# Performance Theory and Practice in Stockhausen's KONTAKTE

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**Abstract**
The structural relationship of live instruments to electronic sounds in KONTAKTE draws on Stockhausen's early experiences in radio, and as a student of information theory and speech processing. His earlier work GESANG DER JUNGLINGE created a methodology for speech synthesis that led to a similar approach being adopted for scaling and transforming keyboard and percussion sounds.

## 1 Introduction: Radio Drama

Stockhausen gained his early professional experience in radio, first as a student in the musique concrete studios of Paris Radio under Pierre Schaeffer [1], then as resident composer and later director of the electronic music studios of Cologne Radio [2].

Both Paris and Cologne studios operated under the wing of their respective Radio Drama departments. Historically, aesthetically, and technically, electronic music is a form of radio drama. Radio drama was an entirely new form of sound composition. It explored the voices inside your head and how they interact with the real world. In the beginning, radio drama was broadcast live. It called for new performance skills. The microphone extended the range of conscious hearing. The first mixing desk was the BBC's Dramatic Control Panel of 1931. Radio drama brought together natural voices, artificial sounds, and music in one experience [3].

For about twenty years, until the arrival of tape after the war, radio led the way in production standards, because it went out live and did not rely on imperfect recording media. Not only computer music but music in every medium owes an enormous amount to the pioneers of radio. They were the first to recognize the challenges, and the first and most persistent in trying to solve them.

## 2 Performance Theory for Live Electronic Music

When we talk about performance theory and practice in electronic music, we mean not only how live music can be combined with music that comes out of a collection of loudspeakers; we also mean how the reality of a live performance can be reconciled with the realism of a music existing on tape, both as a documentary object, and as a subjective experience. But this is nothing new. If you go to a concert to hear a Mozart concerto, for example, the same process is going on there as well: reconciling the physical reality of the solo performer, representing the here and now, with the

historical reality which is Mozart's score, and the psychological reality of what was going on in the composer's mind.

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My subject is performance theory, interpretation, and practice in relation to two major compositions of electronic music by Karlheinz Stockhausen, the *Gesang der Junglinge* of 1955-57 [4], and *Kontakte* for piano, percussion, and electronic sounds, from 1959-60 [5]. The earlier piece was composed for five-channel tape and incorporates the pre-recorded sound of a boy singing. It has no live performance component, although the boy's voice is intended to sound real and is recorded to a very high standard of realism. The impression is like a kaleidoscope, an aural vision of multi-faceted and coloured jewels moving about, that for a moment become recognizable, and then move into new patterns, always changing:

### 2.1 Music Example 1: Gesang der Junglinge (0'.00" to 1'.02")

It is a fundamental principle of Stockhausen's electronic music that what you hear is not just a loose collection of items picked up here and there from sound effects discs or by random experimenting with patches and so on. That sort of procedure can lead to attractive results, but that is that: after a while, you listen again, and bits start to flake off because there is nothing organic in the design to hold it together. Serialism gives you a structure for discovering a total range of sounds that share certain basic properties. If you are painting your house and want to work out what colours go together, a structured system of colour relationships will give you greater certainty and more flexibility of choice. With music it is the same. Understanding colour means you understand vision, how colour is perceived by the eye. With music you are involved with the hearing process, which is somewhat more complicated because it involves dynamic change in time, and thus memory as well.

## 3 Speech Analysis

The unifying element in *Gesang der Junglinge* is the voice. Electronic music in the 1950s was closely identified with scientific research in speech recognition by computer, then a slow analogue device. Western science wanted to be able to program early computers to monitor suspicious telephone conversations, and in order to do that, they needed to work out the basic sound elements of speech, and rules for how they hang together. Composers were brought into this, often without fully realizing it, which is why so much early electronic music is speech-related. So the idea is to extract the basic noise and vowel particles from a recorded voice, then synthesize and reassemble them into coherent speech.

