

Secondary design – as a supplementary knowledge base for HCI design

Full Paper

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Abstract

Traditionally, the HCI design is greatly influenced by active knowledge harnessed during requirement elicitations. However, as the world of ICT moves towards user-centric computing with a need for evolving features, designers face challenges from heterogeneous users with complex needs, accessing technology with myriads of communication mediums. In response, this paper explores peoples' inherent desire and way of engagement with other entities which guides us towards design that is not pre-determined by experts, but by users' response to changes (secondary design). Secondary design is analyzed in an empirical case study of the implementation of new Learning Management System in higher education institution by following end-users appropriation response for a period of 20 months, and conducting more than 30 interviews. The analysis shows that secondary design is not 'unfaithful use of technology' but a sensible practice with known triggers and effective re-designing processes aiming to fit new features with practices and identities.

Keywords: Secondary Design, HCI Design, Heidegger's Tool Analysis, Design knowledge base

Introduction

Within the human computer interaction (HCI) design, active knowledge (things that can be represented and actualized in system trials such as prototypes) traditionally directs and predicts the design process and users' expectations (Coyne 1994). As the world of ICT moves from a technology that aims to fulfill a task towards a technology that can provide a superior user experience with evolving characteristics, designers cannot expect users to be homogenous and their needs to be easily accessible. In addition, as systems are developed for heterogeneous and often unknown users with different communication artifacts, users' contexts and expectations are becoming too complex to define (Stewart et al. 2005). However, there is also a design requirement for generalizability, as systems need some sorts of boundaries to function effectively.

To set the initial boundaries for a generalizable yet well function design, two-fold approach is needed; first, a more universal understanding of human-technology relationship that bases users' practical engagement with technology and second, mechanism to integrate these understandings in the design process. In this paper, we propose a supplementary knowledge base for HCI design based on the notion of *secondary design* that resonates with the concept of *being human*, i.e. our inherent desire and way of engagement with other entities. Secondary design is a process by which users define the role of technology features in their daily practices. It is different from the primary design, mainly because the design process does not depend on the active knowledge, but instead on users' actual practice and experience. Secondary design process may resemble, at first, a trial and error method, where users 'emplace' new features in finding their way to an appropriate use. However, examining closely secondary design is also a universal response to new changes in human life. This innate and existential human nature can be used as a source of general blueprint to design for heterogeneous, unknown users with myriads of different communication mediums. Given that secondary design is borne out of our way of *being human*, this

research specifically seeks to answer: **How can we harness the knowledge base of a secondary design to the new challenges of HCI design?**

In response, this paper specifically explores users' application of secondary design in their interaction with technology. After proposing an exploratory framework for a secondary design, we explore users' mechanisms of secondary design implementations. The concept of secondary design "change subtly the design metaphor from product design" (Winograd et al. 1986a) to process design that requires a close examination of users' methods and mechanisms of defining their problems and solutions within the design space. The argument is that an understanding of these methods and mechanisms can provide useful information for IT developers to inset fitness attribute in software products. The research grounds on Heidegger's existential theoretical framework, commonly referred as the tool analysis. Heidegger's tool analysis framework explains that the natural way of *begin* tools (e.g. technology) is readiness-to-hand (equipment), in that we have no reason to reflect consciously upon the tool we are using. In such a way, the user will have a chance to be concerned with the ultimate goal of the practice. In addition, users' absorbed mode of engagement is our primordial (basic) way of interacting with tools such as technological features. With new technological features introduced to our daily practices, we applied our 'historical context', experiences and pre-understandings to create/mend a relationship with the unknown features, hence stirring them toward their natural being (equipment).

In analyzing the process of a secondary design, this paper draws on an empirical case study of the implementation of new Learning Management System (LMS) called Moodle deployed on three campuses in higher education institution in Sweden. The authors were able to follow the implementation process and end-users appropriation response for a period of 20 months, during which they were able to conduct more than 30 interviews in two separate occasions – at the beginning of Moodle implementation and at the end of 20th month.

