

Unbounding the Interaction Design Problem: the Contribution of HCI in Three Interventions for Well-being

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ABSTRACT

In this paper we consider HCI's role in technology interventions for health and well-being. Three projects carried out by the authors are analysed by appropriating the idea of a value chain to chart a causal history from proximal effects generated in early episodes of design through to distal health and well-being outcomes. Responding to recent arguments that favour bounding HCI's contribution to local patterns of use, we propose an unbounded view of HCI that addresses an extended value chain of influence. We discuss a view of HCI methods as mobilising this value chain perspective in multi-disciplinary collaborations through its emphasis on early prototyping and naturalistic studies of use.

Author Keywords

contribution of HCI; medical informatics; behaviour change; value chain

ACM Classification Keywords

H.1.1 Systems and Information Theory (Value of Information); J.3 Life and medical sciences (Health)

INTRODUCTION

The contribution of HCI to technology-based health interventions is a topic of significant and ongoing debate (e.g. Brynjarsdóttir et al., 2012; Klasnja et al., 2011; Siek et al., 2014). Klasnja et al. (2011), for example, pose the question of whether HCI designs should be judged on their 'efficacy' to bring about a desired change in the behaviour of users. They argue that this is not practical, given the long time frame of realising health benefits, and that it is unnecessary and may be counterproductive. Instead HCI designs should be evaluated on the extent to which they stimulate behaviours, such as self-monitoring, believed to be part of successful change strategies. Such a 'tailored' notion of efficacy, they argue, puts an achievable boundary around HCI design, and is more likely to lead to generalizable HCI knowledge about patterns of interaction. Siek et al. (2014) similarly argue that final efficacy is beyond the bounds of HCI, while Brynjarsdóttir et al. (2012) point to the need to consider

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the impact on practices rather than changes in behaviour. These arguments echo long-standing debates in HCI about whether our concern as a discipline is restricted to the interface and local patterns of interaction, or extends to a broader 'domain of application' (Dowell & Long, 1989).

In this paper we re-examine HCI's contribution by reflecting on three projects being carried out by the authors in domains of health and well-being interventions: the well-being of young people in care; smoking cessation; and psychological counselling. While we support the view that HCI projects should not be judged on whether they produce measurable behaviour change, we contend that this should not impose a constrained perspective on the HCI design problem. Rather, we argue for an unbounded view in which ultimate efficacy provides a significant context for design thinking.

VALUE CHAIN ANALYSIS

At the centre of our analysis is the construction of a value chain for each of our three projects (see Figure 1). The idea of a 'value chain' is appropriated from theories of organisations (e.g. Porter, 1985) in which activities of producing products or services are viewed as processes that lead to outcomes of value. Here we chart an analogous causal history from early analysis and mock-up designs through to the societal benefits of health interventions. In contrast with approaches to HCI that evoke a binary distinction between patterns of behaviour *now* versus health outcomes *later*, the value chains in Figure 1 make explicit an extended sequence of effects in the creation of valuable outcomes.

Within the value chains for our three projects we identified three regions relevant to the debate about HCI's contribution: *proximal effects*, which might occur within days or weeks of implementing the HCI design; *intermediate effects* that might occur during a trial or evaluation lasting several months, within the normal range of HCI research; and *distal effects* that occur over the longer term and which can be evaluated only through multiyear longitudinal research, beyond the usual range of HCI studies. In the following we consider how an implicit value chain motivated design thinking in the three projects. These projects differ in scale from a small-scale project focusing on proximal effects to a large-scale project with scope to investigate more distal effects. Yet we suggest that in all three cases the value chain is significant for design thinking and analysis.

Virtual locker for young people in care

Our first project, conducted by one of the authors, is the smallest in scale and concerns the well-being of young people in care. The project aims to explore the design concept of a virtual locker, an online repository that provides continued access to identity-related materials. This would provide young people with continuing access to these resources, believed to be important in constructing identity, and provide a basis for informed care decisions.

