

GUEST EDITORIAL PREFACE

Special Issue on Creativity-Centered Design and the Digital Arts

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This edition of the Journal of Case of Information Technology focuses on the nascent area of Ubiquitous Music (ubimus), which encompasses computer music, human-computer interaction, and ubiquitous computing (Pimenta et al. 2014). Much of the work in this area has looked at practices that can empower participants of music-related activities and their experiences through creativity-enhancing tools (Keller et al. 2014). Mobile devices have been shown to enable opportunities for such practices, in a variety of scenarios and levels of musical ability. They have allowed researchers to study questions of everyday creativity, with encouraging preliminary results (Farias et al. 2016).

Another side of this work touches the development of computer music technologies: languages, interfaces, applications and custom hardware (Lazzarini et al. 2016; Timoney et al. 2016). This ties the revolution in creative coding that has opened up the implementation of new tools for artistic purpose, with the maker movement in electronic device fabrication. The availability of open hardware, in the form of mass-produced miniaturized computer systems ('systems on a chip, SoC'), plus the sharing of circuit design and components ('DIY hardware') has allowed new forms of artistic interventions. Such technology, also coupled with off-the-shelf computing devices (both mobile and desktop), and an all-pervasive networking infrastructure, is bringing on the emergence of an Internet of Musical Things (IoMT), which is likely where the state-of-the-art in ubimus research is heading.

Lazzarini and coauthors' (2016) paper focuses on the prototyping stage of the design cycle of ubimus ecosystems. Three case studies of prototype deployments for creative musical activities are presented. The first case exemplifies a ubimus system for synchronous musical interaction using a hybrid Java-JavaScript development platform, *mow3s-ecolab*. The second case study

makes use of the *HTML5 Web Audio* library to implement a loop-based sequencer. The third prototype - an HTML-controlled sine-wave oscillator - provides an example of using the Chromium open-source sand-boxing technology *Portable Native Client* (PNaCl) platform for audio programming on the web. This new approach involved porting the Csound language and audio engine to the PNaCl web technology. The PNaCl Csound environment provides programming tools for ubiquitous audio applications that go beyond the *HTML5 Web Audio* framework. The limitations and advantages of the three approaches proposed - the hybrid Java/JavaScript environment, the HTML5 audio library and the PNaCl Csound infrastructure - are discussed in the context of rapid prototyping of ubimus ecosystems.

Timoney et al. (2016) discuss an initiative to create an intelligent technical architecture capable of delivering embodied, flexible, and efficient rhythmical stimulation adapted to individuals' motor performance and skills for the purpose of enhancing or recovering movement activity. This research exemplifies the principles of ubiquitous music research and how knowledge from this field can target creativity-driven social enhancements. Case studies illustrate the potential applications and a discussion of suitable theoretical guidelines closes the paper.

Farias et al. (2016) present a series of experimental studies targeting ubiquitous musical activities. The studies explore the application of *time tagging* as an aesthetically oriented interaction design metaphor. A new support mechanism is proposed: *the stripe*. The stripe works as an entry point to the sound data providing a functional unit that features both interaction and audio manipulation. A new prototype based on the stripe metaphor was implemented. Twenty four subjects participated in the assessment of three creative sonic products produced with and without support for time tagging. Results indicate that – provided equivalent conditions – creative products obtained through asynchronous activities demand a larger temporal investment but do not necessarily yield more creative outcomes. The paper concludes with a discussion of the implications of the obtained results for aesthetically aware interaction design.

Keller et al. (2016) identify three methodological approaches to creativity-centered design: the computational approach, the dialogical perspective and the ecologically grounded framework. These methods relate to the current definition of ubiquitous music. The authors address both the social and material factors that shape creative musical phenomena within ubiquitous music making. The second section discusses a design study highlighting the concepts laid out in the first part: activities and resource usage. A split between creative products and resources, which points to three material observables, frames this discussion: resources, products and by-products, including creative waste. Two new design qualities are proposed: *volatility* and *rivalry*. The paper concludes with a summary of the study results, suggesting further explorations of the ecological framework as applied in ubiquitous music experiments.

Schiavoni and Costalonga (2016) propose a Computer-Science-oriented reading of ubimus practice. Ubiquitous music research has been explored by practitioners and researchers targeting the expanded possibilities of music making “anywhere, anytime and by anyone” (Pimenta et al. 2014). Part of this paper presents concepts, features and challenges on Ubiquitous Computing (ubicom), highlighting the challenges that have forced new strategies in development and conceptualization of technological systems. The authors focus on the technical contributions brought by uicom and propose models that can help ubimus researchers to reach their goals.

The research scenarios presented in this volume point to the fact that, as technology changes our living environment, we need to look deeply into how this affects music creation, performance, appreciation, consumption and our future on Earth. It is therefore of significance that we seek to understand how these new forms of creative endeavour are shaped in practice. The formulation of case studies to examine these questions is one of the paths chosen by researchers in the field (Farias et al. 2016). Another strategy targets the development of high-level models that

are not dependent on specific technology (Keller et al. 2016; Schiavoni and Costalonga 2016). This approach tries to deal with the early-obsolence phenomenon that characterizes current unsustainable industrial practices. One of the manifestations of this trend is the massive production of technological junk. Knowledge that is not tied to a short-lived device or instrument may be applied to multiple contexts, thus providing a way to deal with the speed of technological development without its deleterious environmental side effects. One example is the concept of ubiquitous musical ecosystem (Lazzarini et al. 2016). Ubimus ecosystems encompass multiple tools that work at various levels of integration, thus providing a flexible approach to both musical interaction and audio synthesis and processing. Through the repurposing of existing know-how -- adopting the well-established Csound digital processing language -- and of widely used tools -- such as the web browser -- ubimus ecosystems furnish a path to community-shared construction of musical expertise. Thus, the data provided by hands-on studies can be put to immediate use through easily accessible development tools. This close exchange of knowledge highlights the beauty of carrying out research within a community in permanent dialogue that praises collaboration.

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