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Listening Under Algorithmic Conditions

Benjamin Heidersberger's
Pentatonic Permutations



The *Pentatonic Permutations Player*.

If we take the artist – work – listener triad as the basis for an analysis of musical works of art, how can algorithmic compositions be located in that context?

I will examine this question by using Benjamin Heidersberger's piece *Pentatonic Permutations* to scrutinize how the relation between work and listener changes under algorithmic conditions.

The *Pentatonic Permutations*

The compositional concept of the *Pentatonic Permutations* is already present in the title of the work: Heidersberger permutes the Japanese Kokin-Joshi Scale, a hemitonic pentatonic scale with the intervals 1-4-2-3-2 (in semitones). In doing so, he takes advantage of the potential of computer-based algorithmic composition. At no point does the work appear in musical notation. Instead it exists from the very beginning in numerical relations that find their expression in sonic¹,

i.e. in electrical or acoustic-mechanical form: A computer program generates the composition as MIDI events, which are then played by a software synthesizer in Linux. Accordingly, the *Pentatonic Permutations* are performed as a computer-based sound installation without any interference from human actors. That this performance practice is clearly intentional can be seen in the way that the project's media technology was developed: Having started off as a rather experimental setup with loose components, the artist transferred the design into a small chassis with hardwired parts. This mobile *Pentatonic Permutations Player* is suitable for both private and public sound installations.

Cosmological and cosmogonic dimension

The *Pentatonic Permutations* undermine what could be called, in a methodological sense, the common relation between work and listener. Such permutations of traditional relations are of course nothing new in the field of contemporary music. However, the *Pentatonic Permutations* are particularly suitable for shedding light on the changing relation between work and listener under algorithmic conditions. This fact originates in the *cosmological* and *cosmogonic* dimension of the work:

Within the *Pentatonic Permutations*, 16 sequences of tones get phase-shifted. Each of these tone sequences contains a different number of notes: Their lengths equal the 16 prime numbers from 2 to 53. The tones of these sequences are called up one after another, one tone per second. The timing and order of their appearance is strictly determined by the algorithm, i.e. the work does not contain any random elements. As there are also pauses

¹ For the concept of the sonic see: Wolfgang Ernst, *Im Medium erklingt die Zeit*, Berlin 2015, 93-115.

and inaudible notes, the tones of the piece do not resound every second like the ticking of a clock. Instead, there are often gaps between the tones. The moderate tempo and the slowly fading samples of a Steinway grand-piano place the *Pentatonic Permutations* in the context of minimal music and meditation music.²

The *cosmological* aspect of the work results directly from the phase shift: Heidersberger's structuring of the piece ensures that every possible permutation of the 16 tone sequences appears exactly once before the performance ends. Considering the given playing speed of 60 bpm, this yields a running time of 16 trillion years for the *Pentatonic Permutations* – a period exceeding any human experience and, according at least to some physical theories, also the estimated lifetime of the cosmos.

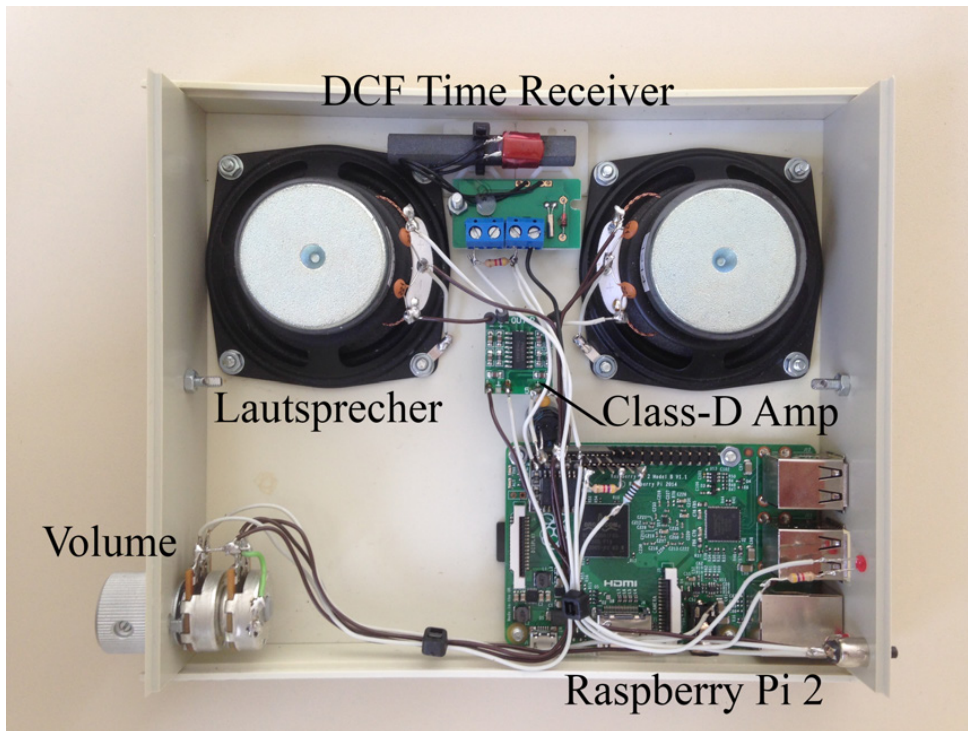
The *cosmogonic* aspect of the *Pentatonic Permutations* is also created by technical means: No performance of Heidersberger's work begins with the first tone.