The paper organized as follows. We begin with a review of the literature on HCI design and a discussion on theoretical background. We then outline the research method adopted for the empirical part of this study and summarize the key findings. We will analyze results from the case study and develops secondary design as a legitimate knowledge base for HCI design. The paper concludes with discussions and direction for future research.

Literature Review

HCI has emerged as an interdisciplinary field for researchers and practitioner such as "user experience designers, interaction designers, user interface designers, application designers, usability engineers, user interface developers, application developers, technical communicators/online information designers (Carroll 2013; Harish et al. 2013)." Examining the topic areas reveals that the issue of design is one of the primary focus of HCI research (Fallman 2003). "Usability is an emergent quality that reflects the grasp and the reach of HCI. Contemporary users want more from a system than merely 'ease of use' (Carroll 2013).

Within HCI literature, design process may categorized into tool centric, user centric, or socio technical views (Ritter et al. 2014). In a tool centric view design process are well-structured with rational steps that starts with requirement engineering and ends with creation of an artifact (Lowgren 2013; Pahl et al. 2007), assuming that systematically following a set of prescribed methods can lead to a greater usability (Nielsen 1994). User centric view states that the users are often knowledgeable and know how to use the system more effectively in their work environment. In this user centric view, designers need to engage users during the design process (Bannon 1991). User-Centered Design and Requirements Engineering methodologies should be integrated, or at least aligned, to avoid some of the problems practitioners face during the User Needs Analysis (Lindgaard et al. 2006).

The rationale to apply socio technical design rest on the notion that techno-centric approaches to systems design do not adequately consider the complex relationships between the organization, the people enacting business processes and the system that supports these processes (Goguen 1997; Norman 1993). System designers should assume that people will try to tailor their use of a system (Ackerman 2000). Furthermore, definition of information technology requirements should, ideally, support business objectives (Goguen 1997; Norman 1993). The process of design is essentially a socio-technical process. The decision to take on this socio technical endeavor should result in a system that is not designed for specific use or particular users, but a system that is dynamic can sustain themselves (Coiera 2007).

While HCI has moved from tool centric view towards socio technical view, there has been significantly larger focus on a primary design that mostly base active knowledge as design foundation (Baxter et al. 2011). Primary design plays an important role in demarcating the design process to develop information systems' properties and functions. It reflects the original IT designer's artifactual intent and agenda. But the background used in the primary design to develop usability features still remains to base designers' pre-understanding or experiences (Winograd et al. 1986b). In addition, IT designers' lack "the same practice background" (Riemer et al. 2013b) and knowledge that enable users to 'emplace' new features in daily practice. As the target audience becomes heterogenous, unknown, or use different media of communication, the challenge to design, in particular, based on active knowledge, can become complex.

In what follows, we explore the possibility of a supplementary knowledge source for design in users' interaction with technology. IS researchers have used terms such as Bricolage and tinkering as examples of end-users processes of implementing IT artifacts (Ciborra 2002), commonly referred to as secondary design. It is concerned with users' decisions on how to apply these properties and functions in ways that were not intended, or even at times imagined by designers. IS literatures have reported various reasons behind the secondary design, such as unexpected change of user needs, mismatch between specifications and software product, user's unfaithful engagement (maneuvering technologies), and emerging of constraining characteristics of technology features (Boudreau et al. 2005; DeSanctis et al. 1994; Lapointe et al. 2005; Leonardi 2011).

The following sections will further develop the concept of a secondary design with the aim of extrapolating a complimentary 'knowledge base' for primary design processes.

Theoretical foundation

Researchers in different fields, especially phenomenologist, have explored the phenomena of situational practices, interactions, or experiences. Such research include phenomenological works of Husserl (Husserl 1970), Heidegger's tool analysis (Heidegger 1927), Dewey's theory of transaction (Dewey 1931), and Alexander's theory of design (1964). For our paper, we have selected Heidegger's existential analysis or commonly known as the tool analysis to explore the process of a secondary design as users' means of achieving a smooth relationship with technology. We have chosen the tool analysis for because of its holistic ontological base; its ability to describe both primary and secondary design knowledge bases; and its emphasis on context and practice. In particular, we will concentrate on his '*tool analysis*' concept published in '*Being and time*' (1927). In addition, other works such as Riemer and Johnson (2013b), Germonprez et al. (2011), and Harmon (2010) have influenced our thought of inquiry.

