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## **Quantum Music, International interdisciplinary project (2015–18), Creative Europe, EACEA (559695-CREA-1-2015-1-RS- CULT-COOP1)**

It is not easy to reflect on the project that occupied the better part of the last three years of my life. While the memories and impressions are still vivid, it may be too early to tell whether it will have a lasting impact. The project in question was called *Quantum Music* by its masterminds, former classmates at the Mathematical Grammar School in Belgrade: Vlatko Vedral, Professor of quantum physics at the University of Oxford and the National University of Singapore, and Dragan Novković, Professor at the Department of Audio and Video Technologies of the School of Electrical and Computer Engineering in Belgrade. For the first time, an institution from Serbia – the Institute of Musicology SASA – became the project leader within the *Creative Europe* programme, whilst the international consortium of partners and associate partners gathered together cultural, higher education and research institutions from Serbia, Slovenia, Denmark, the Netherlands and the United Kingdom.

The main objectives of *Quantum Music* were to explore how the seemingly distant worlds of quantum particles and everyday sounds could interact and to bring the abstract principles of quantum physics closer to a wide audience by means of music. The project was kickstarted by a series of quantum-acoustics experiments during which particles exhibited characteristics that could be converted into audible sounds. Namely, in temperatures close to “absolute zero” ( $-273,15^{\circ}$  C), all wave functions of separate atoms turn into a single wave function; this is the quantum “sound”.<sup>1</sup> While we cannot hear it, quantum physicists have been able to work out equations and formulae upon which such events occur; hence Vedral and Novković decided to transfer these inaudible quantum “sounds” to “our world”. My own

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1 Cf. Marko Rančić, „Kad atomi đuskaju svi kao jedan – Boze-Ajnštajnov kondenzat“, <http://www.svetnauke.org/9674-kad-atomi-duskaju-svi-kao-jedan-boze-ajnstajnov-kondenzat>

motivation for accepting their invitation to be the project coordinator was sparked by the opportunity to create something new and thus revive the spirit of the maverick post-WWII avant-garde “obsessed” with progress, innovation, technological breakthroughs and new sounds. At that point (in 2014) I had only recently returned to Belgrade to take up the post of a researcher at the Serbian Academy of Sciences and Arts, having previously lived in Manchester for almost seven years; hence I was institutionally well positioned to lead a project that aimed to connect science(s) and art(s).

The research took the international consortium in several directions, starting with the creation of new hardware that transformed the classical piano into a hybrid analogue-digital instrument. As noted by Jelena Janković-Beguš and myself, “Whilst creating the hybrid piano and soundbanks for it, the scientists, engineers and musicians found themselves ‘on the same wavelength’ [...] although they arrived at that meeting point from different directions. Specifically, the scientists were interested in ‘hearing’ the quantum world, while musicians aimed at expanding the sound range and expressive possibilities of traditional keyboard instruments.”<sup>2</sup> The idea for creating the hybrid piano came from LP Duo (Sonja Lončar and Andrija Pavlovič) whose diverse concert activities include performances both on classical pianos and on a variety of synthesisers, especially old analog synthesisers, of which they are avid collectors. However, they have always complained that even the best of contemporary synthesisers neither have the mechanism nor the dynamic range of grand pianos. The engineer Darko Lazović fulfilled their dream of creating an electronic instrument that retained genuine piano mechanics and enabled the demonstration of the entire spectrum of pianistic virtuosity, while at the same time introducing a variety of new sound colours and new performance possibilities. This was complemented by a creation of a new software interface for this new hardware, but also of soundbanks synthesized on the basis of equations obtained during the experiments in the quantum laboratories.

The second, artistic direction involved creation of a new music genre; composition, performances and distribution of the first quantum music pieces based on the study of the behaviour of quantum particles (and not merely on the use of quantum computers), as well as composing new music and rearranging pre-existing music for the new hybrid instrument. This was followed by the creation of an audio-visual narrative that accompanied concert performances of these new quantum music pieces, in order to introduce and explain to the audience the most important phenomena of the quantum world, such as quantum vacuum, entanglement, superposition, wave function and collapse, teleportation etc. The Quantum Music multimedia show was successfully performed in six cities in Spring and Autumn 2017 (Singapore, The Hague, Copenhagen, Aarhus, Ljubljana and Belgrade). Further

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<sup>2</sup> Ivana Medić and Jelena Janković-Beguš, “What Does Quantum Music Sound Like and What Would Pierre Boulez Think of It? *Super Position (Many Worlds)* by Kim Helweg (2017)”, *Muzikologija/Musicology* 24 (1/2018), 83.

performances were given throughout the year 2018 in London, Paris and New York. As part of this project, an international interdisciplinary conference devoted to Quantum Music was held on 21 and 22 March 2018 at the Serbian Academy of Sciences and Arts, under the auspices of the Ministry of Education, Science and Technological Development of the Republic of Serbia. The conference, which attracted a large number of listeners as well as considerable media attention, gathered together physicists, mathematicians, engineers, composers, musicologists and pianists, who were either directly involved in the realisation of the eponymous Creative Europe project, or involved with similar research within their institutions, independently of our consortium.

The project *Quantum Music* opened a new chapter in the relations between science, technology and music, leading to the discovery of new sound worlds. Moreover, for the first time in its history, music was offered the chance to contribute to science by transferring/translating quantum experiments to our audible world. Our long-term goal is to continue to popularize the new hybrid keyboard instrument, the soundbank of quantum sounds and the new music genre to the widest possible audience, but also to further the educational side of the project and to expand and intensify our collaboration with prestigious institutions and individuals in the fields of science, arts and technology worldwide.

Article received: November 5, 2018  
Article accepted: November 15, 2018