Instead, the piece always starts at the particular point it would have reached at that certain moment, if it had begun with the big bang 14 million years ago. In this way, the work marks the hour of the birth of the universe and the time of its own performance in a unique way. This means that when a performance begins or a private listener tunes into the piece with the *Pentatonic Permutations Player*, the *Pentatonic Permutations* do not start to play, rather it is as if they have been playing literally *the whole time*.

² For an impression of the *Pentatonic Permutations* please visit: https://soundcloud.com/benjamin_heidersberger

The relation between work and listener

The *Pentatonic Permutations* are, of course, not the only work of art that a listening subject can experience only in extracts due to its duration. Most prominent in this regard is the automatically playing version of John Cage's *ORGAN²/ASLSP* in Halberstadt. However, at 16 trillion years long, the running time of the *Pentatonic Permutations* can only be expressed numerically or be



The technical setup of the *Pentatonic Permutations Player*.

computed in the strong technical sense of that word. Therefore, the work transcends not only the human lifespan, but human imagination per se. Furthermore, the cosmogonic coupling to the big bang suspends the free variability of the time axis, as has been the custom for media players in private use since well before the phonograph. The concrete technical implementation of the compositional intention by the means of the time signal transmitter DCF77 differs significantly from any written instruction in a musical score. Despite the provability of its unity, the work is always only ever constituted as fragmented in the listening experience. It transcends the human as a subject of knowledge and as an actor and therefore fundamentally questions the understanding of humans as the measure of all things.

But how to listen to the *Pentatonic Permutations* under these conditions? The listener who approaches the piece naively initially hears the sound of the meditative music, which doesn't necessarily reveal its algorithmic origin. On the other hand, the listener who approaches the work with a knowledge of its concept finds him- or herself undergoing a different listening experience that has

changed due to the awareness of the piece's dimension as a cosmic clock. This demonstrates that at least some knowledge about the concept of the *Pentatonic Permutations* is vital for grasping the cosmologic and cosmogonic aspect of the work. The sound in its material manifestation is just not sufficient.

Is the transcending of the subject as it is constituted in the common relation between work and listener therefore only a conceptually generated chimera? In the end, the *Pentatonic Permutations* have only been conceptually playing since the big bang, or it at least seems that they have. Against these assumptions it could be argued that Heidersberger's performative act inscribes the cosmologic and cosmogonic aspect of the work in the concrete operativity of the media technology. Here, a sentence by Helga de la Motte-Haber seems to apply in a slightly radicalized form: As she writes, it are the cosmological dimensions of sound that first take shape in the artistic subject. Traditionally, it was the art of composition as a technique of the artist that could, on the one hand, be hidden from the listener and which was, on the other hand, at least partially necessary for the constitution of the "right way of listening."³ Today, in contrast, it is technique in the modern sense of technology that – in the guise of the old composition as technique of the artist – evades the listening subject in a much more concrete way.

If the *Pentatonic Permutations* actually prove to be representative of the changing of the artist – work – listener triad under algorithmic conditions, further analysis should focus on this altered technique.

³ See Helga de la Motte-Haber, *Musik und Natur*, Laaber 2000, 65.



The Indian *NT Puja 36 in 1 Divine Voice Chanting Mantra Box* that gave inspiration for the *Pentatonic Permutations Player*.