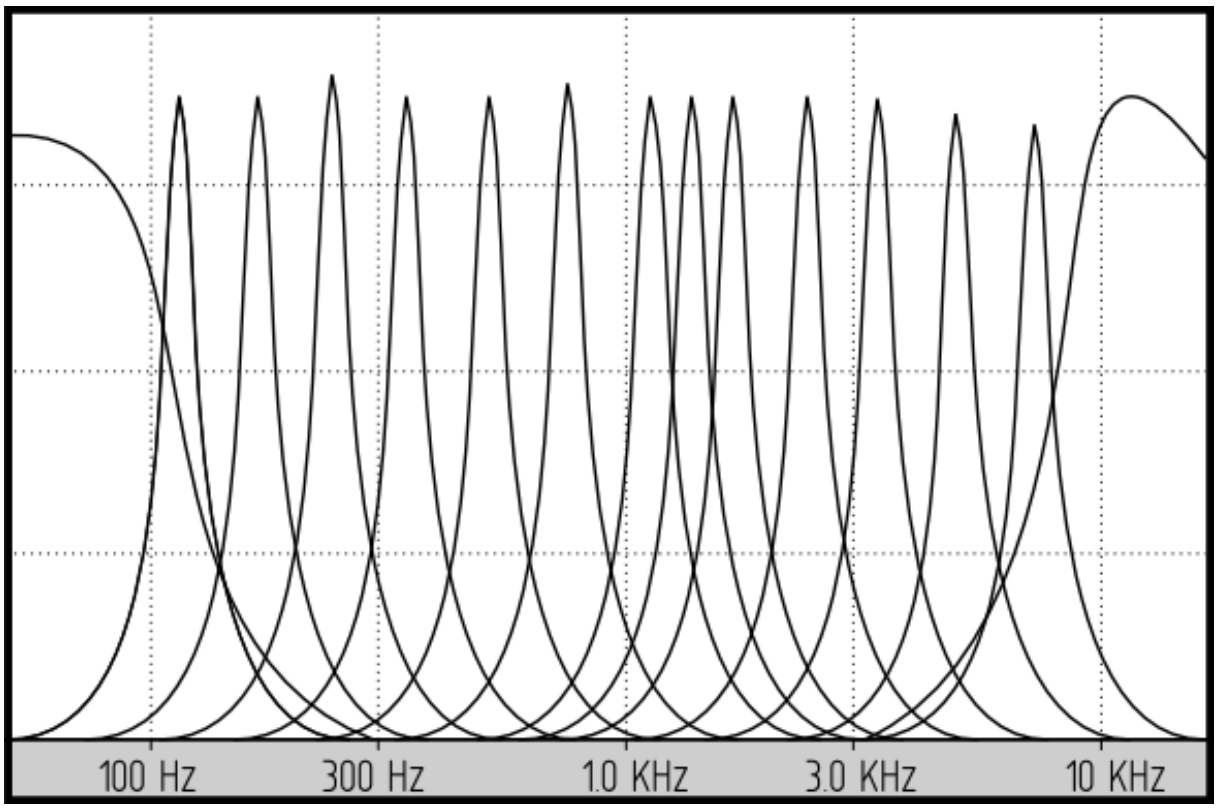

DELILAH TOO:
AN ARCHAEOLOGY OF PRIVACY
by DEREK HOLZER

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Clipping, damping, amplitude compression, electronic differentiation, and integration of random speech—it produced an engineer's parody of human speech. It was as if someone had taken it into his head to dismantle [the Black Sea towns of] New Athos or Gurzuf, put the material in little cubes in matchboxes, mix them all up, fly the lot to [Siberian] Nerchinsk, sort them out, and reassemble them precisely as they were before, reproducing the subtropics, the sound of the surf, the southern air, and moonlight.

--Alexandr Solzhenitsyn, "The First Circle" (1968)

[keywords: vocoder, noise, privacy, public speech, cryptography, media archaeology, sound art, installation]

ABSTRACT

Taking it's name from the advanced speech security system developed by Alan Turing in the Second World War, "DELILAH TOO" proposes a media-archaeological model of voice encryption as a method to protect privacy while still speaking in the public sphere. Technologically, "DELILAH TOO" is based on the voice-scrambling capabilities of the vocoder--a device far better known for its role in the history of electronic music than for it's cryptographic potential. The work will take the shape of an playable, public sound art installation which requires the participation of the audience to be fully appreciated.

