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# An Interview with Sensorband

Sensorband, as the name suggests, is an ensemble of musicians who use sensor-based gestural controllers to produce computer music. Gestural interfaces—ultrasound, infrared, and bioelectric sensors—become musical instruments. The trio consists of Edwin van der Heide, Zbigniew Karkowski, and Atau Tanaka, each a soloist on his instrument for over five years. Edwin plays the MIDI-Conductor, a pair of machines worn on his hands. The MIDI-Conductor uses ultrasound signals to measure his hands' relative distance, along with mercury tilt sensors to measure their rotational orientation. Zbigniew activates his instrument by moving his arms in the space around him. This motion cuts through invisible infrared beams mounted on a scaffolding structure. Atau plays the BioMuse, a system that tracks neural signals, translating electrical signals from the body into digital data. To quote the group's World Wide Web page (<http://zeep.com/sensorband>), "the result is a powerful musical force of intense percussive rhythms, deep pulsing drones, and wailing melodic fragments."

As a developer of new electronic musical instruments, I have been involved in some of Sensorband's projects, and have seen the group perform a number of times, starting in 1994 at the Sonic Acts Festival in Paradiso, Amsterdam. At these concerts, the audience becomes involved in the compelling energy of the performance, the relationship between physical gesture and sound, and the musical communication between the three performers. A Sensorband concert is impressive in its display of instrumental virtuosity, and proves that the three musicians have been playing together for some time.

Although they had met each other individually on several occasions (including the International Computer Music Conference in Cologne in 1988), the first time the three met as a group was in Octo-

ber 1993, at the Son Image festival in Berlin. While in Berlin, Edwin had the idea to form a trio. Sensorband's first performance was in December of 1993, at Voyages Virtuels, a virtual reality exhibit organized by Les Virtualistes in Paris.

I interviewed Sensorband in The Hague in November 1996, and thereafter the discussion was extended through electronic mail. The topics of the interview included: how they established an ensemble based entirely on new electronic instruments; the special musical and technical concerns associated with the medium; their aesthetic views on the relationship between science and art; and their influences and approaches. Before presenting the interview, however, I will start with some explanatory notes about the musicians and their unique instruments.

## Background

### The Performers

Zbigniew Karkowski (see Figure 1) was born in 1958 in Krakow, Poland. Zbigniew studied composition at the State College of Music in Gothenburg, Sweden, aesthetics of modern music at the University of Gothenburg's Department of Musicology, and computer music at the Chalmers University of Technology. After completing his studies in Sweden, he studied sonology for a year at the Royal Conservatory of Music in Den Haag, Netherlands. During his education, he also attended many summer composition master courses arranged by Centre Acanthes in Avignon and Aix-en-Provence, France, studying with Iannis Xenakis, Olivier Messiaen, Pierre Boulez, and Georges Aperghis, among others.

Zbigniew works actively as a composer of both acoustic music and electroacoustic computer music. He has written two pieces for large orchestra,

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Figure 1. Zbigniew Kar-kowski performs virtual percussion in a “cage” that is armed with infra-red beams. (Photo by Peter Kers.)



both of which were commissioned and performed by the Gothenburg Symphony Orchestra, plus an opera and several chamber music pieces that were performed by professional ensembles in Sweden, Poland, and Germany.

Atau Tanaka (see Figure 2) was born in Tokyo and educated in the USA. He studied electronic music at Harvard University under Ivan Tcherepnin, composition and recording engineering at the Peabody Conservatory, and computer music at Stanford University's Center for Computer Research in Music and Acoustics (CCRMA). While at Stanford, he was asked to compose the first concert piece for BioMuse, a bioelectrical musical instrument (described below).

In 1992, during his studies at CCRMA, Atau was awarded a residency at the Stanford atelier in the

Cité des Arts in Paris, and conducted research at Institut de Recherche et Coordination Acoustique/Musique (IRCAM). Enticed by the rich musical culture in Europe, he stayed on, settling in Paris for five years. During this time, he concertized with the BioMuse, and continued his work with sensor technology, often working in residency at Stichting Elektro-Instrumentale Muzeik (STEIM) in Amsterdam. In 1995, he became Artistic Ambassador for Apple France for his work using interactive technologies for music. During this time, his work included solo sound/image performances, telematic concerts, interactive media pieces, group performances in the French improvised-music scene, and the creation of Sensorband. He is currently living in Tokyo, pursuing network, noise, orchestral, and recorded-music projects.

