

# Requirements Engineering For ADDICTion-Aware Software (E-ADDICT)

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**Abstract.** Digital Addiction, (hereafter referred to as DA), has become a serious issue that has a diversity of socio-economic side effects. In spite of its high importance, DA has received little recognition and little guidance as to how software engineering should take it into account. This is in stark contrast to other domains known for traditional addiction, e.g. drugs, gambling, and alcohol, in which there are clear rules and policies on how to manufacture, market and sell the products. We contend that software engineering is required to attempt to provide ways to develop software that does not lead to addiction and to accommodate users who are genuinely vulnerable to addictive behaviour. This thesis will concentrate on conceptualising DA to advance the understanding of how addiction elements influencing features and functionalities of social networking systems.

## 1 Introduction

Digital Addiction (DA) can be described as a significant degree of dependent behaviour that is triggered and facilitated by software products. It can lead to both pleasure and relief of discomfort, but unfortunately, in a way that can harm a person socially, physically and psychologically. However, despite its impact on society, DA is still considered outside the boundary of the software engineering. That is, unlike the situation with drugs or alcohol, software engineering has, so far, not been charged with the responsibility for dealing with or mitigating the effects of DA. DA raises new challenges to software engineering in general and requirements engineering in particular. Our research argues for novel approaches, which are able to cater for the diversity, subjectivity and also the private nature of information related to DA, i.e. users' "soft issues" [1].

## 2 Problem, Motivations and Aim

DA is still seen as a problem on the user's side, rather than the responsibility of the software or the software developers. Hence, the problem of DA is typically articulated in a

way that makes the solution entirely within the domain of other disciplines, such as psychology, sociology and health care. For example, Beard [2] highlighted different factors related to the uniqueness of the content, style of use and activity in the “Internet culture”. Widyanto and Griffiths [3] emphasised the addiction ‘on’ rather than ‘to’ the Internet. As such, the Internet is treated as a medium, i.e. single entity, without studying the applications’ features, their designs, the goals they help to achieve or the users’ motivations, values and emotions they should satisfy as primary causes of DA. In contrast, this thesis suggests that the study of these factors inherently belongs to the early stages of developing software; namely requirements engineering. Our work acknowledges Ramos and Berry [4] argument, that requirement engineering can help in mitigating software emotional impacts and, consequently, minimise post-deployment efforts. DA strongly relates to the requirements of users in the first place. People use software as a means to reach certain requirements, however, while doing so, they may get addicted.

The number of publications addressing the role of software design in DA is very limited, e.g. [5] [6] and mainly focused on the attractiveness features of the Internet itself as a medium. A few studies indicate the need for such body of knowledge. For example, Griffiths [6] suggests that future research should focus on the object of the addiction. In [2] [3], the authors claim that there is still lack of understanding of what it is on the Internet that make users addicted. In [7], the authors argue that the “generalised pathological Internet use occurs when an individual develops problems due to the unique communication context of the Internet”.

The aim of this research is to conceptualise “digital addiction” and investigating adaptation-centred user requirements to support social software development.

### **3 Delimitations**

Game addiction will be out of our focus due to its special attributes related to attractiveness features, e.g. visualisation, flow experience, competitions, flexibility characteristics and rewarding mechanisms [8, 9]. The other reason is related to the complexity of validating gaming NFRs such as fun, storyline, continuity and aesthetics [10]. However, in our study we might face similar difficulties as requirement verification via test is always challenging when the requirements are to stimulate emotions as it is explained in [10]. Also games are addictive in their own right, independent of computing and their associated behaviours can be classified under “Specific Pathological Internet Use” [6] which means the addiction is content-driven similar to gambling and viewing pornography. In other words, the behaviour demonstrates attachment to the content, either it is software-mediated or not. However, gaming addiction literature would still be a good source to do comparison study to learn from and get some insights.

The study will target social networking applications, e.g. Facebook, as they have become the dominant theme on the Internet. We have adopted a criterion to determine what we mean by social networking applications. First, it is these applications within a

virtual space and have the following special features: persistence, searchability, replicability and invisible audiences [11]. They should also include the functional building blocks introduced in the honeycomb framework [12], and these are: identity, conversations, sharing, presence, relationships, reputation, and groups.

