4 Disklavier Preludes

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Fig. 1. Still frame of *Disklavier Prelude #4.*

1 PROGRAM NOTES

4 Disklavier Preludes is one of the main works in *The Gedanken Room* (2021). This is a work that explores the implications of Quantum Computing for Music composition, both conceptually and practically. Its 4 parts explore the use of the Disklavier both as an input and output interface for building Quantum Circuits and retrieving its measurements, in a live interactive multimedia environment with which live performers interact. The cinematographic narrative addresses utopian/dystopian issues in human-machine interaction.

2 PROJECT DESCRIPTION

2.1 The Context

The work *4 Disklavier Preludes* is a creative music and multimedia exploration of the implications of Quantum Computing (QC) for Music composition and performance. Its 4 parts are integrated into *The Gedanken Room* film-recital [4], premiered in 2021, that addresses QC and Music, drawing each piece as a thought experiment inside a border-less dark room.

This creative work emerges in the context of the larger research project titled *Adventures in Quantumland* [3], where we can find a review of different attempts for an integration of QC in creative practice. The current approach, known

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as Quantum-computing Aided Composition (QAC), focuses on using QC in mostly realtime interactive scenarios in articulation with live (human) performers [6].

The *4 Disklavier Preludes* were also composed in direct reference to Russian performer-composer Alexander Scriabin (1872-1915). His music and characteristic harmonic explorations permeate the 4 preludes, as well as his multimedia and multi-disciplinary curiosity. It is known that Scriabin explored colors and light in his creative work and, incidentally, that he also felt he needed to learn about physics and quantum mechanics [1, p. 135].

The very first four notes played, C4 Bb4 F#4 and D5, denote the essence of the most iconic harmonic trait of Scriabin's music: the mystic chord. These four notes allow one to construct all the variants of the mystic chord since, in the derived dominant articulation, C4 and F#4, as tonic and #4, trade places, while Bb4 as the b7 will give us the major third, and D5 as the 9 will give us the #5, which is part of the whole-tone-mystic variant [2, p. 30].

2.2 The Technology

In each Prelude the Disklavier is connected to a computer running different combinations of custom software devices that both read and activate the keys and pedals of the instrument. At this point, the connection with QC is not only conceptual but also practical. *4 Disklavier Preludes* is one the first works making use of *The QAC Toolkit*, a software package that allows musicians and artists to build, run, and simulate quantum circuits [5]. QC is used in the generation and transformation of MIDI note events, or clips, that are sent to the Disklavier, via the MIDI interface. More detailed information can be seen in [3].

Fig. 2. Still frame of *Disklavier Prelude #1.*

2.3 The Narrative

The first Prelude is set as a study session. The performance starts by progressively exploring an harmonic space that is constructed with the help of a program controlling the Disklavier response to keys pressed. By the end, a simulated

quantum circuit decides which notes to play on the Disklavier while the performer creates a minimalist accompaniment on the fly.

The second Prelude is preceded by an interlude where the performer can be seen asking a machine about Heisenberg's Uncertainty Principle. The machine then re-tells the story of Heisenberg discovering the way electrons behave in the atom, as articulated by Carlo Rovelli [8] - an episode that led to a first form of quantum mechanics. The second Prelude plays precisely with a depiction of that.

It is interesting to note that while *Disklavier Prelude #2* is the only piece without a live human performer on stage, the music played by the Disklavier includes a section of human transcribed performance. Here again in direct reference to Alexander Scriabin, who was recorded by some of the early player-piano machines (the predecessor of the modern Disklavier) - the Hupfeld Phonola and the Welte-Mignon [7].

Disklavier Prelude #3 includes the participation of a dancer and an acting role. In it, we can see the dancer being activated by the actor coming into the scene wearing a lab coat. The semi-mechanical movements of the dancer, going back and forth, represent both "particles and virtual particles" (the theme of this Prelude) as well as the constrains imposed by the controlling, *all seeing* light. This piece is also offering a strong critique of modern society and its relation with technology. In particular, it critiques the blind belief that social media and virtual reality are inherently positive for individuals and society, and help to connect people without significant downsides.

The last Prelude is a duet for Disklavier and saxophone. The Disklavier is playing and transposing whole-tone-mystic chords while the saxophone player is improvising, trying to anticipate and respond to the imposed harmonic changes. In this way, it completes the overall movement where Preludes increase melodically in the number of notes while reducing the number of possible harmonic combinations. Visually too, there is an uncertainty relation being expressed here between the dancer's exact position and movement, where the movement is expressed by the light color change at the same time that the exact position remains invisible/unknown.

Fig. 3. Still frame of *Disklavier Prelude #2*.

Fig. 4. Still frame of *Disklavier Prelude #3.*

3 MEDIA LINKS

- Video: https://www.youtube.com/watch?v=YW0qvONZF6c

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REFERENCES

[1] Faubion Bowers. 1973. *The new Scriabin; enigma and answers.* StMartin's Press, New York.
[2] Bettsylynn Dunn Goldwire. 1984. *Harmonic evolution in the piano poems of Alexander Scriabin.* Ph.D. Dissertation. Thesis DMA–University of Texas at Austin.
[3] Omar Costa Hamido. 2021. *Adventures in Quantumland.* Ph.D. Dissertation. UC Irvine. https://escholarship.org/uc/item/93c1t8vx
[4] Omar Costa Hamido. 2021. The Gedanken Room. https://www.imdb.com/title/tt14443510/ IMDb ID: tt14443510 event-location: USA.
[5] Omar Costa Hamido. 2021. The QAC Toolkit. https://www.quantumland.art/qac
[6] Omar Costa Hamido. 2022. QAC: Quantum-Computing Aided Composition. In *Quantum Computer Music: Foundations, Methods and Advanced Concepts*, Eduardo Reck Miranda (Ed.). Springer, Cham, Switzerland, 159–195. https://doi.org/10.1007/978-3-031-13909-3_8
[7] Anatole Leikin. 2011. *The performing style of Alexander Scriabin.* Ashgate Pub, Farnham ;.
[8] Carlo Rovelli. 2016. *Reality is not what it seems: the journey to quantum gravity* (first american edition. ed.). Riverhead Books, New York.