



**Politecnico
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Scuola di Dottorato ~ Doctoral School

WHAT YOU ARE, TAKES YOU FAR

Doctoral Dissertation
Doctoral Program in Management, Production and Design (35th Cycle)

The Role of Engagement in Emotional Design

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Abstract

User engagement (UE) defines the link between a product and its users and measures whether users feel interested and involved. Identifying it correctly and selecting the most appropriate analysis method can provide meaningful information that could be used as input during the design process. Likewise, Emotional Design considers not only users' requirements but also their perceptions and reactions during and after an interaction with a product, service, or experience. In this sense, the literature regarding the technics for analyzing UE shows a higher prevalence of self-report over physiological methods, which implies an opportunity to include physiological metrics (electroencephalography, heart rate) and investigate further novel models to recognize if a user is more or less engaged.

For this work, a set of models, methods, and tools were selected to investigate the role of engagement. Specifically, Design Thinking (DT), the Technology Acceptance Model (TAM), electroencephalography (EEG), and heart rate are applied in selected contexts, such as e-learning, advertising, spaces design, and VR.

The benefits of UE have been explored by deploying iterative methodologies conceived to increase users' involvement throughout the innovation process. As a first case, aiming at designing a more sustainable and viable solution, this work presents a conceptual design of the main sterilization chamber for infectious waste treatment obtained by DT deployment. Furthermore, considering that UE dimensions encompass users' attitudes and usage behavior toward new systems, TAM was selected, as part of this work, to analyze and define the determinants for successfully adopting an e-learning tool designed for EU farmers and agricultural entrepreneurs.

On the other hand, in view of the possibilities associated with physiological technics, the subsequent investigations are related to the search for a link between EEG and UE. For this purpose, three experiments were designed to explore if the EEG could assess the user's perception while interacting with a product/service. The first experiment aims to verify if an advergame creates a higher incidence in the UE, positively influencing user purchase intention (UPI). The second analyzes using a VR environment, whether the forms and chromatic changes in the lightning condition can affect the users' emotions evaluated through their valence, arousal, and engagement. The third experiment, similar to the previous one, used EEG-based metrics to analyze the users' perceptions while exploring five VR

scenarios conceived to elicit five particular emotions. Finally, an additional study regarding the use of heart rate as a means to understand student engagement is presented.

This work demonstrates the possibility of obtaining feasible results based on users' behavior analysis. Methodologies and models, such as DT and TAM, are characterized by their focus on the users and their capacity to include different stakeholders. By considering users' needs from the early stages of the design process, the results can be reflected in a better perception of the products and services offered and increased engagement. In addition, physiological technics provided reliable quantitative information to improve the emotional analysis and to frame users' feelings and perceptions while avoiding subjectivity in the responses.

The entire methodology was developed to support current research on emotional design. Each investigation contributed to the overall goal of providing solid evidence about the benefits of UE assessment and its role, including methods and tools for measuring and analyzing it during the design and development of a product, service, or experience.

This work intends to allow future researchers to consider the UE as one prominent indicator of product success and contribute to emotional design analysis. The obtained outcomes can be regarded as a potential foundation for future applications aiming to consider UE as a determining factor in their research.