Figure 2. Atau Tanaka uses muscle signals and gestures to play the BioMuse instrument. (Photo by Peter Kers.)



Figure 3. Edwin van der Heide works with the MIDI-Conductor, an ultrasound-based spatial hand-held instrument, to perform time stretching on digitally sampled vocal sources. (Photo by Peter Kers.)



Edwin van der Heide (see Figure 3) studied music technology at the Utrecht School of the Arts, and sonology at the Royal Conservatory in The Hague, where he graduated in 1992. Since then, Edwin has been working as a solo performer and has been active in several collaborations and groups, including Sensorband, Loos, and Theatregroup Hollandia.

Recently, Edwin collaborated with Victor Wentink at the Delta Works in Holland on a permanent sound installation featuring over 60 loudspeakers, commissioned by the Dutch government. Since 1995, Edwin has taught sound design at the Interfaculty Sound and Image at the Royal Conservatory and the Royal Academy of Art in The Hague.

### The Instruments

Zbigniew Karkowski's instrument is a system of 32 infrared sensors mounted in velocity-sensitive pairs: 16 sensors are transmitters, and 16 are detectors. These sensors scan the position of the arms and the velocity of their movement. Voltage data from these sensors is translated into MIDI by Vladimir Grafov's custom-built scanner. From there the data is sent to Opcode's Max software (the structural "brain" of the system), and to Digidesign's Sample Cell II, which is the "orchestra."

This system was developed by Zbigniew and Ulf Bilting in Sweden in 1990. The first performance with it took place at STEIM in February, 1990. Zbigniew's initial idea was to be able to play music by just moving his arms in the air. The important as-

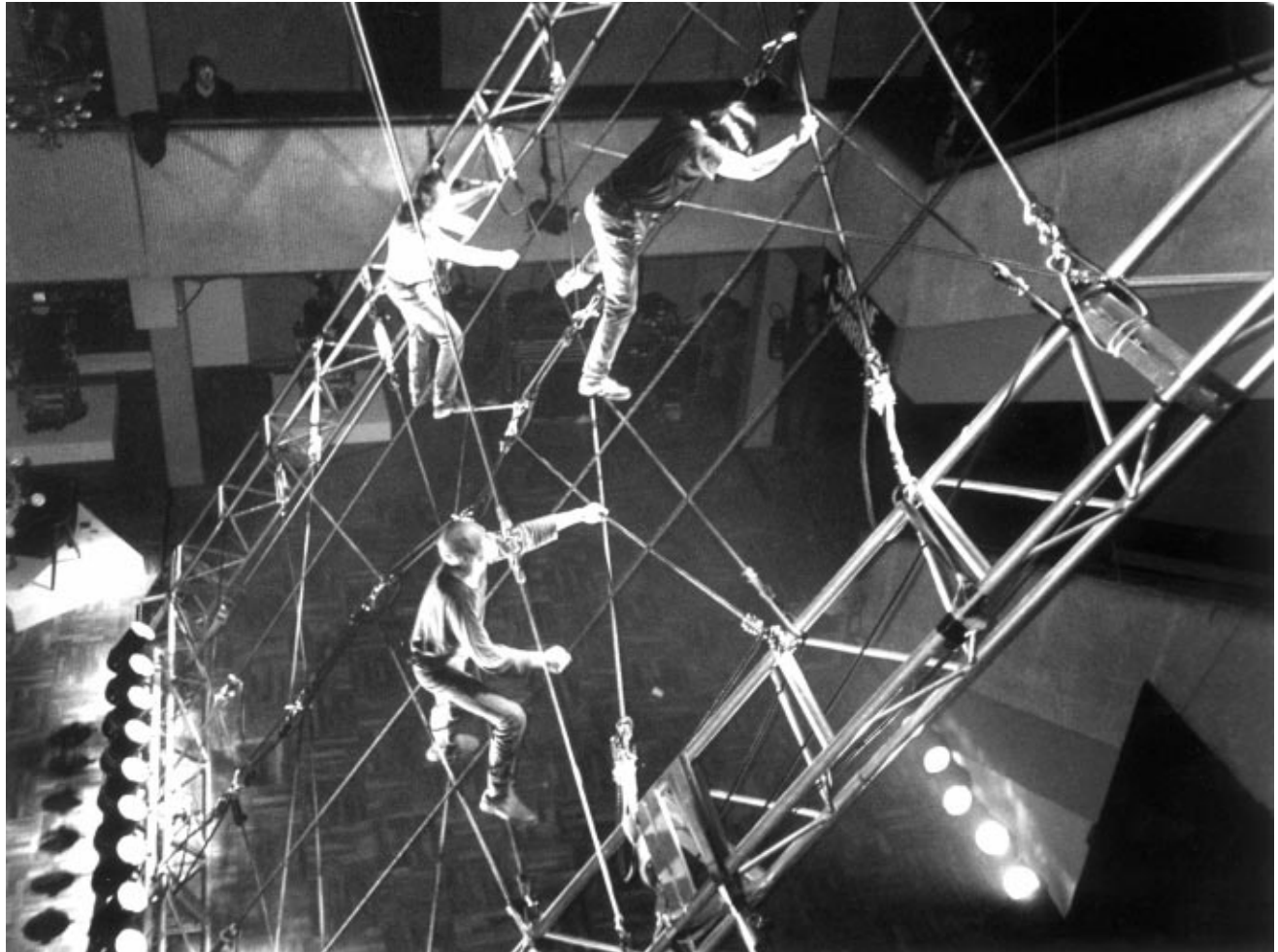
pect was to build an environment where the performer on stage can act both as a composer and conductor without being attached to wires or any other contraptions.