Constraints on research in this context and the short duration of this early-stage investigation limited the evaluation to two focus group sessions, one conducted with social workers, and the other with young care leavers. Evaluation was conducted with prototype demonstrations, walkthroughs and tasks completed with online wireframes. Qualitative data was gathered through discussion and observation; this was supported by surveys completed individually by participants.

Despite this being an early evaluation study, the value chain in Figure 1 provides an important frame of reference for how the project contributes in principle to a desirable societal outcome. The proximal effects in the chain, the ones most directly observable through the use of the mock-up, are how the virtual locker is perceived by the two primary groups of users: carers and young people. Critically, what frames the analysis is the aim to gain insight about the realisation of intermediate and distal effects. The evaluation made use of storyboards and scenarios which play out over an extended period of time. Inferences are sought about whether the virtual locker design is perceived to support these users' fundamental needs *such that* it would be used effectively by individuals, supporting collaborative use between carers and young people for the accumulation of personal materials over time. These inferences in turn are shaped by the desire to achieve more distal effects: that the virtual locker should provide a life-long resource for identity construction and informed care.

This first project illustrates how, for this kind of early evaluation, a clearer articulation of the value-chain is also an outcome of the study. In this case, intermediate effects were identified and clarified: that social and collaborative processes of capturing and interacting around personal materials are understood to be essential.

A mobile app for smoking cessation

The second project concerns the design of a mobile app to help people quit cigarette smoking. It is a collaboration between four of the authors, as interaction design researchers, and a government agency which provides advocacy, counselling and information services for smoking cessation. App users can access an online forum with *stories* by people quitting smoking, as well as *tips* from experts and *distractions* from cravings. The value chain in Figure 1 shows how the design problem was conceptualised. To achieve uptake of the app is considered to be a proximal effect in that it can be assessed very early in any deployment. Following this, intermediate effects are the degree of engagement achieved among quitters who interact with each other

through the forum, and their engagement with tips from experts. These have been studied in observations of the app in use through interviews, diaries and log data collated and analysed across a sample of 28 users. A later intermediate effect occurred when users did genuinely maintain a quit attempt supported by the tool during the trial. Beyond this there are distal effects that are much harder to assess. One is whether, in fact, the trial participants managed to quit smoking, often defined as being smoke-free for 6 months. This is difficult to assess not just because of the longer timeframe, but also because it shifts the standard of proof to one of medical research and demands a randomized control trial with a larger sample. Beyond this are the even more distal effects of lower smoking rates in the population, something that would take many years of data to measure and establish.

Consistent with the account put forward by Klasnja et al. (2011), the intention here is not to measure distal effects. But rather the focus of data collection and evaluation is on intermediate effects which are assessable through a trial lasting several months. Nevertheless, we contend that the design problem we are engaged in as HCI researchers is not bounded by this practical limit on measurable outcomes. An important point, common to many behaviour change domains, is that there is no consensus theory on what techniques used by quitters will lead to a successful cessation outcome (see Hekler et al., 2013), and in any case the online interaction presents a new context which demands new understandings. A deeply problematic issue is that behaviour that appears to represent a desirable intermediate effect, such as high levels of discourse between quitters, could have adverse distal effects, like making participants more comfortable with patterns of relapse. In response, our position is to work closely with experts in smoking cessation to attempt to infer the likely consequences for distal outcomes and identify issues for further study. While it remains true that we cannot measure these distal effects directly in the manner of health research, the focus of our analysis nevertheless looked forward down the value chain.

Online support for youth mental health

The third project, involving two of the authors, is larger in scale, and aims to build an online mental health therapy that includes social interaction among patients, ex-patients and clinicians. The intention is to prevent relapse in patients recovering from psychosis through a 2-5 year danger period and ultimately achieve complete recovery from symptoms. Drawing on a design model proposed by Coyle & Doherty (2009), initial prototyping and ideation was targeted at proximal effects and included simple feasibility, usability and acceptability tests, such as focus group sessions with prospective users. The logic of these was that prospective users must want to and be able to use the technology if it is to have any effect.

