

Towards Integration of Sustainable User Experience Aspects in Software Systems Design: A Human-Centered Framework

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ABSTRACT

The usage of software systems has immense impacts on human psychological well-being (a primary user experience outcome). The World Health Organization refers to well-being as “a positive state”, encompassing e.g., a good quality of life. Studies have shown that the human well-being is dependent on the satisfaction of certain psychological needs. However, normally, the software system development processes capture requirements that are needed to fulfill the purpose of the system itself and not the psychological requirements of humans who use and interact with these systems on an everyday basis. In order to address this challenge, we present a framework, named as SUXEH (Sustainable User eXperiences Enabled Human-centered) framework, that addresses human psychological needs explicitly as one of the main modelling efforts in the early stages of the development process. The framework does so in a way that eases the integration of sustainable user experience aspects (mediated by the human needs) in the systems design phase of the overall development process.

CCS CONCEPTS

• **Software and its engineering** → **Development frameworks and environments**; • **Human-centered computing** → *Human computer interaction (HCI)*; • **Social and professional topics**;

KEYWORDS

Software systems design, Human-centered design, User experience, Sustainability, Human needs, Interdisciplinary

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1 INTRODUCTION AND MOTIVATION

Conventionally, software engineering design methods include guidelines and/or rules on how to specify a system from the perspective of its functionality, that is, what and how the system performs its

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functions. The first objective is always to make the system work according to the specified requirements. The requirements that are mapped to the design phase are typically functional requirements. The non-functional requirements or the software quality requirements are mostly taken care of during the final product evaluation [3]. Whether functional or non-functional, these requirements are normally system-centered and not human-centered. In contrast, recent studies from the more human-centered perspective (see e.g., [2, 4]) have shown that the everyday technology we use has nuanced impacts on our psychological well-being. However, the psychological needs of the people, who use these socio-technical systems and interact with them, have not been normally taken into account during the main software system development activities. On the one hand, and partly due to the demand of short time-to-market and prevalent fuzziness in understanding human-psychological needs, the focus in software systems engineering and the user satisfaction of a system has remained always connected to the fulfilment of the system-centered requirements [1, 6]. On the other hand, software developers lack guidelines on how to cater and analyse human psychological needs during the development process. In this paper, we argue that the identification of human psychological needs at an early stage of software development can play an important role in making design decisions. Inclusion of these needs at later stages specifically once the system has been developed may be difficult, insufficient and expensive.

It has been proposed in the Human-Computer Interaction (HCI) and User Experience domain that certain human psychological needs are mediators of long-term sustainable user experience outcomes like that of human well-being, engagement, and motivation [5]. In order to improve user experience and well-being, the authors in [5] emphasize on supporting certain psychological needs via technology designs using a model named METUX (Motivation, Engagement and Thriving in User Experience). Inspired by the METUX model, we propose a framework, named as SUXEH (Sustainable User eXperiences Enabled Human-centered) framework, that addresses the above cited problem for inclusion of human psychological requirements essential to human well-being (and other long-term sustainable user experience outcomes) in the early stages of the software development process. The main contribution of the framework is the provision of guidelines on:

- The identification of basic human psychological needs relevant to the system to be specified
- The representation of these needs in requirements models
- How and to what extent the system can support these basic needs through its functionality
- Avoidance of designs that can hinder these needs by their negative influence on overall human well-being

- Translation and interaction across fields

2 THE SUSTAINABLE USER EXPERIENCE ENABLED HUMAN-CENTERED (SUXEH) FRAMEWORK

Figure 1 serves to illustrate the overview of our proposed framework. It consists of the functional requirements model of a system to be designed (the functionality goals component), human psychological needs (the enabling goals component), and the goals that are needed to be satisfied for sustainable outcomes of user experience (the user experience outcomes component). These components do not exist in isolation. They belong to domains that traditionally do not negotiate or interact with each other. The SUXEH framework identifies the links between these components that represent different domains, hence allowing these domains to interact and exploit the links between them for better system modelling in terms of improved and sustainable user experiences. These components are different views of the same system enabling us to design holistically for better human well-being.

The SUXEH framework emphasizes on broader impacts of system use on the overall human well-being and other aspects of human life, and not just the direct impacts of user interaction with the system that are usually addressed in the HCI or software engineering domain. The framework presents the following systematic approach:

- Fundamental psychological needs (based on [5, 8, 9]) are identified as *enabling goals* for the sustainable user experience outcomes (e.g., motivation and well-being).
- The high-level enabling goals are then defined within the technology domain to remove fuzziness in its meanings with the stakeholders.
- The enabling goals are refined as low-level sub-goals in a way that precise functionalities can be specified for further use in the software design phase.
- In order to avoid designs that can negatively impact sustainable user experiences (e.g., stimulating binge-watching or addictive behavior), the functionalities are categorized for their positive/negative contributions towards achieving an enabling goal by considering their long term broader impacts on, for instance, overall sustainable well-being.

One of the identified fundamental human psychological needs is *autonomy*. It is defined as “*acting with high willingness and in accordance with personal goals and values*” [5]. Systems that supports “*customization*” and “*offer options*” help in creation of a sense of autonomy and ownership as shown by studies in the past (e.g., in [7]) and proposed by the framework. In order to enable sustainable user experiences, these options and customization support are required to be modelled as those autonomy-enhanced functionalities that impact long term sustainable user experience outcomes like that of human well-being.

3 CONCLUDING REMARKS

We have presented the SUXEH framework that identifies and represents fundamental human psychological needs (that are based on mature psychological theories) explicitly as systems functions in

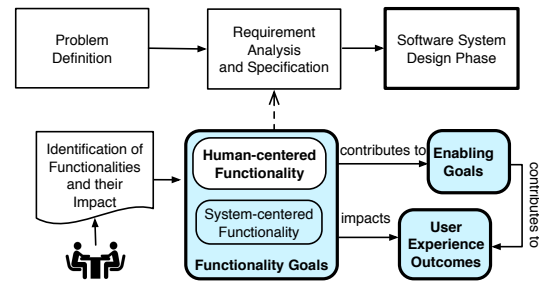


Figure 1: An Overview of the SUXEH Framework

early stages of software development. The SUXEH framework has been applied to case studies (a Taxi System, and Video Streaming not detailed in this abstract). Our framework is generic in a way that it is neither system specific nor end-user specific, and does not bind systems requirements to any specific software system design methodology. Hence, it applies to different types of human users and equally to all types of software systems, and allows translation and interaction across fields.

We do not claim that our framework provides complete guidelines on integration of human psychological needs in the early stages of requirement specifications, but we believe that our framework provides initial directions that guides beyond GUI design and usability, and provides more holistic and realistic picture of integration to address broader impacts on human well-being and other long term aspects of sustainable user experience outcomes. We emphasize that provision of this information in requirements specifications acts as a significant input in making design decisions during software systems development. In our future work, we look forward to investigate (or create) appropriate design methods that can be improved to incorporate human-centered requirements.

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