The system provides the performer with real-time control over parameters such as velocity/dynamics, tempo, and articulation, as well as control of the formal structure of the music, mainly through Max.

Atau Tanaka's instrument, the BioMuse, is a bio-signal musical interface developed by Hugh Lusted and Ben Knapp of BioControl Systems (Knapp and Lusted 1990; Lusted and Knapp 1996). The BioMuse was developed at Stanford University's CCRMA in conjunction with the Medical School and the Electrical Engineering Department. The original intent was to create a musical instrument driven by bioelectrical signals from the brain, skeletal muscles, and eyeballs. The BioMuse is also used in applications of eye tracking and brain-wave analysis, in work with the physically challenged, and in telemedicine. It uses electroencephalogram, electromyogram (EMG), and electrooculogram signals, and translates these analog bioelectrical signals into MIDI and serial digital data.

Atau's musical work with the BioMuse uses the BioMuse's four EMG channels. Each input channel receives a signal from a differential gel electrode triplet. Armbands with these electrodes are worn on the inner and outer forearm, tricep, and bicep. These signals are filtered and analyzed by the digital signal processor (DSP) on-board the BioMuse, and converted to MIDI controller data as output. In

Figure 4. Members of Sensorband perform on the Soundnet.



Atau's stage setup, the resulting data is routed to a laptop computer running Max. Max patches created by Atau transform the control data so that it can enter a compositional framework, and then be dispatched to MIDI synthesizers and real-time computer-graphics performance software.

Edwin van der Heide's instrument consists of two elements: the controller part and the sound synthesis part. The controller is called the MIDI-Conductor. A small series of these controllers was developed and built by the interviewer in a joint project of the Institute of Sonology and STEIM, under the supervision of Michel Waisvisz, and modeled after Michel's instrument, the Hands (Krefeld

1990). (There is an active collaboration between STEIM and the Royal Conservatory; both play important roles in developing new instruments. For more information, on the World Wide Web see <http://www.xs4all.nl/~steim> and <http://www.koncon.nl/220/SOmain.html>.)

Edwin's small, hand-held instrument has ultrasound sensors (for measuring the distance between both hands), a pressure sensor, two tilt sensors, a movement sensor, and a number of switches. All of these sensors are connected to the STEIM Sensor-Lab, an embedded, programmable microcontroller that translates the signals into MIDI data.