### 3.1 Music Example 2: Gesang der Junglinge (11'.46" to end)

The easy way out of course would be to cut up a tape of real speech and then re-assemble it, which is what Berio does in *Thema - Omaggio a Joyce* [6] and Eimert in *Musik und Sprache* [7]. It works, but you don't actually learn anything. It's like running the film of an explosion backwards: everything comes together beautifully but you don't actually learn anything new about how structures fall to bits or how they can be put together again. What Stockhausen does is more systematic, and also more interesting. He wants to find out by analysis what the basic elements of speech are, and then fabricate artificial sounds that resemble them, so that when the process is reversed, and the voice is reconstructed, you know where you are coming from as well as where you are going. So you end up with a list of basic sounds from [fff] and [sss] to [ah] and [oh], and you discover that consonants are noises of specific bandwidth, and that [t] is the same as [sss] but shorter, and so on. It is a learning process, and you come out knowing a lot more about the nature of speech sounds than you did before.

Of course you can say that a good composer intuitively understands the human voice, so all this hard work is unnecessary. If only that were true. Even poets need to listen to poetry as sounds as well as read and write it as words on paper. Only that way do you reach a point where the sounds acquire their own level of meaning, quite separate from the sense content of the words themselves.

What Stockhausen and his colleagues learned from the experience of *Gesang der Junglinge* and trying to simulate the human voice, was that it was not possible, with the technology then available, to reduce continuous speech to an alphabet of basic sounds. Not only that, it would never be possible. The voice doesn't work that way. Think about early computer imaging, where the best you can do is 20 x 20 resolution. But the image is fixed, so you know that it can be improved by increasing the resolution to 2400 x 2400. If the image is moving, all your camera needs to do is follow the bits that move and ignore the rest. With speech however everything is in continuous motion, and every element in the flow of speech affects everything else. So the intellectual model of speech as a jigsaw puzzle is never going to work, because there is always only one way to put a jigsaw puzzle together.

That the theory Stockhausen followed did not work in fact, is a discovery of the greatest importance. The theory was wrong. Now we know. That is what research is about. It doesn't change the fact that the composition is a work of genius, beautifully crafted, exciting to hear. It asks what is still a fundamental question: How does the voice work? What bits of information are involved? How do we recognize words as such? How do the sounds of words join together to make continuous sense? We still need to know.

## 4 Instrument modelling

Stockhausen's next major project in electronic music was *Kontakte* which means "Contacts." Here the focus is instrumental rather than vocal sound. As a student in Paris in 1952 he had spent long hours listening to and analyzing the evolution of recorded sounds of ethnic musical instruments: how the sound is initiated, reaches a steady state, and then dies away. This was years before the arrival of the most elementary analogue synthesizers. In comparison to speech, which is produced by an infinitely flexible structure, instruments are stiff resonators, for the sake of consistency of tone. That makes them simpler to define. There are fewer basic elements.

Once again, for practical reasons Stockhausen is not concerned with modelling the acoustic process, which is impossible when you are working with analogue tape. What he did instead was to create accelerated waveforms of different kinds. He was following in the path of the great Hermann Helmholtz, who experimented with sirens that could be programmed to a limited degree to vary the tone, and makers earlier in the century like Hammond, Martenot, and Trautwein, who employed tone wheels and simple electrical circuits to generate a range of simple wave forms: sine, square, ramp, etc. By creating a range of artificial wave forms out of accelerated loops of tape, in the form of rhythms, melodies, arpeggios, impulses, continuous tones, etc., Stockhausen ended up with a collection of continous tones of different timbres.

### 4.1 Music Example 3: Kontakte (12'.54" to 13'.35")

This sort of work is hit or miss. You don't know in advance how the wave-forms will sound, so you work through a range of possibilities: some like drum patterns, some dynamic shapes, some accelerando, some made of more than one layer, and so on. And you play back the resulting continuous tones on a vari-speed tape machine, on a scale from low to high, and listen out for realistic sounding results.