When the prototype seemed sufficiently usable and acceptable we proceeded to a pilot-testing phase which involved a two month trial with the system continuously available to 20 patients and 3 clinicians; this corresponds to the intermediate phase of our model. A primary concern here was engagement: would patients maintain

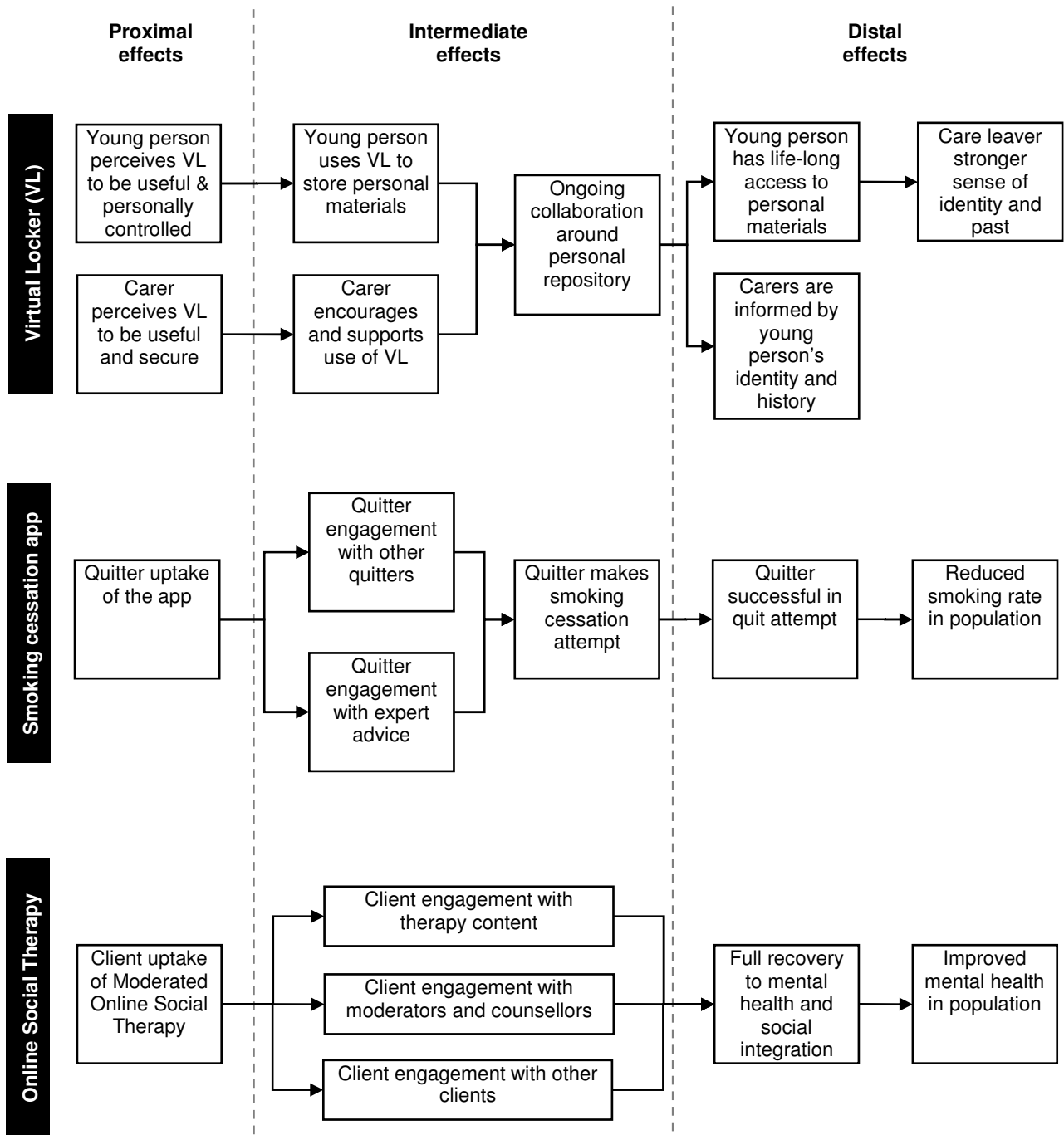


Figure 1: Value chains for our three projects on (1) a virtual locker for young people in care (2) a mobile app for smoking cessation and (3) online social therapy for youth mental health