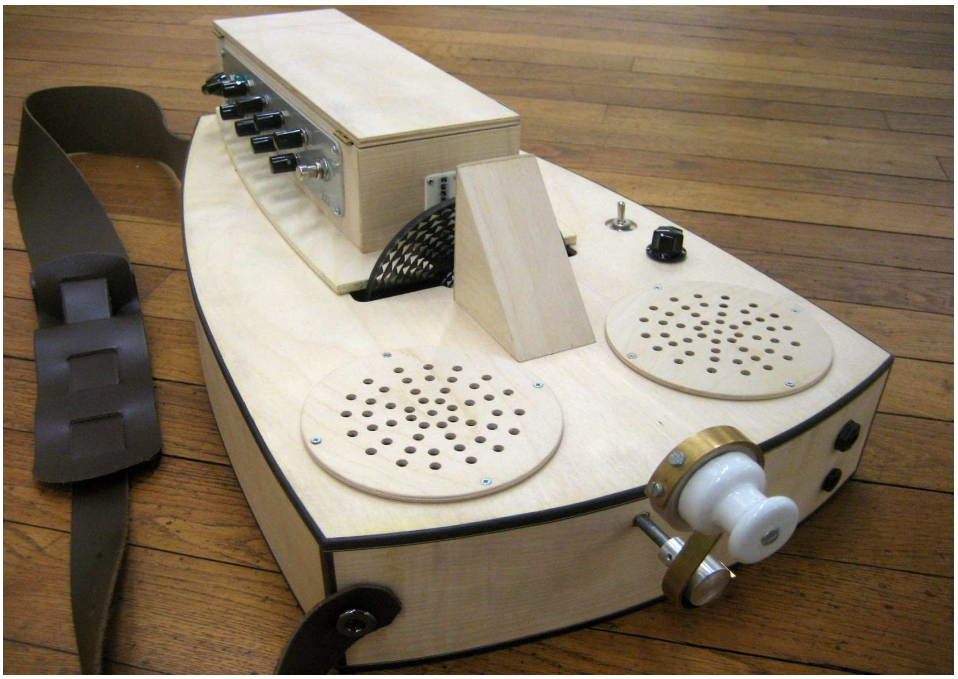
INTRODUCTION

The desire to speak privately in a public space has spurred technological developments since antiquity. The Echo Hall in Ancient Greek Olympia was reportedly built as a massive echo chamber of acoustic confusion, preventing eavesdroppers from hearing conversations unless they were standing directly in front of the speaker. Similarly, the 17th Century Jesuit scholar Athanasius Kircher imagined elaborate architectural tubes and passages to convey sounds secretly between public and private spaces.

But it was radio, that harbinger of Modernism, which opened up the public sphere in the most radical way possible. Suddenly, a voice could conceivably be heard by anyone, anywhere around the world. But not every voice wished to be heard by anyone. So with the dawn of the radio era came a new wave in the age-old art of secrecy, with one singular device at its core: the vocoder.

In the era which gave birth to the vocoder--a voice-scrambling device which later would be better associated with the music of Kraftwerk and Funkadelic--the world was not dramatically different from the one we live in now. A global "clash of civilizations" was taking place, and the United States had recently been bombed on its own home soil, providing pretext for long and costly battles fought overseas to establish and preserve commercial empires, in which secrecy (and the public disclosure of secrets) would play a leading role.

In this not-so-distant time, a persecuted gay man such as Alan Turing, or an imprisoned political dissident such as Alexandr Solzhenitsyn, would intuitively understand the need to converse in public without the the subtext of their intentions (whether sexual, political or otherwise) falling on the wrong ears. It is no small accident of history that both men were employed by their countries' respective militaries to create machines for encoding military and state secrets into a wall of broadcast noise.

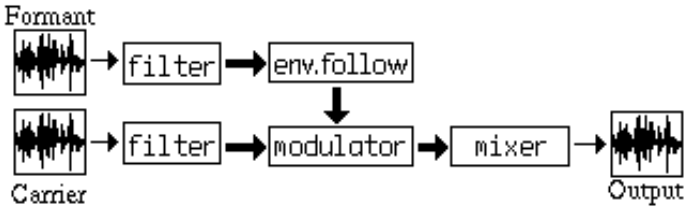


IMEDIA ARCHAEOLOGY

One of the central ideas of my work is a healthy skepticism in the notion of progress and a belief that radical changes in technology have not radically changed the kinds of problems we face because of those technologies. So rather than chase the latest digital developments to cure the latest digital dilemmas, one can also seek to see how these issues were addressed in earlier times and by more "primitive" means. This media archaeological approach does not simply fetishize "oldness", but also proposes how aspects of obsolete and abandoned technologies might address both the utopias and dystopias faced by our contemporary situation.