For sound synthesis, Edwin uses a personal com-

Figure 5. The Soundnet sensor.

puter with an Ariel DSP-96 board. This board contains a Motorola 96000 floating-point DSP. Edwin developed the software. Algorithms such as real-time phase vocoding, oscillating harmonizers, and room simulation with Doppler-shift effect are used along with hard-disk recording and playback in a live concert environment. Besides the DSP, Edwin recently started to use Supercollider on the Apple Macintosh for real-time granular synthesis and chaotic looping of samples.

In addition to playing their individual instruments, the Sensorband musicians also perform together on Soundnet, an architectural musical instrument of monumental proportions (see Figure 4 and the front cover). It is a giant web, measuring  $11 \times 11$  m, strung with 16-mm-thick shipping rope. At the end of the ropes, there are eleven sensors that detect stretching and movement. The three Sensorband musicians perform on the instrument by climbing it. Soundnet was commissioned by the festivals Visas and Exit in Paris, where it was first performed upon in April 1996. It was then performed upon at the Dutch Electronic Arts Festival, organized by the V2 Organization in Rotterdam.

Soundnet was inspired by the Web, a "spider web" 1 m in diameter that was created by Michel Waisvisz at STEIM and the Institute of Sonology. The idea with Soundnet was to scale the Web to a size proportional to human "spiders." The sensors (see Figure 5) were designed by the interviewer and fabricated by Theo Borsboom, a Harley-Davidson mechanic. The sensors are located inside each cylinder, with a spring and piston that can sustain 500 kg of weight. The large spring resembles a motorcycle's shock absorber. Inside the cylinder is a large fader (potentiometer). As the performers climb the ropes, the sensors stretch and move in response to their movements. This displaces the faders inside, sending a variable-voltage control signal to the iCube, which is the computer interface box. (For information about the Infusion Systems iCube, see the World Wide Web site at <http://www.infusionsystems.com>.) The iCube sends a MIDI signal to a Macintosh that is running the Max software.

Soundnet is a musical instrument using interactive technology; however, the technology aspect



is modest compared to the physical aspect. The rope, the metal, and the humans climbing on it require intense physicality, and focus attention on the human side of the human-machine interaction, not on mechanistic aspects such as interrupts, mouse clicks, and screen redraws. Sensorband has chosen to work with digital recordings of natural sounds. The signals from Soundnet control DSPs that process the sound through filtering, convolution, and waveshaping. Natural, organic elements are thus put in direct confrontation with technology. The physical nature of movement meeting the virtual nature of the signal processing creates a dynamic situation that directly addresses sound as the fundamental musical material. Through gesture and pure exertion, the performers sculpt raw samples to create sonorities emanating from the huge net.

The Soundnet's immense size introduces an enormous challenge of instrumental virtuosity. Although innovative MIDI instruments are often called controllers, with Soundnet, the notion of control is called completely into question: the instrument is too large for humans to thoroughly master. The ropes create a physical network of interdependent connections, so that no single sensor can be moved in a predictable way that is independent of the others. It is a multi-user instrument where each performer is at the mercy of the others' actions. In this way, the conflict of control versus uncontrollability becomes a central conceptual focus of Soundnet.

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## Musical Roles in Sensorband

**Bongers:** With the kind of technology you are using, it is possible to play each other's parts and control each other's sounds. Can you describe your roles in the group?

**van der Heide:** Each musician's sound depends on the type of sensors he uses. For instance, Zbigniew's sensors are triggers, so he plays more percussive sounds. Atau and I both play more with timbre and sound color. It is one of the secrets of why Sensorband works so well.

**Tanaka:** The fact that we settled on these instruments is an important part of what we do. There is a common gesture-based element among these three instruments. However, since each instrument works with a different kind of sensor, each serves a different function in the ensemble. The music would change if the instruments were different.

**van der Heide:** As with any genre, the combination of instruments, and the sound sources attached to them, help define the ensemble. For example, with a string trio, there are string instruments. . . . But I would not be able to play Zbigniew's part well.

**Karkowski:** It would sound different. Nevertheless, the important thing is that there is always the possibility that we can play each other's instruments.

**Tanaka:** The three instruments sometimes take on separate roles, sometimes start to blend together, sometimes confuse each other and then go apart again.

**Karkowski:** In a way, the only thing that defines our different roles are the limitations of our instruments. This is one of the only traditional aspects of the group.

