes, which supports the in situ elicitation of feedback. This is incorporated within an evaluation infrastructure which enables clinicians to collaboratively evaluate IT system usage and related work practices. Access to the collected feedback is given through a central online repository presenting the feedback and analysed collaboratively. We describe this through a case where nurses collaborate by the means of electronic whiteboards on the infrastructuring of a procedure of patient transfer from an intensive care unit to a general ward.

The need for an evaluation infrastructure

Obtaining usage feedback from healthcare production systems from the systems themselves can be difficult, not only because of technical limitations in existing systems' ability to export data but also due to bureaucratic and organisational barriers which enforce the legal conditions under which data can be accessed.

In order to facilitate the collection of feedback to feed into an infrastructuring process we describe a feedback mechanism based on the idea of infrastructure probes (IPs) that enables users to self-document IT systems usage and usage problems and conduct a local collaborative analysis of the collected feedback.

Within secondary healthcare the collection of feedback about issues concerning the use of IT systems is typically organized through a central helpdesk service. Clinicians may either call for immediate help or fill out an online formula to report a problem, which is then processed at the helpdesk asynchronously. While calling helpdesk may (or may not) solve an immediate problem for the individual clinician in a given situation the underlying problem may not be limited to the technical part of the IT system, but related to the work procedure that the clinician is carrying out through the system and the problem is therefore likely to surface again. The alternative of filling out an online formula to report a problem is related to a number of challenges one of them being that it takes too much time and does not solve the immediate problem of the clinician, thus resulting in workarounds. While we do not solve the latter challenge within the framework of an evaluation infrastructure, we aim at making it easier for the clinician to provide feedback and point to ways of how to analyse it.

The same challenge for attaining feedback accounts for research initiatives. According to (Davis 1995), the traditional way of collecting feedback during a naturalistic evaluation of a prototype is either paper-based forms or the location of a human observer to act as a mediator for the feedback. While the former is cumbersome for the user, the latter is expensive. We suggest a solution for attaining feedback in-between written feedback and a human observer where clinicians are able to document their observations (articulations) of problems as they occur in an easy manner and do so in a dedicated and separate platform-agnostic system that the clinicians have access to and set up locally, to avoid the practical problems of obtaining feedback through an existing system.

First we describe the concept of infrastructure probes as a theoretical base for the feedback mechanism followed by an example of how an evaluation infrastructure can be established, based on the sample case. Finally we briefly discuss lessons learned.

Infrastructure probes as a feedback mechanism

We adopt the conceptualisation of work infrastructure of a worker or organisation as coined by Pipek and Wulf (2009) as "the entirety of devices, tools, technologies, standards, conventions, and protocols on which the individual worker or the collective rely to carry out the tasks and achieve the goals assigned to them." (Pipek and Wulf 2009 p.455). Following this definition the denominalization of infrastructure: *infrastructuring* is "all activities that contribute to a successful establishment of usages" (Pipek and Wulf 2009 p.450). The notion of "point of infrastructure" (POI) is specifically the notion of either a breakdown where the work infrastructure becomes visible to the user or a use innovation in which the user experiences an improvement toward achieving the work goal (Pipek and Wulf 2009). We acknowledge that design is both motivated and transformational as it seeks to induce change related to the work

infrastructure, but infrastructuring puts emphasis on the users' role and less on the designer.

The problem is to support and organise infrastructuring because of the still existing separation between “design time” and “use time”. At design time users rarely have time to do the additional task of designing and in use time designers may not be present to obtain feedback. To support the search for possible points of infrastructure is to support the capture of in situ reflections at an activity level. Our goal is to support what (Pipek and Wulf 2009) refer to as articulation support – that is to “support the technology-related articulations” (p.467) concerning usage and usage problems within the work context by providing them with a feedback mechanism. One way to support this is by means of infrastructure probes (Dörner, Heß, and Pipek 2008). IPs are tools that enable users to self-document and reflect on their usages of IT infrastructures the purpose being to find out which problems users are confronted with during use and the reasons for why the problems occur. Secondly IPs can give indications on how users solve their immediate problems. One practical methodological benefit is that the user can remain in his/her working context and that an observer does not have to be co-located.

In our case the use of smartphones as an entry point for clinicians to provide in situ feedback seems opportune. Previous studies (Hertzum and Simonsen 2011) indicate that formative ongoing feedback can enrich understanding in the pursuit of continuous appropriation and improvement of a healthcare infrastructure. We have applied the experience sampling method (Csikszentmihalyi and Larson 2014) in an earlier study in which coordinating nurses at an operating ward provided feedback on the occurrences of a general problem: interruptions from phone calls. One of the lessons was that elaborated descriptions of specific instances of interruptions was favourable for understanding the phenomenon and generate specific ideas for how to counteract some of the interruptions (Brandrup et al. 2017).

