Grains, a Universe of Sounds
Proposal for talk at TNC 2017

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Abstract
Granular synthesis is a form of sound synthesis that marries the ideas of quantum physics with sound. This talk / performance gives a brief overview over the theory of sound synthesis and culminates in an interactive performance that involves the audience to create an audience controlled soundscape by using cloud technologies, advanced sound synthesis and improvisation.

Theoretical background
For a long time sound and music was just something magical that happened if you had the right string on the right resonance body, if you had the right tube and some way to get air to vibrate in it or if you stretched an animal skin over a hollow body and banged on it. Sure you could change the physical characteristics of the sound making mechanism and this would affect the timbre, but the basic structure of the timbre was very much a function of the physicality of the materials involved.

Also the question stayed: what is timbre exactly and how can you change it? Fourier showed that every sound can be split into sine waves and that timbre just means a different composition of sine waves. For a long time this was a rather theoretical concept, as there wasn’t a way to actually compose enough sine waves to to use this in a musical context. This changed in 1897 when the Telharmonium was invented by Thaddeus Cahill the first additive synthesis musical instrument that was heard by a wide audience [5].

In the beginning of the 20th century physics did undergo a serious shift. Quantum Physics was discovered and light henceforth was known to have this dual nature of being a particle
and a wave. Dennis Gabor an engineer from Hungary who studied communication, formulated a quantized theory of the other sense that is tied to a wave, sound and so granular synthesis was born. It didn’t lead to any ground-breaking discoveries in physics, which is why it is mostly forgotten in that field.

Granular synthesis is hard to do outside a powerful computer, so only recently musicians have started to experiment with it.

From Curtis Roads : Microsound [2]
Microsonic techniques (granular synthesis) dissolve the rigid bricks of music architecture - the notes - into a more fluid and supple medium. Sounds may coalesce, evaporate, or mutate into other sounds.

The sensations of point, pulse, line, and surface appear as the density of particles increases. Sparse emissions leave rhythmic traces. When the particles line up in rapid succession, they induce the illusion of tone continuity that we call pitch. As the particles meander, they flow into streams and rivulets. Dense agglomerations of particles form swirling sound clouds whose shapes evolve over time.

Presentation / Performance
In this session, Dragica Kahlina and Jens-Christian Fischer will explore the combination of granular synthesis and the cloud. After a theoretical introduction (with some practical demonstrations) to synthesis of sound in general and granular synthesis in particular, the audience will be invited to participate.

By putting the tools to manipulate a “grain of sound” into the hand (or rather the phone) of every member of the audience an interactive sound-installation / performance will take place. A cloud server collects the information provided by the audience and forwards it to a computer on stage doing the granular synthesis.

Dragica and Jens-Christian will guide the process and in addition improvise further upon the soundscapes generated by the audience. The result is the combination of sound textures controlled by the audience and live improvisation. Which part influences what part? Can a crowd of 600 people generate coherent music with just one sine grain each? Where does the individual part stand for itself and what is happening to a single part, when it is part of a larger crowd, that itself is influenced by many small parts

Requirements
In order for this performance to work, the following technical requirements are given:
- PA system for music reproduction with at least 4-8 line inputs
- ideally a sound engineer during the performance
- 2 speaker microphones
- WLAN capable of handling 600 (or number of participants) concurrent connections and bandwidth / low latency (<10 - 15ms) connection to SWITCHengines
- 2 separate projection screens
- Optionally: on stage camera for showing instrument / ipad / computer displays
References

6. Granular Synthesis Website: http://granularsynthesis.com

Bio Dragica Kahlina
Dragica Kahlina started as a physicist and now explores the computer as a creative tool. She is exploring the relationship between noise, sound and music and venturing into the vast untapped wilds of electronic sound synthesis helped by a new generation of digital controllers like the Eigenharp or the iPad. With Jens-Christian she has worked on different sound projects combining improvisation, electronic synthesis and different musical concepts like microtonal scales. She holds a MSc in theoretical physics.

Bio Jens-Christian Fischer
Jens-Christian Fischer is the Team Lead of Peta Solutions at SWITCH, the team that builds and operates the SWITCHengines cloud product. In his free time he’s an improvising musician that plays guitar / electronic effects / synths and sings. He has been working together with Dragica in various projects that centered around free improvisation. He holds a MSc in Information Technology.