**Bongers:** Have you ever considered adding a fourth member to the band?

**Karkowski:** We have not thought about it, but we are open to collaboration.

**van der Heide:** We have just realized a project, *Xtended Thrill*, in collaboration with Granular Synthesis at InterCommunication Center (ICC) of Japanese Telecom in Tokyo.

**Karkowski:** We also performed with percussionist Paul Koekat DasArts in Amsterdam in 1996.

**Tanaka:** The performance we did with Paul was exciting for us—Sensorband plus a guest. The trio

acts as a good core unit, because the idea of three sensor instruments is a simple and straightforward concept. Three is a good number. In a trio, the instruments can be either solo or accompaniment, virtuosic or egalitarian. It has always been a strong ensemble in other musical genres, whether it is string trio, jazz trio, or power trio.

**van der Heide:** The trio is the smallest ensemble with which you can create all the musical forms.

**Karkowski:** There were many groups in the history of popular music that consisted of soloists playing together—for example, Cream, the seminal virtuoso rock power trio of the late 1960s (Eric Clapton, Jack Bruce, and Ginger Baker).

**Tanaka:** In Sensorband, we each bring the sounds of our solo performances to the group, so the problem often can be that the texture is too thick when we are all playing at once.

**Karkowski:** We used to all play at once all the time! [All laugh.]

**van der Heide:** There are still many forms of this trio that we have not explored yet. The first time where we really started working with duos against duos, to form duos inside the trio, was at the concert in November 1996 in Krakow, Poland at the Audio Arts Festival.

**Bongers:** Does the audience experience you as a group or as individual soloists?

**van der Heide:** The presentation is a band presentation.

**Karkowski:** We are a band, because we perform as an ensemble. [See Figure 6.]

**van der Heide:** We never give solo performances on the same concert.

**Karkowski:** [laughs] Only very long solos!

**Tanaka:** Because of our musical roles during performance, the audience perceives us as a group. There is a mass of computer-generated electronic sound coming from three musicians on stage. The audience must distinguish who is playing what. At some moments it is clear, and there are other moments where it is unclear. We can play with this ambiguity. It is a kind of natural reaction on the part of the audience to try to make a connection between the physical gesture they see and what they hear. However, to do so is difficult, because these sounds are unknown. These are abstract computer-

Figure 6. Sensorband in concert.



generated sounds, whereas with acoustic ensemble music there is always some prior knowledge of how the individual instruments sound.

**Bongers:** I can imagine that it is important to define your boundaries, to limit your playing in performance. Perhaps the danger with all this technology is that the musical possibilities are limitless and variable. How do you cope with this compositional problem?

**Karkowski:** The most important problem is the danger of confusing yourself as the performer. When one performs something for a long time it feels like a part of him. When he tries something new, it can feel foreign. The strength of the group is that we have been working with certain technology

for a number of years. I have hardly changed my sounds in the last five years. [Edwin laughs loudly.]

**Tanaka:** This is an important point, because we are dealing with a technological field where some people change machines every year. But each of us has been working with technology-based instruments to sustain the relationship with the machine for a longer time. One has to stay with a violin for 20 years to begin to really master it. The issues with these new kinds of instruments is that there is no performance-practice history; it is based on technology that flips and changes every year. For me, it was interesting with the BioMuse to find an instrument I could stick with for some time and explore it in depth. It is different from the way most

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people deal with this kind of technology in the arts . . . they wait for the new machine to come out next year, and when they get it, they have to start all over again. Our approach has many ties to traditional instrumental music in this way.

**van der Heide:** Although I am still working on 3-D sound and a better system, I came back to using the MIDI-Conductor again, which I have been using for more than six years now. I am feeling more and more comfortable with it, and at the same time, I am becoming much more responsive and musical in playing the instrument in the ensemble.

**Karkowski:** I recently watched an interview with Pierre Boulez on French television, where he mentioned that there always will be a difference between computer music and traditional instrumental music, because musicians can perform (or interpret) gestures, and computers cannot. We think that is the previous generation's view on computers. One of the most important goals for us is to make gestural music performances with computers.