In the case of sound technology, one sees a fundamental shift happen during the 1940's. Peacetime applications, such as the sound-on-film technique which allowed both spoken motion pictures and the optical sound synthesis (a topic explored in my previous TONEWHEELS works, such as the opto-electronic hurdy-gurdy pictured above) pioneered by Oscar Fischinger, Edwin Emil Welte, Evgeny Scholpo and others in the 1930's, for example, were abandoned after the war in favor of techniques derived from the improved science of dropping bombs on people.

The need for smaller, faster, more reliable and eventually cheaper communications and computing circuits shows its legacy to this day in electronic music, mainly in the form of the oscillators, filters, clocks and counters used by analog synthesizers and their digital emulations. One could imagine both Stockhausen and Kraftwerk were keenly aware that their instruments were the descendants of the V2 rocket and the atomic bomb, and the development of the vocoder sits historically at this exact turning point.



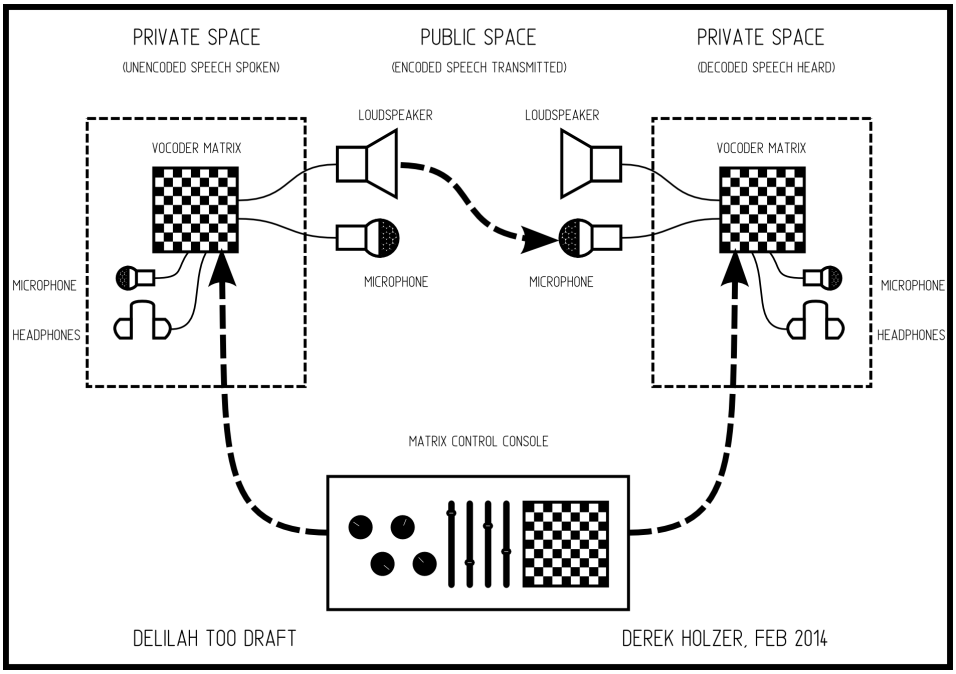
BASIC PRINCIPLES OF THE VOCODER

Solzhenitsyn's description of the vocoder quoted above remains poetically effective--things are torn apart, packed into tiny containers for transport and somehow put back together on the receiving end, somewhat like the transporter beams of Star Trek. Of course, how those containers are packed and what happens to them along the way have a huge impact on what information can be reassembled at the destination.

The device itself functions by analyzing the "formant" (human speech) according to its spectral content, and breaking that down into a dozen or more bands of information. This control information is then transmitted, and is decoded at the receiving end using a matching set of bands derived from a synthetic "carrier" signal. While Kraftwerk used a keyboard synthesizer as the carrier to create melodic, vocoded robot-speech, the 50-ton Allied military vocoder SIGSALY employed unique, one-time-use vinyl records of random thermal noise, played back on a precision-timed turntable as carrier to encrypt conversations sent transcontinentally over the airwaves during the Second World War.