Way of being human

Heidegger's main concern was to develop a coherent explanation for how things exist in the world. In answering this question, he begins by examining different modes in 'which human exist and encounter' the outside world (Heidegger 1962). The way we exist or being humans (he refers as - 'Dasein') is through "engagement in practice" (Riemer et al. 2013a). That is, Dasein naturally exists as a practitioner and it is Dasein because it engages in practice. Thus, the mode of human existence (Dasein) is this-and-this by doing this-and-this (Riemer et al. 2012). According to Heidegger, engagement in practice is not something we choose to do. In fact, Dasein is "thrown" into a context, where it cannot choose but act, resulting its everyday action to have a 'historical context' as a background (Heidegger 1927).

Way of being 'non-human'

Heidegger continues to define how entities existed based on Dasein's encounter with the external world by introducing two concepts, *ready-to-hand*, and *present-at-hand*. In a *ready-to-hand* mode, encounters are 'already there' as a means for practice. For example, every time a carpenter picks a hammer, he looks for 'nail-hammering' entity, rather than giving a conscious attention to the property of the hammer: what is made of, the shape, size and other surrounding environment factors. Secondly, an entity can present itself to Dasein as '*Present-at-hand*', in which the encounter with the entity is full of reflection and contemplation. The *being* of present-at-hand can be explained in three ways (Harman 2010) – a) first time encounter with an entity b) a scenario where entities breakdown and results in a 'temporary disturbed' and c) when entities are observed just for the sake of it, implying intentional reflection.

Secondary design: a case of emplacing new features in everyday practice

Heidegger's framework provides a theoretical grounding to study end-users mechanisms of emplacing technology features in their daily practices. As he outlined, our response to everyday situation can either be in the form of "reflective coping", which involves a conscious analysis of a situation in cases such as unfamiliar contexts or "absorbed coping", if the context we find ourselves is proverbial and does not need a reflective thinking to respond (Dreyfus 1990). In the first scenario, we call upon pre-existing experiences accumulated over time to create a new 'node of extension' to our everyday technology features. In cases such as absorbed coping, we continuously 'bricolage' fragments of technology features and non-technology tools to engage with the world (Ciborra 2002).

Secondary design happens in the aim of making a shift from reflective to absorbed coping. Such a shift affected by our past experiences and ways of creating a relationship with technology features, new features ability to bricolage with existing practices, and the grand outcome of using technology features such as *being* a craftsman, a teacher or any social identity the users may assume. Reflective coping, therefore, is an interpretation induced by past knowledge and practical engagement with new features to emplace them in Dasein's reality (Gaál-Szabó 2012).

Heidegger's present-at-hand discussion also discloses Dasein mechanism of secondary design process. From user's point of view, present at hand practice of engagement simply aims to fit the new feature with what exists as a ready-at-hand work practices. To do so, the interaction with readiness-to-hand entities applied as a reference point to work on the present-at-hand phenomenon. What a user sees as an affordance in new technology features, for example, is a result of an associate a user makes between pre-understandings knowledge and the new features. The following table summarized our theoretical framing.