**van der Heide:** Every medium has its own qualities. A recording will never sound the same as a live concert, because the recording plays exactly the same thing twice, which you never can do in a live performance. On the other hand, you could also compose especially for this recorded medium. So, each medium has its own advantages for the composer.

**Karkowski:** This is obvious. The whole movement of punk rock illustrated this in a clear way. Live performance is mainly about attitude and presence—it can even be more important than what is created. I am convinced that the performer's attitude and energy on stage is more important than the sound coming from the speakers. And, of course, in the recorded media, this aspect is eliminated.

**Tanaka:** I like Edwin's idea that certain media can exploit certain musical gestures, because it relates to the earlier notion of idiomatic instrumental writing.

**Karkowski:** The computer is an instrument, but it is actually a tool as well. If one uses an instrument—say, a violin or guitar—in a non-idiomatic way; for instance, if one plays the violin with a chain saw or drill machine, then it is not only an in-

strument in the traditional sense, but also a new tool to make sound.

**van der Heide:** Yes, but not just another tool. It is more, because using a computer in live performance is an artistic choice. There is much to gain by using a particular medium. This decision reflects the interest and artistic choices of the performer.

**Tanaka:** A performer begins by highlighting characteristics of a certain tool or a technology for interesting artistic use, by featuring its capabilities, as well as its limitations. The word "tool" implies something utilitarian, something more generalist. With a tool, there is the hope that it will become better at its job, and will perhaps someday do everything. With an instrument, on the other hand, the performer accepts its limitations, and in fact, celebrates them, taking into account the instrument's personality.

The problem with computers is that they are generalist devices. Here we are, on stage, with the same computers that people use to keep their finances. So I make a choice of software, a choice of the way I work with the computer, and this starts to define my instrument.

**van der Heide:** If one uses score- or note-generating programs, the question becomes whether the music they're making is theirs—or is it the music from the program?

**Tanaka:** But then, a piece of software can take on a kind of personality, like an instrument. Dissimilar-sounding music made with a certain program can sound similar. Although this is often criticized, maybe it is not such a bad thing—perhaps the program can have an interesting musical personality of its own?

## Network Concerts

**Bongers:** In addition to the computer instruments, another medium that you have been experimenting and performing with is the network concert, where each of you perform live from totally different geographical locations. Can you describe how this started, and how you deal with the specific compositional or logistical problems you encounter? Is it

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also for convenience, when one of the band members cannot be there, or is it for artistic reasons?

**Tanaka:** In our ISDN [Integrated Services Digital Network] concerts, we use videoconferencing technology to perform a live concert. This network technology consists of a certain audio quality which is not CD quality, a certain video quality which makes the image look like it is coming from the moon, and time delay. When other musicians are confronted with the system, the first thing they request is to eliminate the time delay. But we feel that it is a characteristic of this system, and consider this transmission medium, video conferencing, as part of our extended instrument. A Sensorband concert for ISDN is different from Sensorband live. We never use it to compensate for a missing member, it has never been for replacement. We try to distinguish that clearly.

As you mentioned, the performance situation is an ensemble where one musician is local but the other musicians are distant. Therefore, the audience is more separated from the musicians who are projected on video screens. But somehow, due to the mode of communication, or the medium that is used, the audience relates to the contact dynamic between the local musician and the musicians performing on the video, engaging with these distant performers. The fact that this human interaction takes place through these severely compromised conditions raises the audience's awareness to problems like trying to keep eye contact, or trying to respond to each other using the delay, or in spite of the delay. The nice surprise is that the audience joins us in a natural way.

**van der Heide:** The first concert with ISDN was a concert where Atau and I were in New York performing with Camel Zekri, an acoustic guitarist, who was in Paris, and both spaces already had ISDN connections. This was not a Sensorband performance. This piece of mine was written as a local piece for guitar and MIDI-Conductor. It also worked well over ISDN, because there was heavy interaction between me and the guitar player as I processed his sounds and sent them back. In the places where his acoustic sound was not amplified, the only sound that was audible was the processed sound from his guitar. These sounds were sent to

New York, processed by me, and sent back to Paris. When we practiced this piece in Paris before the concert, we rehearsed it using a digital-delay simulation. When we perform using ISDN, we do not want to make the performance as accurate as possible in the traditional sense, but as different as possible. It is a completely different medium.