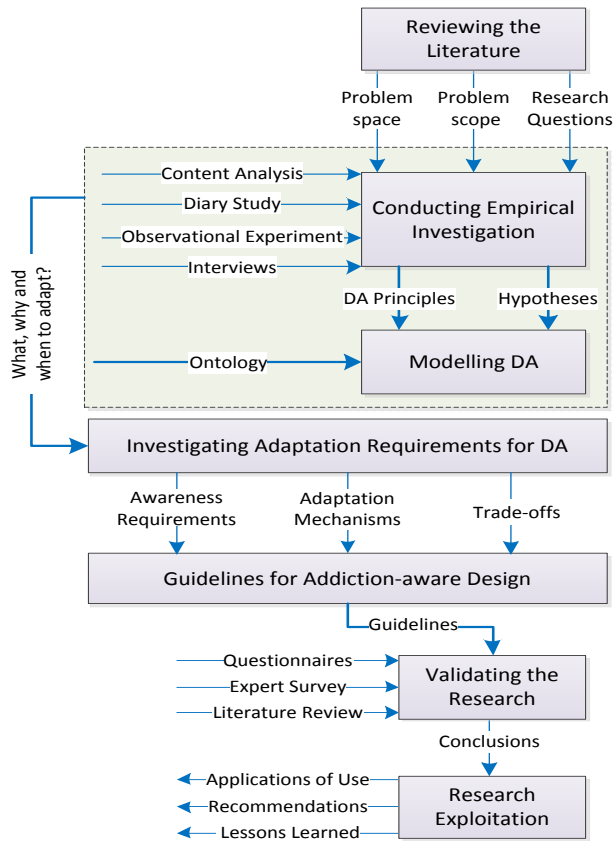
## **4 Research Objectives and Method**

Our main objective focused on conceptualising DA to advance the understanding of how addition elements influencing features and functionalities of social software systems. We hope that findings enable us to build requirements engineering framework for DA and to be supported by guidance materials to help software engineers derive DA requirements.

As communicating these requirements through the development of social software requires an approach; we would provide some guidelines supported by examples to demonstrate how that can be achieved. This work would also provide insights on how RE adapt to cope with DA.

To make this objective manageable and easier to achieve, we have broken it down into intermediate and initial objectives and activities. These are summarised in Figure 1.

In this section we present the method and high-level plan for the research. While, exploratory study is always broad and not fit to answer specific questions, the purpose is to conclude the adequate research design, data collection, subjects selection criterion and to test the feasibility of all of that. Ultimately we hope that studying User Experience (UX) could, ideally, provide insights on the “why” questions. Several studies, e.g., [13-16], showed that user experience is not negatively affected even when social software such as YouTube, Facebook, Wikipedia have poor compliance to usability principles. Therefore, to understand the true nature of DA, the broader scope of UX need to be incorporated by including “felt experience” such as “pleasure, curiosity, and self-expression”, and also what users gain, rightly or wrongly, from particular behaviours. Law et al. [17] concluded that UX is “dynamic, context-dependent, subjective” and must be grounded in User-Centred Design (UCD) practices. For this reason and due to the lack of studies that attempted to associate software aspects to DA, the research will start with using grounded theory approach (i.e. qualitative research).



**Fig. 1.** The overview of research objectives and activities

#### 4.1 Objective 1: Reviewing the Literature

A literature review will be first done to consolidate our understanding of DA and its relation with software design.

#### 4.2 Objective 2: Conducting Empirical Investigations

Given the fact that each method has its own distinct concerns and limitation, it is more ideal to incorporate more than one method to gain better understanding of the phenomena. Therefore we would apply the following methods:

#### **4.2.1 Content Analysis**

We will be considering four-dimensional factors to give sense of scope for the phenomenon, these are; (1) Social software in terms of software design, requirements and goals for which this software is being used; (2) Context of use; (3) Users' personal characteristics; (4) Interaction between the social software and users. The selected sources will be analysed based on the following questions: What factors contribute to DA? What are key concepts/dynamics around the DA? What personality traits make users more susceptible to DA?

#### **4.2.2 Diary Study**

Diary Studies are a type of remote testing and contextual inquiry method used in HCI research to capture data from users in their own settings [18]. This method can enable capturing the causes, i.e. external triggers, of certain emotions such as impulsiveness and how users responded to such feelings. We can also utilise time diaries to find out how much time spent due to a particular feeling.

#### **4.2.3 Observational Experiment**

Users' behaviours will be observed during controlled experiment on selected social software to enable capturing patterns of use, classifying users and identifying software addictive aspects. This will involve collecting some quantitative and qualitative data. Users' thoughts and emotions will be the basis of the qualitative data to identify motivations and preferences. Quantitative data will include some statistical data about users' interaction with the software features and also their emotional response data by some UX metrics [19]. Interviewing subjects will follow to enhance expected results.

### **4.3 Objective 3: Modelling DA**

The inherent diversity of users and the complex nature of DA require collaborative efforts. Therefore, the outputs of objectives 1 and 2 will be used to conceptualise DA components in a form of ontology, to facilitate knowledge sharing, communication and collaboration.

We will investigate how to exploit collaborative ontologies to elicit users perceptions towards DA with the aid of annotation/tagging capabilities to allow collaborators to interact with the model and feed it with community-driven semantics. This with the aid of some techniques such as Wiki-driven ontology [20], Folksonomy [21] and FolksOntology [22].

#### **4.4 Objective 4: Investigating Adaptation Requirements for DA**

Adaptation decisions require identifying what to observe in the environment and the systems itself [23]. The output from the previous objectives should enable identifying what to observe, the features and factors that can be adapted, when, how and, probably, where they can be adapted. This adaptation model is looking to adaptivity features and filtering options, such as persona-based filtering options, attribute-based filtering options and extra filtering to do with other extracts of the DA modelling. This will provide software engineers with sort of requirements to support adaptation decisions. This might include HCI requirements, i.e. heuristics, software development requirements and requirements to do with users' motivations, values and emotions [1].

### **5 Progress**

I am currently finalising the ontology I developed for the concept of DA. I have also produced logical models to identify the main components of DA in different definitions found in the literature to enhance our understanding of the concept.

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