therapy exceeded our expectations. Because of the short length of the pilot trial, only one psychological measure was taken: a depression test taken before and after the trial. This showed significant reduction in symptoms, which we attributed to the increased social interaction our system afforded these often-isolated patients.

This promising result enabled us to improve the system and embark on a 4 year randomized control trial of the medical efficacy of the therapy, which is currently in progress. While efficacy can only be determined at the

end of the trial, the project's HCI and psychology researchers are working together continuously throughout the trial on engagement, usability and interaction design issues. We continually monitor engagement and make adjustments to software and moderation protocols designed to stimulate and maintain engagement. Importantly, these adjustments are guided by what is inferable about their effects on the distal outcomes shown in Figure 1. It is clear in this project that there is no clear boundary where HCI issues stop and health issues begin; rather these are intertwined throughout. Due to the social

use of the therapy over this longer time-frame? Thus we measured usage rates over time using server logs. We also interviewed trial participants, and while the emphasis was on the acceptability of software features, we also probed for user experience and found that patient enthusiasm for the social interaction afforded by the networking and interactive features of the technology, frequent informal feedback is received from patients regarding both their usage and their health and mood status. This provides valuable insights into the efficacy of the system both as a technology and as a therapy.

DISCUSSION: MOBILISING VALUE CHAINS

The construction of a value chain of proximal, intermediate and distal effects has been illustrated for three HCI projects related to health and well-being interventions. We present these as illustrating a perspective which contrasts with recent accounts that suggest distal outcomes are beyond the scope of HCI. It is correct that HCI designs should not be judged on their measurable outcomes for behaviour change (Klasnja et al, 2011), and also that health interventions may produce valuable knowledge about patterns of interaction unrelated to final outcomes (e.g. Ploderer et al., 2014). However, we nevertheless argue that it is important to make explicit a value chain that charts a presumed logic for reaching distal benefits. While measurement of distal effects may not be possible, design thinking and evaluation should still aim to inform our understanding of the scope, limits and potential for the realisation of distal benefits to health and well-being.

A key observation across our three projects is that a shared sense of the value chain can underpin and motivate the collaboration between multi-disciplinary partners. In this view, the efforts of different disciplines, including HCI, medicine and health counselling, are not seen as being directed towards different segments of the chain. Rather, the efforts of these disciplines overlap and work collaboratively towards clarifying, establishing and connecting the effects of the value chain. In all three projects, domain experts (care professionals, cessation experts, and psychological counsellors) were involved from the outset, rather than just in a later validation phase as suggested by Klasnja et al.

Initially, the value chain provides a frame for considering and clarifying the envisaged interplay between proximal effects and distal outcomes. In later stages of research, it supports discussion of potential consequences of study findings, and can guide ongoing system refinement.

The extended nature of collaboration was seen most clearly in our third project, in which the HCI researchers and psychologists worked interactively over an extended period to advance the efficacy of the design. But even in the first two projects, that dealt more directly with proximal and intermediate effects, the implicit value chain was important in framing the focus of the investigation.

A related observation is that the techniques of HCI appear to be well-suited to mobilising this shared sense of a

value chain in a multi-disciplinary context, and this may be one of HCI's special contributions. This observation is supported by Suchman et al's (2002) account of a prototype providing a meeting point between the disparate viewpoints of various stakeholders. This role of HCI occurs through our conventional focus on ecological validity: of studying real users and other stakeholders in realistic situations that are meaningful to them. In this way the techniques of HCI can be seen as attempting to simulate and explore the types of situation in which distal effects will be realised, so helping to establish the shared value chain at an early stage.

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