Dimensions	Activities unfolded in progression of a secondary design	
Users coping mode	Reflective coping	Absorbed coping
Technology way of being	Present at hand – object for reflection	Ready to hand – equipment with a history of meaningful dealings
Relationship dynamics	Encountering and blending new features with existing work practices	Selecting and assembling for everyday practice
Triggers of engagements	Features' novelty and breakdowns	Curiosity
Time dimension	Pre-understanding and past socio-technical experience as a knowledge base to inspect and emplace new features	properties are domesticated over time and added for 'assemblage purposes'

Table 1. Summary of phenomenological framework for secondary design

Research method

This research applies a case study to illustrate secondary design in action. Case study is "an empirical inquiry that investigates a contemporary phenomenon within its real life context" (VanWynsberghe et al. 2008; Yin 2009), involves a close examination of "people, topics, issues or programs" (Hays 2004). Case studies are appropriate methods especially when the context and phenomena do not have clear boundaries (Blaikie 2009) and integrates both generating and testing theory propositions, hence bridging a gap between theory and practice (Swiercz 2003). In addition, case study enables to conduct empirical inquires about situational practices and their consequences in the overall work practice (Yin 2009). We adopted the case study method because it enabled us to study the contextual relationship between technology and human agency.

Background of the Case study

The case study is the transition process of a LMS of a higher education institute in Sweden during 2012-2014. The University has implemented WebCT for more than ten years before deciding to a new

technology called Moodle. At any given time, the University has about 1500 teachers and 13,055 students in three campuses situated in different cities, in which one of the campus's entire courses are offered only online.

During Moodle implementation, the university nominated (voluntarily) 16 so-called Moodle champions (also known as *super-users*) who served as a focal point in their respective departments. These champions participated in different trainings prepared by Learning Resource Center (LRC). LRC staffs, in addition to two system developers, are responsible for administrating and providing system support. In their capacity, the champions could assess the appropriation process of Moodle among more than 1000 university staff and many students.

We contacted LRS for research engagement, after LRS accepted our invitation; the program managers from LRS sent an email invitation to Moodle champions, staff members, and developers to participate in our case study research. In particular, one of the administrators had created a group email addresses for such particular purpose, where potential interviewees were able to select convenient meeting occasions for the research.

Data collection

We conducted in-depth interviews on two separate occasions with Moodle champions, developers, and LRC staffs. On average, the duration of these interviews were between 45-60 minutes. Phase I interview has conducted during the first few months of Moodle implementation, while follow up interview in Phase II occurred after 20 month after LMS implementation. In particular, the interviews we conducted with each of the LRC administrators were on average four times, as we seek follow-up interview on different occasions over the period of 20 month. All the interviews questions have an open-end format and data was collected using audio tapes and notes.

Participants	No. of Participants	
	Phase I	Phase II
LRC Administrators	2	2
LRC staff member	1	1
Moodle Champions	10	12
Moodle Developers	2	2
Total	15	17

Table 2. Data collection

Data Analysis Techniques

To analyze our case study, we rely on 'content analysis' (Klein et al. 1995). All the interviews were transcribed manually and uploaded to Atlas.ti without modifications. In brief, we draw on the following main three steps to analyze the field data:

- 1) We coded the first 20% of each phase of interviews manually and the remaining 80% were coded with the help of Atlas.ti.
- 2) The interviews were coded based on users' response at conversation level and we consistently looked for patterns in each response. For example, end users' frequent response such as "there is no substitute in Moodle for such and such WebCT functions" coded as *past socio-technical imbrications* (Leonardi 2011).
- 3) After finalizing the coding process, one of the authors re-read the coded sentences iteratively to merge pattern keywords and find new ones, if applicable, thus repeated step 2. After re-reading the interviewees' responses, finding/replacing new pattern keywords, four categories/main family nodes were surfaced (See Table 3).

Categories	Descriptions	Examples
Past Socio-technical structures and imbrications residuals	Pre-understanding, past imbrications with technology, and a way of assembling features applied to inspect new technology features.	<i>"But the question is more about the equivalent options they can get in Moodle" Interview_1_p6</i>
Features' capability recognition	Users' attempt to make sense of functions and properties and their potential use in their daily practice and existing 'IT ecologies'.	<i>"How do I can get this, why can't I see the course or something like that. More like I used to do this in WebCT, how can I do this in Moodle?" Interview_1_p1</i>
Coordination	End-users were able to identify design intention and functionalities to the point where they coordinate their daily activities, workarounds, and make other negotiations with the new feature.	<i>"Moodle lets you to slip out to other software like saving in excel format and the teachers are found out that. Especially in study group, we don't even open Moodle sometimes." Inteview_2_p3</i>
Newly formed socio-technical structure	New features found their 'proper' places in practice and new network of IT ecology and structure emerged	<i>"Users have calmed down, we have Moodle. The frustration about not knowing has been diminished and we are looking forward" Inteview_2_p3</i>

