PREFACE

End-User development challenges for creative computing

1. Introduction

Human creativity has been the focus of research on issues traditionally pertaining to the Arts and Humanities, but also to help in activities of our daily life. Creativity is also one of the fields that has long been supported by information technology and computing, which can be thought of as a combination of understanding, as is the focus in Science, plus a constructive activity referred to as shaping, as is the focus of Engineering [1]. Regarding the latter, as a result of the exponential evolution of computing, its relation with creativity has evolved, giving rise to new concepts such as creative computing [2,3]. The central idea of creative computing is to use all available knowledge in the field of computing to facilitate human creativity. In this vein, end-user development has much to say to improve humans' creativity [4]. Along with understanding, the human capability of shaping through computers can emerge either at programming or software engineering level. Since the differences between the former are fundamentally in the degree of participation of the end-user in the software creation and in the quality of the created products, end users can focus on the entire life-cycle of software development, its design and programming, or only the construction phase.

2. Papers in the special issue

The first paper [5], presents the Data Exploration for Design (DEfD) method, a design inquiry method that was developed to enable and guide designers to creatively explore and use datasets for design inquiry. This creative exploration of data is aimed at enabling valuable inferences to be extracted for the design process, which would otherwise have been more difficult to find technically through the use of other design research methods. The DEfD method supports data exploration in different design situations through three stages: problem framing, exploring and inferring. The method was used in a pilot study with novice designers, generating not only valuable results for the design process, but also contributing to the training of participants in data, informing them about how to creatively use data exploration for design inquiry.

The second paper [6] proposes the integration of user-centred design in the Agile software development methodologies. Through this approach, they conduct a user study that provides an insight into how end-users would design a progressive web app for digital cultural heritage. By conducting an observational research design that centers on a focus group approach to gather user requirements and design ideas, the study found that users prefer a simple and pleasing design with an emphasis on visual representation, and straightforward and intuitive navigation to minimize cognitive load.

The third paper [7] addresses end-user programming in the context of smart home environments. Reisinger, et al. compare three different approaches of end-user programming in a home context with regard to their usefulness and understandability. A empirical study with users was conducted by performing three types of tasks (understanding, configuring, and programming), and using three different approaches

for end-user programming (form-filling, data-flow, and grid-canvas). The study found no significant differences regarding the intelligibility of the three different implementations, but significant differences between prototypes, specifically in task completion time, rate, perceived success, and perceived configuration difficulty in the configuration task, and in task completion time and programming difficulty in the programming task.

The last paper [8] presents a model-driven framework to automatically develop visual editors to work with domain specific languages in tangible interaction environments, which take advantage of multimodal interactions and augmented reality. The framework consists of a systematic method, a metamodel for defining multi-modal editors and some supporting tools. The framework has been applied in the development of editors for several models in software engineering, with results that provide evidence of its potential to support the teaching of modeling and to work with models in this field in an innovative way.

3. Reflections on creative computing

From the reflection on the works reported in this issue, we find three key areas related with the body of knowledge in the interplay of end-user computing and creative computing, namely knowledge combination, human-centered computing and technology-enhanced learning.

• First, the combination of knowledge provides a creative base for generating new ideas and solutions, which not only helps solve problems but also inspires and encourages innovative activities. Creative computing is essentially about combining knowledge, about how it can improve human creativity, as has been proved to be the case in Big Data and Artificial Intelligence [3]. Knowledge combination explores how creative computing is a valid tool for connecting and combining a great variety of knowledge.

• Second, human-centred computing is the union of a large number of disciplines dedicated to human knowledge and software design. Traditionally the concerns of human-centred computing have been focused on ergonomics and usability, but also on the systems and practices of the human use of technology, placing humans at the centre of the computing environment to augment their creativity and expression [9].

• Finally, beginning from the nature of creative computing as a tool for the improvement of human creativity and the combination of knowledge, one of the most interesting areas of development is learning and learning environments. There is a great demand for the improvement of creation of learning contents and processes through computing, particularly through what is called computational thinking [10]. Technology-enhanced learning can deal with computational thinking and creativity as a tool for both authoring and analyzing learning contents and processes.

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