If any of you have sampled a dog bark and played it back on a midi keyboard, you will have discovered that as the pitch goes up and down, the dog changes as well from a terrier to a chihuahua and then to a great dane. That is because every sound implies a structure. With musical sounds the structure is a musical instrument. In regular music, to achieve consistency of timbre you look for a family of instruments, with a miniature for the high notes and a larger version for the low notes. We have known about this for seven hundred years: a consort of recorders, a viol consort, a string quartet, a saxophone quintet, etc. It's all about scale transposition in physical terms as a way of achieving consistency in terms of tone colour.

In *Kontakte* however you end up, not with families of timbres, because you have only one tape of each wave form. Instead, you have groups of timbres that are identical in their internal structure, but sound very different according to pitch, duration, or treatment. In fact, they sound so incompatible it is a puzzle to understand how they can be related at all. For example, if you take a pure sine tone at 165 Hz, e below middle c, and hear it as an impulse, it can sound like a drum; but the same wave form at 512 Hz, c above middle c, if you let it sound, is like a flute. Take

the same sound at 2000 Hz, chop it short, and add reverberation, and it becomes a little Greek cymbal.

### 4.2 Music Example 4: Kontakte (28'.40" to 29'.30")

## 5 A Continuum of Instruments

So what do you do? What theory can account for that? What Stockhausen decided was utterly brilliant, and in a way completely consistent with what he had been doing before, with the boy's voice, in *Gesang der Junglinge.* He said, what this tells us is that the real musical instruments we know are related to one another in ways we had never realized before. They represent categories of thought that are specialized and consistent within themselves, but that are not in fact real. (This is the philosophical bit.) Not real, that is, in terms of the continuum of vibration as it really is. The music of *Kontakte* with live performers is already interesting because the audience is in the midst of an electronic sound world that is constantly whizzing and burping and rotating round your head, and you can hear that from time to time the players on the platform are trying to keep up with the electronic sounds, and identify them, play along, or even shoot them down. This is not your average electronic piece by Babbitt where the live voice and the electronic music go their own way. It is not like Berio's *Differences* where the live instrumental sounds are gradually replaced by electronically distorted versions, like a hall of mirrors[8]. In *Kontakte* we discover that the electronic music is the higher reality, and the actual musical instruments are only cross-sections. You know that astronomers take the light from a star and create a spectrum, and look for black lines in the spectrum; these are the absorption lines, and they tell you what elements the star is made of. In *Kontakte* the electronic music is the spectrum of possibility, and the musical instruments the absorption lines, the elements.

## References

[1] Schaeffer, P. 1952. *A la Recherche d'une Musique Concrete.* Paris: Seuil.
[2] Morawska-Buengeler, M. *Schwingende Elektronen: Eine Dokumentation uber das Studio fur Elektronische Musik des Westdeutschen Rundfunks in Koln 1951-1986.* Koln-Rodenkirchen: P.J. Tonger.
[3] Gielgud, V. 1957. *British Radio Drama 1922 - 1956: A Survey.* London: Harrap.
[4] Stockhausen, K. 1996. *Gesang der Junglinge* (1955-57) and *Kontakte* (1959-60: electronic version without instruments). Original WDR recordings. Compact disc *Elektronische Musik 1952 - 1960.* Stockhausen Verlag cd 3.
[5] Stockhausen, K. 1988. *Kontakte* (version for electronic sounds, piano and percussion). Compact disc Koch CD 310 020 H1.
[6] Berio, L. 1998. *Thema (Omaggio a Joyce)* (1958: RAI). Voice of Cathy Berberian. Compact disc BMG 09026-68302-2.

[7] Eimert, Herbert. 1963. *Einfuhrung in die elektronische Musik.* Vinyl lp Wergo WER 60006.
[8] Berio, L. 1960. *Differences* (1958-60). Vinyl lp Time Records S/8002.