Table 3. Four Main categories of context based coding

In order to keep the fidelity of our research, we have followed the seminal work of Guba and Lincoln (1982) concept of "trustworthiness" in qualitative studies to substitute for reliability and validity of quantitative studies. "Trustworthiness contains four criteria: credibility, transferability, dependability, and conformability (Guba, 1981; Guba & Lincoln, 1982). These criteria, descriptions and how these criteria are adapted by our research are summarized in the table 4 (Adapted from Shenton, 2004).

Criteria	Possible Provisions	Example From This Research
Credibility	Early familiarity with culture of participants; iterative questioning; different types of informants and sites	The primary research site is at the home institute of one of the researchers. Multiple sites and different stakeholders were interviewed.
Transferability	Background data to provide context of the study; Detailed descriptions (thick descriptions) of phenomenon	Researcher was engaged in the research site for an extended period of time to gather detailed descriptions.
Dependability	Detailed description of the methodology	We also report how the participants were recruited.
Conformability	Triangulation to minimize investigator bias; audit trail	We analyzed the data with manual coding as well as using the qualitative software Atlas-Ti. All the research materials are recorded and digital files are stored in the computer for access and audit.

Table 4: Reliability and Validity

Data analysis

Reflective coping – Emplacing features in everydayness

During Phase I, as users start to familiarize with new technology, we have consistently observed two main concerns of end-users: 1) looking for similar socio-technical ways of structures and (2) new functionalities that enable them to repeat old ways of beings.

Firstly, users were actively asking similar routines and hoping for fast track to old habits (“*They want to be like WebCT as they feel safe since they know how it works...the question is more about the equivalent options they can get in Moodle*” Interview_1_p6). Such routines are built over time, can be unique to each individual user and may even be over-persistent, even after features that used to support old routine has gone (“*There are several people who do workarounds, especially when it comes to grading. I have it as well, which I created before long time ago, from WebCT limitation, but I continue using it, in fact I adopted my old solution the new system*” Interview_1_p8).

Secondly, while reflecting on new features, consistent with Heidegger’s notion of time, past experience is used as a reference point to create a relationship with new features. In reflective coping, respondents’ questioning of new features connotes more like finding a ‘link’ in the new feature with their already existed work practice, rather than the nature of the functionality itself. Hence, it was common to see users apply only specific part of a feature that ‘make more sense’ to their everydayness practices. (“*We just click a lot of next buttons without even thinking about their implication and when it says mandatory that is when we actually stop to put check a box. There are a lot of features that aren’t important at all*” Interview_1_p1). In cases where past familiarity and way of doing contradicts with new features, either users turn into workarounds to ‘patch up’ the missing ‘ingredient’ of the features or completely reject the features (“*I never use the new email system in Moodle, I actually removed it, just removed it from the daily use. We use Outlook or Skype, mostly outlook*” Interview_2_P1). Our empirical evidence shows that novelty and breakdowns are the common triggers of reflective coping. (“*The question I get from users is usually about functionalities such as how do I make input place for assignments? How do I make a wiki? How do I use overview of the result or report?*” Interview_1_P10).

Absorbed coping – interact with ready to hand features

In this Phase II interview sessions, two main themes were observed: 1) users were comfortable enough with the new features to emplace them in their daily activities, and (2) new socio-technical structure have emerged, as users ‘adapt and domesticate’ newly added features.