The cryptographic aspect of the vocoder can take several aspects, but all depend on the listener having the proper "key" to decrypt the signal. In the simplest version, the "voice scrambler", the frequency bands of the voice modulator are assigned to other, random frequency bands of the carrier signal (for example, low frequencies in the voice are represented by high frequencies in the carrier). The result of this "channel-swapping" may still resemble human speech in its cadence, but in a language and from the throat of a speaker far from human.

The key to decrypting this signal depends on knowing how the channels have been swapped, and adjusting the receiver accordingly. However, as the vocoder also specializes in reducing the amount of information necessary to represent speech, any disruptions in the transmission had the potential to create massive glitches--and equally massive miscommunications!



THE DELILAH TOO INSTALLATION

"DELILAH TOO" is conceived as a two-way communications channel for encrypted public speech. While the original vocoders functioned in the etheric agora of radio waves, "DELILAH TOO" substitutes this with the acoustic space of the exhibition hall or another physical, public location.

At either end of this space stand two identical cabins, each visibly equipped with both a loudspeaker and a microphone on the outside. Inside, each cabin will be equipped with a vocoding device, along with a matrix mixer which controls how the channels of vocal information are encoded and decoded, and a pair of headphones, small microphones and a button allowing them to talk (instead of listen). Participants standing inside the PRIVATE SPACE of each of these cabins have the opportunity to speak with each other through the PUBLIC SPACE, via the loudspeakers and microphones. However, as their voices are encrypted before they reach the loudspeakers, and decrypted once they reach the microphone, the content of these conversations between the PRIVATE SPACES should be completely indecipherable to anyone standing in the PUBLIC SPACE.

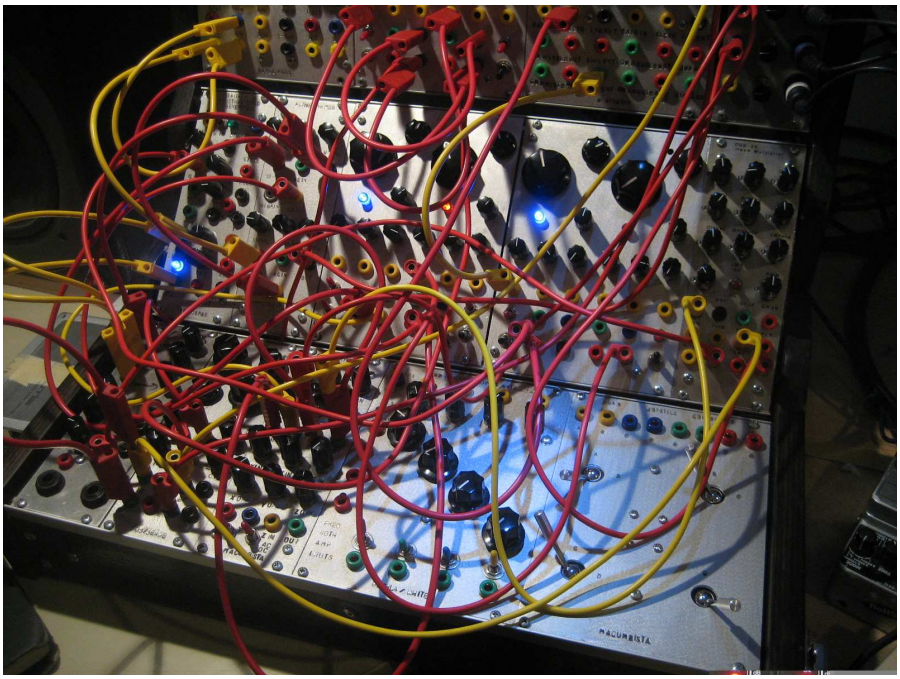
What is heard within the PUBLIC SPACE sounds more akin to a kind of abstract electronic music, composed of the frequency bands of the speakers' voices scrambled and modulated by noise and specific tones. The key used to encode and decode speech is produced by a console in the center of the PUBLIC SPACE, which participants have a possibility to influence. This key is created by a generative algorithm, and parameters of this algorithm can be controlled by simple knobs, buttons and switches on the console--making it a kind of interactive composition for the participants to play. New keys are generated in steps, at a tempo and rhythm determined by the interaction with the composition. Once generated, the key is then sent to each of the PRIVATE SPACES. Thus, the audience in the PUBLIC SPACE can influence the sonic character of what they themselves hear, but have no control over the content of what is actually spoken.

