Emotion-Driven Specifications in Interactive Artworks

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Abstract. Although emotions are well-recognized features in affecting human behaviour, little research has been undertaken on the inclusion of emotions in the non-functional requirements of a software system. Recently, interactive art became an exploratory field where artists and software engineers collaborate in the creation of art pieces; thus, through technology and software tools, human body expressions are translated into artistic products. The aim of our project is to understand the process that generates specifications during the viewer's experience with an interactive art installation where non-functional requirements are described by emotions. Therefore the emotion-driven specifications that we aim to obtain will define the hardware and the software of the interactive art installations to be developed in order to convey the desired emotions to the audience. In order to acquire these results, we create proof-of-concept artworks described by a conceptual modelling language and verify their functionalities.

Keywords

Emotions, interactive art, non-functional requirements, specifications

1 Introduction

Emotions are recognized as a driven force of the human activities. Although considerable research has been devoted to emotion recognition in the field of HCI, rather less attention has been paid to its analysis in requirements engineering [1]. The existence of user interfaces capable of detecting body gestures, facial expressions and scripted voices needs to be supported by the inclusion of emotions in the software requirements in order to predict and influence human reactions. Thus, emotions can become an important feature in monitoring human-computer interaction. Nowadays even many advisory systems such as e-health systems tend to reach their goals targeting our emotions [2]. Since emotions act as goals in software production, more effort should be conveyed in order to derive methodologies to capture emotions in the requirements in a consistent way.

The scenario of interactive art can offer itself as a playground to test human perceptions and aesthetics. Moreover, the viewer's emotions are recognized as one of the main non-functional requirements since they offer an insight into the viewer's engagement level with the art piece. Through the inclusion of technology, interactive art creates a new experience of human-computer interaction; "interactive art, in its many forms, is vitally concerned with these same issues and it is important to see what each area can learn from the other" argued Edmonds et al.[3] referring to the issues investigated in the HCI field.
Thus, in our research, we consider emotions as non-functional requirements of interactive installations and study the implications on the system functionality, since emotions, as pointed previously, are believed the driving force of human activities during interaction.

2 State of the Art

Since the early 60s, artists and software engineers have been collaborating during the design and development of interactive artworks. The necessity of this interplay comes from the different competences that are required during the creation. Artists own the idea and the message to convey through a certain piece of art, whereas software designers and developers, following the requirements predefined by the artists, implement the software that will transmit a certain output to the audience. Furthermore, Glass and DeMarco [4] state that by developing artworks the field of software engineering could be fed by "innovation and creativity", attributes that generally own to the art scenario. Thus, new methods, models and tools devoted to innovation in software could be boosted by the collaboration of artists with software engineers. An example of multidisciplinary team is the SArt project, where members of the Software Engineering group of the Norwegian University of Science and Technology (NTNU) develop softwares devoted to the functionality of interactive art pieces [5]. Software engineers have to overlook the computational complexity at the increasing of the requirements. Many recent studies convey in identify the requirements elicitation as an unsolved issue in art projects faced by a multidisciplinary team. The computer scientist C. Machin [6], describing the artwork Priva-Lite Panel Construction Digital Garden realized with the artist E. Rolinson, stresses the challenge in the requirements definition. As argued by Browne et al. [7], a modular approach in the design is necessary to avoid complications that results by the addition of further functional requirements desired by the artist. Often the latter have no clear idea of what the artwork should generate, therefore his/her demands are changing, leading to the process of "evolutionary prototyping" where scientists transform continuously the developed prototype to satisfy the artist's request [8],[9].
Bentley et al. [10] state that research on emotions in software engineering has been sufficiently driven in the past, however it remains at a theoretical level, without being tested. Their contribute in designing a computer game, where user's engagement was treated as the main goal. Nevertheless, no validation was

conducted and therefore no implementation followed to the suggested design. Two techniques have been developed by Hassenzahl et al. [11] to account enjoyment among the non-functional requirements. The same factor was included among the emotions considered in designing video games by Callele et al. [1]; the capture and the expression of emotions during the engagement was the objective of that study. The proposed design was context-aware and difficult to implement in many video games; moreover, further research appeared necessary in order to better relate "look and feel" for conveying certain emotions during the game. Wierzbocki et al. [12] present an art installation, where the viewer's emotions are translated into led light signals through the analysis based on face recognition. This example of interactive artwork is one of the few examples where emotion are explicitly addressed in interactive art.

3 Emotions as non-functional requirements

Models including emotions among the non-functional requirements of a software system have been proposed, nevertheless the application of these models to software products revealed limitations [11,12]. Furthermore, the integration of a cognitive perspective of the viewer engagment among the software requirements has been disregarded so far in the artistic context. Since emotions act as goals in software production, more effort should be conveyed in order to derive methodologies able to capture emotions in the requirements in a consistent way. The theoretical approach is not been sufficiently supported by experiments conferring evidence to the intuition. "Traditional software engineering methodologies and tools are poorly suited to develop new media applications", argued Biswas et al. [13].

We face the problem of the inclusion of emotions in the non-functional requirements of interactive artworks starting from the definition of a emotion-driven requirements modelling language to the understanding of the specifications process. The formulation of a emotion-driven requirements modelling language is achieved defining the goal models of the agents involved in interactive art pieces. In our case the agents are the viewers, whose emotions are described by a cognitive model and the installation, whose aim is to induce certain emotions on the participant. Comparing the two goal models, their completion can be deduced and agents' plans can be designed in order to fulfil the given non-functional requirements. Different scenarios will be defined to better design the requirement driven architecture, where soft-goals and task will represent the interaction to accomplish the ultimate goal to induce certain emotion in the participants during the engagement with an interactive art piece.
Parallel to a deductive approach, we follow an inductive method testing the artworks functionalities and enquire users, in order to validate the defined emotion-driven requirements modelling language and gather information about the specifications generation process. In particular, prototyping is the method we follow during the artwork implementation, since it allows to redefine the software and

the hardware continuously to better match the fixed requirements. The choice of following both an inductive and deductive approach is necessary to match the theoretical framework given by the emotion-driven requirements modelling language with the experiments obtained through the interactive artwork prototyping.

This study conducted on interactive art installations could lead to the creation of new approaches to be adopted on other software products where interaction is set as the main goal. Moreover, our findings could offer further insight into the human-computer interaction field where emotions are targeted.

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