As users got to know the Moodle environment and able to make an ‘intelligent guesses’ about features’ capability, they started to interact with technology features with expectations. It was evident that, users strongly believed that they had the right practical knowledge about how designed features should work and what results these functionalities should produce (“*It is more like they already know what they want and see if it can be done in Moodle*” Interview_2_p5). In times, when expectations and the capability of the features mismatch, they either adapted and modified the feature’s contextual use, hence changing original design intention or modify their context; emerging new socio-technological duality (“*User have calm down now and we finally feel like we have Moodle. The frustration about not knowing has been diminished and we are looking forward*” Interview_2_p3). Once Moodle found its ‘place’ and became ready-to-hand, reflective coping mode of engagement subdued and gradually replaced with absorbed coping (“*I am not sure that people have learned all the features in the system; it is more like they have found what they think they need and settled with that.*” Interview_2_5 . . . “*now we don’t talk about Moodle at all. Rather the talk is more like how many students do you have in Moodle?*” Interview_2_8).

At this point, many users went through tailoring new features accordingly with their context (“*You have this news option and I don’t like that. I hide it, even though that is at least the one thing, the designers want you to have, and create a new standard forum, which I called “information for teachers”.*” Interview_2_p5), changed their daily context accordingly with new features (“*We feel like you adapt the way Moodle is working.*” Interview_2_p2), or reject some features entirely (“*The one thing I omitted to use is the Jmail account message system. I have my web based instruction on Adobeconnect as most of*

my students are all over the place” Interview_2_8). The result of such re-designing was the emergence of a newly formed socio-technical structure that allowed absorbed coping of engagement.

Absorbed coping opens up an opportunity for users to consider learning new features willingly and out of curiosity. (*“In the beginning, it was more like visiting a surface, and was a strange to get use to Moodle. However, today, we are further than that. We exchange each other information and new features, so we learn from colleagues. We often talk to one other. We ask if there is something interesting, and we show to one other about it. We are not satisfied Moodle as it is, so we are keep digging” Interview_2_p3*) Traditionally, the beginning stage of technology adoption is perceived as the only “windows of opportunity” to learn new ways of work practices (Tyre et al. 1994). Our empirical evidence, though, showed that users’ own creativity and innovative thinking peaks once users find a ‘comfortable zone’, where daily activities that involve technology run in absorbed coping.

Discussions and contributions

Designers’ pre-understanding or *being* is reflected in the primary design (Winograd et al. 1986b). When users ‘inspect’ these features based on their pre-understandings and experiences, design intention becomes the first to be ‘re-designed’ by end-users. As a result, primary designed functions may tailor to serve other ends. Perhaps, intention redesigning accounts for most of the secondary design tinkering practices.

In addition, new features could either be clumsily fit the existing IT ecology or lack specific function/s with-in; thus users may have a hard time finding a ‘place’ for those features. In our empirical work, the new email system called Jmail installed as an extension in Moodle, though fulfill most traditional email system concepts, lacks attachment functionality. Some have accepted the extension, while most users turn to their regular email systems such as Outlook accounts. Evidently, the lack of particular functionality with-in features may result in rejecting the feature all together.

Secondary design operates best when users feel less overwhelmed with new features at the beginning of technology adoption. Based on our data, secondary design occurs somewhere between ‘functionality awareness’ in reflective coping and ‘coordination’ category in absorbed coping. Users started to ‘vaguely’ recognize the capability of features and their possible place in their daily practices, but not yet complete the ‘emplacing’ process. Too many features at the beginning of an adoption could lead to overlooking functionalities, regardless of their usability. Finally, secondary design strongly associated with how users identify themselves with their environment. We have observed more secondary design practices such as tinkering, mainly triggered by curiosity, in computer savvy departments such as computer science. Consistent with Heidegger notion of Dasein, our daily practices of engagement reflect our individuality and vice versa.

The contribution of this paper is twofold; first to use secondary design as a theoretical framework for HCI research, second, how constructs from secondary design could be used broaden the design impact on designers. The notion of a secondary design as a potential theoretical grounding is very appealing because it is developed based on the very common human natural reaction toward changes in the surroundings. Traditionally, HCI primary design process focused on usability features that are developed based on active knowledge such as requirement elicitations. By supplementing the focus of usability and active knowledge with the notion of a secondary design, HCI designers’ knowledge base can have a broader focal point for maximum design impact.