**Karkowski:** For example, during our residency in Canada in August 1996 (at *Obscure*, part of the *Meduse* arts center in Quebec City), we presented an ISDN concert using the system in a nonstandard way. It was interesting to do only two things with it—the exact things that others try to avoid—namely, feedback and delay.

**van der Heide:** One of the interesting applications with network technology is to retransmit the projection from a signal coming from one space back to that same space, as a kind of feedback. Distance is one of the important issues in using ISDN. Distance becomes one of the issues of the composition.

**Karkowski:** Another artistic aspect with ISDN concerts is the idea of control. Very often, composers use computers to achieve greater control. We have found, after playing several concerts like this, that we could never control the output 100 percent. Aspects like the delay become unknown variables, which is interesting.

**Tanaka:** As artists, our first instinct is not to make technical improvements to the system, but rather, to manipulate the technology in a creative manner. The technical limitations become characteristics of the composition. Doing this allows us not to be so worried about transmission delay, rather, to be concerned about the general notion of distance. We bring the element of distance to a concert, which, as Zbigniew said, we sometimes have difficulty controlling.

**Karkowski:** Instead of merely using technology, we try to do something truly musical with it . . . the audience feels the passion.

**Tanaka:** Yes, I have had many reactions from people about emotion or the passion of the musical communication that we attempt to maintain through the distance. In fact, a different result is heard in each of the three locations, which is compelling.

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## Japan and the Relationship Between Art and Science

**Bongers:** You are now involved in the Japanese art scene. Is it different from the situation in Europe or the USA?

**Tanaka:** In Europe, the composer's function is respected to a certain degree, but at the same time the use of technology challenges this role. That is why Japan is an interesting place right now, because art in a non-occidental culture has had a different sociological role. The notion of high art is a Western European notion. This is a system that has been imposed on artistic expression and production worldwide. Conversely, in Japan, art is tied to craftsmanship. Even though Japanese culture has successfully assimilated the Western way, Japan keeps its cultural traditions of thousands of years, where an artist was more of a craftsman. This living history combined with the arrival of technology puts Japan's culture at an interesting crossroads now.

**van der Heide:** In Europe, art and science are often separated, whereas Japan is one of the few countries where art and science are more integrated. The link between art and technology is important. A couple of centuries ago, art and science belonged together, where as today, scientists are often taken seriously only if they prove things in a rational way.

**Tanaka:** I agree that art and science are not so far in spirit. I have a scientific background, parallel to my musical training. Technology arts such as computer music give us the chance to show how close these things have always been.

**Karkowski:** I think that there is always art before the science.

**Tanaka:** The fact that science is rational and art does not have to be is one distinguishing characteristic.

**van der Heide:** Art is rational, too, but in a subjective way.

**Tanaka:** Art deals with the irrational in a way that science does not.

**Karkowski:** Art created during the Surreal, Dada, and Romantic movements was based in irrationality.

**Tanaka:** Yes, these were art movements that deliberately eliminated rationalism. The difference be-

tween rational and irrational is interesting, but more fascinating is to identify what kind of human spirit can be inside a person who pursues scientific research or who pursues musical creation. Having worked in scientific research in music, I find there are some common creative components called upon in the artist and in the researcher.

**Bongers:** There are many examples of great scientists who have been good amateur musicians as well.

**Tanaka:** And vice versa, there are many musicians who are technically quite capable. Edwin, for example, creates his own DSP programs, but for purely musical reasons. As an artist, you must question how many of these jobs you want to take on: the instrument builder, the composer, the performer, or all three.

**van der Heide:** It is a matter of attitude as well. I am definitely not making my inventions to sell, because if I do that, I am not the artist anymore. For example, developing inventions is still fine, but I am not nurturing my artistic self when I start selling, doing business, and going to meetings.

**Karkowski:** One can always say he or she is a scientist, or a soldier, or a doctor, but it is difficult to say when one is an artist; it is generally something that artists would not say about themselves. Of course, there are exceptions like Beethoven or Wagner, but even with them I think someone else called them artists first.

**van der Heide:** That is the problem right now because the definition of artist, the whole word "artist" in discussion at this moment, is not a stable thing anymore. If one says he or she is an artist or a composer, people expect the person to be a painter or write for an orchestra.