Our feedback mechanism is based on an IP tool that builds on the concept of a voice-memo. Practically the user provides explanations of points of infrastructure by the means of a smartphone application that implements an audio recording functionality and forthwith automatic uploading to a central repository, thus making it easy to use. Feedback captured in situ reduces the likelihood of recollection bias and hassle-free upload to a central repository is deemed important regarding ease of use.

The collaborative analysis of the collected feedback is then analysed by the clinicians using techniques like affinity diagramming (Brassard 1989) to create an overview of issues and diagnostic mapping (Lanzara and Mathiassen 1985) to transform issues to suggestions for interventions. See Simonsen and Friberg (2014) for an elaborated example.

Establishing an evaluation infrastructure

Within Region Zealand, Denmark, nurses work with a central shared information space in the form of an electronic whiteboard. In each ward, this provides them with a local overview of their patients, and it supports interdepartmental coordination within the hospital. The sample case is a participatory design project conducted at a medium-sized hospital in this region. The wards invited to join the project include a medical ward for pulmonary diseases, an orthopaedic ward, a surgical ward and the intensive care unit (ICU).

The overall concern is how an electronic whiteboard can support nurses in a patient transfer from an ICU to a general ward, with a specific focus on the initial 24-hour follow-up plan. The goals include sharing knowledge about the patients and establishing common ground with the ICU follow-up to improve care and eventually save lives (van Sluisveld et al. 2015). During twenty-four workshops (1 to 1½ h duration), engaging approximately 85 nurses, they investigate challenges related to patient transfers, the ICU follow-up procedure and possible solutions and suggestions on how to collaborate across wards. Discussions within the group of nurses result in lists pertaining to the needed information related to the former ICU patient (Brandrup and Østergaard 2015). Two nurses from each ward then participate in two design workshops (three hours' duration each) where the purpose is to collaborate on the design of the ICU follow-up plan and procedures in a manner which make sense both to the ICU and to the general ward nurses (Ostergaard, Karasti, and Simonsen 2016). The nurses' shared vision, as an extension of an existing production system, does not include considerations about the ability to provide feedback within the system or evaluation of the use of the follow-up plan. The need for evaluating the nurses' design is, however, still desired as input for the second design workshop.

Three out of four wards were represented at the design workshop when the smartphone application was presented as an alternative to hand writing comments about the use of the follow-up plan for each patient transfer. The nurses' initial reaction was to strongly resist the use of the smartphone and the recording application. They did not feel comfortable audio recording their answers and argued that it was too much to deal with the live testing of the design of the follow-up plan and using a smartphone with an unfamiliar application at the same time. The nurses tried the application at the workshop, and their behaviour was clearly uncomfortable. They did not know how to 'activate' the application, and as the application started to record they started to giggle, saying *No, no, no... If it is the same to you I'll just do my answers in hand writing.* Another nurse said *No one can argue that our colleagues will see the fun in recording their answers – I will do my answers in writing. When writing in hand...that will also make me reflect on things... This [the smartphone] will not make me do that. What if we say*

*something that we want to correct? Then it is too late.*¹ They did agree to have a smartphone with the application available during the three week testing period though. The ward that was not represented at the presentation of the application was handed a smartphone as well along with the choice of audio recording the feedback or do it in hand writing. One nurse from this ward used the application for recording her feedback on the use of the follow-up plan. Her argument was contrary to the other nurses, that it was much *easier* than writing the answers in hand.

Lesson learned

Implementing ICT tools in a hospital setting can be challenging due to technical and organizational barriers. We implemented a feedback mechanism that took some of these into account by making it a standalone application easy to use. One critical challenge in this sample case, however, was the nurses' ambiguous stance toward the smartphone and its application. At the workshop it was perceived by the nurses as a complication of testing the follow-up plan and the notion of voice recording itself was seen as uncontrollable because it is uneditable. For the nurse not present at the workshop the application was in contrast ideal. One lesson learned is that a feedback mechanism has to acknowledge different personal preferences for providing feedback and it should not be the single point of entry for feedback in situations where users prefer writing in hand.

Conclusion

As in much other clinical work, the use of a follow-up plan is fragmented and distributed in time and place. Thus, in order to support an evaluation of the use of this particular system, the clinicians ideally need to provide feedback at the right time and in the right place. That is when they encounter a point of infrastructure.

We have described how a feedback mechanism implemented as a smartphone-based application based on the concept of infrastructure probes can be part of an evaluation infrastructure. The purpose is to support clinicians in the easy collection of feedback in order to share knowledge, evaluate design goals and eventually generate ideas for how to improve the existing healthcare work infrastructure. Through the sample case we have also hinted at some of the challenges of doing so. Our experiences from earlier projects are that smartphones are still not an integral part of the work infrastructure within secondary healthcare, but that it is to some extent feasible to conduct investigations as long as the

¹ The quotes in this paper, which have been translated from the Danish, have been edited very slightly for clarity in English.

phones are separated from the internal hospital network and properly introduced to the users. From the sample case our experience was that the nurses simply had different personal preferences for providing feedback which suggest that a successful feedback mechanism allow for different types of open input.

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