TECHNICAL MEANS AND MATERIALS

This installation requires a PUBLIC SPACE of some sort, whether a "white cube" in a museum or gallery setting or a more site-specific location in another type of building. This space should not be too noisy, or to reverberant since both of these factors would make communication with the installation much more difficult. In this PUBLIC SPACE, two isolation cabins should be placed. These could be translators' cabins or similar constructions, which are reasonably isolated from external sound, have a door which can close, and a window through which the people inside can see out. Besides this, each cabin will have its own active, 500-100W loudspeaker. Both the cabins and the loudspeakers should be provided by the hosting organization.

The equipment located in each of the PRIVATE SPACE cabins is identical. Outside will be a the loudspeaker and a microphone. Inside will be a pair of headphones, a microphone for speech and the vocoding equipment. The cabin's equipment appears highly analog and "transparent" to the participants using them. In particular, changes in the settings of the matrix are visible to those speaking in the cabins, using a grid of LEDs and mechanical relays.

The PUBLIC SPACE console contains a small Raspberry Pi computer, which is used to generate each key (as well as the tempo and rhythm in which they are generated), in combination with settings made by the audience to the controls of the console. Communication between the console and the cabins is made wirelessly. Like the vocoding equipment, this control console appears quite "transparent", inviting the audience to speculate about the actual processes at work.



DEMONSTRATION SKETCH

An audio file of what the installation could sound like can be heard here:

https://soundcloud.com/macumbista/delilah-too-demo

In this short demonstration sketch, we first hear the original voice reading Fernando Pessoa's "I've gone to bed with every feeling", then the scrambled signal, and finally the unscrambled signal. A 15-band vocoder was used for encryption, controlled by a 15x15 matrix. The carrier signal consists of a bank of sawtooth oscillators tuned to match the passbands of the vocoder filters, and mixed with pink noise. Prototyped in Pure Data.

ACKNOWLEDGEMENTS

DELILAH TOO was developed in Berlin DE and in residency at the Edith-Russ-Haus für Medienkunst (***http://www.edith-russ-haus.de***), in Oldenburg DE, with financial support from the Grants for Media Art 2014 of the Foundation of Lower Saxony. Technical support was provided by Jaanus Kalde (***http://jaanus.tech-thing.org/***) in Tartu EE, and by my intern Juan Duarte of the Aalto University Media Lab, Helsinki FI. The work will receive its world premier at the CTM Festival (***http://ctm-festival.de***) in Berlin DE in January 2015, with organizational assistance from Carsten Stabenow. Thanks also go to Timo Toots for his continued belief in my work.

Original 1944 Delilah machine by Alan Turing, Bletchley Park, UK.

TOPICS FOR RESEARCH

While the technical platform of the "DELILAH TOO" installation has been carefully researched and considered, there remain many avenues to explore once the system has been created, largely to do with both the acoustic and social spaces it creates.

For example, as the encrypted speech is transmitted as sound through the PUBLIC SPACE, the acoustics of that space and any other sound events occurring within it have the potential to cause "glitches" in the decryption. Could this cause some doubts on the part of the participants in the PRIVATE SPACES as to the reliability and security of the system they are using? Or encourage them to "jam" or "block" the encrypted transmissions with sounds of their own?

Likewise, what might occur if the system were not treated as a medium of transmission, but rather as a sound instrument to be improvised with in a musical fashion? Could the PUBLIC sound be "composed" without losing it's privacy function? Would trained vocalists or musicians take a different approach than non-professionals or members of the public? Would such a performative use negate the "meaning" of whatever was being transmitted? Or by learning to play the system as an instrument, could performers allow new meanings to slip through from the PRIVATE to the PUBLIC spaces?

Another consideration is how this system might function when used outdoors, or to connect different parts of a city rather than two halves of a single room. I recall two neighborhoods in Valparaiso, one wealthy and one poor, separated by a narrow valley but *almost* able to shout to each other. Would such a system encourage different social dynamics to take place?

Every technological system, every media artifact, remains a dead object until put to use in a social system. And I very much look forward to exploring these uses in a variety of situations once this particular artifact has been constructed.

SIGSALY exhibit at the National Cryptologic Museum, Annapolis Junction, Maryland USA

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ABOUT THE ARTIST

Derek Holzer (1972) is an American instrument builder and sound artist based in Berlin DE, whose current interests include DIY analog electronics, field recording, media archaeology and the meeting points of electroacoustic, noise, improv and extreme music. He has given almost 200 experimental sound performances, created scores of unique instruments and installations, and taught over 130 sound art workshops across Europe, North and South America, and New Zealand since 2002.

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