**Karkowski:** Actually, there have never been so many artists in the world as there are now, because the Western world is rich. We have money to spend for art and education, and many countries even have unions for painters and musicians.

**Tanaka:** When one goes to a record store, there is so much music to choose from, it is almost depressing. At the same time, technology is something that enables or democratizes the creative process, so that the most idealistic people have the notion that anyone can be an artist. But in the

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hands of a creative person, technology can take on a different dimension.

**Karkowski:** We are quite skeptical about technology, but we are just using it. Still, the real issues we are dealing with in the group are totally on a different level.

**Tanaka:** We are not alone in being skeptical. This is definitely the trend in technology in the arts—to question these things, and no longer just worship technological advancements.

## Influences and Approaches

**Bongers:** Are there pioneers in the field of live electronic music, new instruments, or other styles or art forms who have influenced your work?

**van der Heide:** I could mention a few names here today, but tomorrow I would name three other names.

**Tanaka:** Today, many artists have diverse influences. We are part of that generation. But at the same time, we are attempting to distill some of these influences to present a pure message in our music.

**Karkowski:** I really could not tell you my influences; I mean, there are many of them, but they all change with time.

**van der Heide:** For a long time, artistic development has been linear, where each movement has been a reaction to a previous movement. The avant garde has always been a reaction to what happened before, but at this moment, we are reinventing the language. A lot of things have been done before, but not with this technology. There are a lot of movements going on simultaneously now. You cannot speak about a general linear development in the arts anymore.

**Tanaka:** This is a product of the information age we live in. These days, consumers can go to record shops and choose any music of any period that they want to hear. A hundred years ago, this was not the case for either the listener or the composer. Now we are more aware of different currents and influences than artists ever were before.

**Karkowski:** With Sensorband, we are creating something that really has no tradition. We are starting

this tradition now. Before we started Sensorband, the only person in the world I knew who made music this way was Michel Waisvisz, and I saw him perform several times. Generally, Michel inspired me to some degree. . . . He is a great performer. . . . [All agree.] For many years, he continued to perform with the same instrument, instead of continuing to improve it technically.

**Tanaka:** We have precedents like Michel, and before that, Theremin and Max Mathews. In fact, there is much research happening in our field on gestural control. But we should not forget about purely musical influences and artistic objectives. This is what is new—not necessarily the technology, or the idea of sensor control over computer-generated music, but the aesthetic, structural approaches, and the performance practice we establish.

**van der Heide:** When one makes music, one should develop one's own way of thinking, and not base it on other people's ideas. To a certain extent one can, but one should always say, "well, leave it, let us see what happens if I do it myself." My instrument, the MIDI-Conductor, is based on Michel's instrument, the Hands, but I use it differently than he does, both musically and in performance practice.

**Tanaka:** While we may be part of a new tradition, it is impossible to say that we are doing something completely new. Artists are trying to come to grips with where to move after postmodernism. Postmodernism was one approach to dealing with the wealth of historical knowledge we have. I am looking for other ways to acknowledge the breadth of influences we have, not in a collage-like way, but in an integrated fashion.

**Karkowski:** I think that what we are doing is really without tradition. Or if there is tradition, it would be right at the roots—music as ritual, trance, and pure energy. Sensorband's music is contemporary, non-commercial, and we use new technology. We want to communicate. Our concerts exploit energy, we want the audience to feel like they have just gotten their batteries reloaded. We want them to feel stronger and like better human beings.

**Tanaka:** Music is that art form that takes a certain technique, requires a certain logical approach, but at the same time, needs subconscious magic to be

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successful. In our art form, there is a balance between logic and intuition. Music often reacts late to new artistic movements, but music is always ahead of the other arts in issues of perception and creative applications of technology. There are some concrete examples of issues that we have been confronting for a long time in computer music, such as real time and interactivity, which have been addressed only recently in fields such as virtual reality and computer graphics. Interactivity and real time may be in vogue now, but time and communication are the essence of music. These are concepts that are essential in our art form, independent of technology. Musical performance has always had multiple modes of interaction: between performer and instrument, between conductor and orchestra, and between musician and audience. The stage has always been a real-time environment.

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