Phenomena such as triggers, reflective or absorbed coping, the role of pre-understanding on feature adaption, and coordinating different features for everyday practice are among some of the common patterns revealed during secondary design. The notions of secondary designs are deeply rooted in our existential way of *being* human or Dasein. We are also aware that each user practices secondary design uniquely. It is implausible to design for all ‘unexpected’ individual scenarios. Instead of making a list of every details and expectations of users’ maneuvering, the notion of secondary design provides an alternative path on the premises that “it is possible to design something usable for the unexpected by letting users to do the final 'design' when the need arises” (Dix, 2007).

Secondary design provides a roadmap for the common design requirement of generalizability as it grounds on notion the human inherited desire and existential response to novelty such as new technology. As HCI designer uses active knowledge to develop technology functionalities and properties, secondary design knowledge base supplements an understanding of expected users' practice of engagement once a technology is adopted. That is, the notion of secondary design enable us to understand mechanisms in which users are expected to familiarize and create a structure of understanding with new technological artifacts.

By portraying secondary design as a 'natural' way of developing a relationship with technology features, we can also be able to examine the general technology adoption processes from users' perspective. Secondary design, as some have suggested, is not 'unwanted and unfaithful use of technology' implementations (Lapointe et al. 2005; Leonardi 2011). In fact, it is a sensible practice with known triggers and effective re-designing processes aiming to fit new features with one's everyday practices and identities. Even though, users' reaction is contextual and unique in its nature, secondary design in its core is a human existential reaction to a new environment to 'restore order'.

In order to use a secondary design as a knowledge base for design capabilities, IT designers should find ways to incorporate the concept of a secondary design during a primary design stage. Detailed analysis of different ways of accomplishing secondary design during primary design state is outside the scope of this paper. One of the ways secondary design can be achieved is by focusing on users' features' emplacement *processes* in the existing work practices. On our theoretical framework, these processes were detailed as users' struggle and incremental successes in making the shift from reflective to absorbed coping. In addition, one can observe this transition 'stage' in the empirical material between 'functionality' and 'coordination' categories. Parallel with usability design requirement lists, such processes can also become part of design requirements for primary design. The following table presents a rough contrast of secondary design concepts with traditional primary design main concerns.

Characteristics	Primary design	Secondary design
Design environment	Active	Reflective
Design candidate	Specific problems/tasks	Relationships and practices
Emphasis and orientation	Problem/solution oriented	Evolution/practice oriented
Knowledge source	IT knowledge base	Users' Practice of engagement
Design space and problematization	Definable as a collection of instruments and operational ends	Emergent and tacit
Method of knowledge claimed	Detached and objective	Engagement and practice
End goals	Automation	Tool development
Design product	Artifact	Equipment
Ontology grounding	Dualistic	Holistic

Table 5. Summary of primary and secondary design

Conclusion

The research reported in this paper is one of few empirical studies focused on a secondary design. It explores supplementary knowledge base for HCI design, which is traditionally influenced by active knowledge base. We developed the notion of a secondary design and its existential nature as a suitable complement to primary design processes, particularly when the design space in question is heterogeneous and evolving. Based on exploratory theoretical framework proposed, we analysis a post implementation of LMS to gain a better understanding of the secondary design, it's mechanisms mitigating the relationship between users and the tool. Heidegger's tool analysis provides a strong background to study how users interact with new features and influence each other. It also provides a theoretical framework to understand why and how the actions and decisions about the HCI were executed in-context.

Limitations and Future Research

We admit some of our limitations. Our case study is based on a technology that is already implemented in a work practice; hence, we take neither decision-making process nor the effect of power issues on the availability of new features for the users to implement secondary design into consideration. In addition, our results are based on one case study only. However, it is our believe that the proposed framework and its subsequent findings can be replicated in other settings, where it can be refined and extended in the quest of finding complementary knowledge base for HCI design.

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