Christine Anderson
Technische Universität Berlin
Hackerstraße 11, 12163 Berlin, Germany
christine_anderson@gmx.de

Dynamic Networks of Sonic Interactions: An Interview with Agostino Di Scipio

The Italian composer Agostino Di Scipio (see Figure 1) is one of the most interesting European personalities today working in the space between computer music and sound art. In his recent work, he creates purely sonic interactions between a source, real-time digital signal processors, and the room hosting the performance. The network of interactions is conceived as a dynamic, self-organizing system, symbiotically connected with the surrounding environment. The following interview addresses such issues and provides an overview of the theoretical and technological background behind them. It also touches on the central role of noise in Mr. Di Scipio's live electronics compositions and on the degree of freedom allowed to human agents involved in the performance of such works. A list of his compositions is given in Table 1, and a list of recordings is provided in Table 2.

Born in Naples in 1962, Mr. Di Scipio first approached composition as a self-taught musician, and later he pursued more formal studies at the Conservatory of L'Aquila and the University of Padua. A former visiting composer in several institutions, including Simon Fraser University (Burnaby, British Columbia, 1993) and the Sibelius Academy (Helsinki, 1995), he is today Professor of Electronic Music at the Conservatory of Naples and instructor in live electronics at Centre de Création Musicale Iannis Xenakis (CCMIX) in Paris. In 2004, Mr. Di Scipio lectured at the University of Illinois, Urbana-Champaign, and at Johannes-Gutenberg-Universität in Mainz. A portrait compact disc, including some of the works recalled in the interview, will soon be released by Edition RZ, Berlin. He is also greatly interested in issues of music theory involving the relationship between art and technology, and he has published numerous articles and essays in international publications devoted to such issues.

In 2004–2005, he lived in Berlin as a guest artist of the DAAD Künstlerprogramm. This interview took place on 28 November 2004 in his apartment.

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Chaos vs. Noise

Anderson: What is the main focus of your work these days?

Di Scipio: I'm working on a live-electronics solo, *Background Noise Study* (see Figures 2 and 3). The only sound material it explores is any background noise in the room where the performance takes place. It's the third work in a series called *Audible Ecosystemics.* I will extend it into *Background Noise Study, with Mouth Performer,* focusing on involuntary sounds arising from inside the mouth and body of a performer and other tiny sounds of the glottis, the tongue, and the facial muscles.

Anderson: Is that in the same line of your work with chaos and numerical models of complex systems? There, too, noise had a central role.

Di Scipio: In a sense it builds on previous work, yes, yet it's very different. We should make a distinction between chaos and noise, words often used as synonyms. In contemporary science, just like in ancient mythology, chaos stands for a highly dynamic situation, an ongoing and complex wave of turbulence between order and disorder, with several nuances in between. It's a dynamical process that may either bear order and form, or collapse into total lack of them.

As you know, there exist relatively simple mathematical models of highly dynamical systems, collected under the heading of a theory of deterministic chaos. One night during Spring 1989, in my student room in L'Aquila, I implemented one such simple process, iterating a nonlinear transfer function. I tried it first as a tool for algorithmic composition, assigning the numerical output to entry time, duration, pitch, and intensity values of instrumental gestures. The next night, I moved to a greatly reduced

Figure 1. Agostino Di Scipio.

time scale, letting the process drive the variables of granular synthesis methods that I was programming on my IBM80286 computer. I had no special attractions for fractals and other popular science concepts, but I saw potential in these numerical methods as a useful front-end for granular synthesis.

A few months later, I presented these experiments at the International Computer Music Conference (ICMC) in Glasgow (Di Scipio 1990). A little later, at the CSC (University of Padova), Graziano Tisato and I implemented granular synthesis and granular processing on the local mainframe computer system, using several nonlinear maps as a front-end control structure (Di Scipio and Tisato 1993). With that, and with my own standalone applications for the 80286, I made the tape of *Plex* (for double bass and four-channel tape, premiered by Stefano Scodanibbio in Rome during November 1991).

Anderson: Did you know of previous approaches to granular synthesis?

Di Scipio: I was aware of Xenakis's pioneering experiments with granular synthesis, of course, as well as of the early computer implementations of granular synthesis—Curtis Roads, Barry Truax. However, the statistical perspective taken in these approaches, based on probability distribution functions, was for me just one way to compose grains together, not necessarily the only way. With a single model of dynamic systems, I could exploit a larger palette of grain arrangements, ranging from random to more patterned textures, across a variety of other behaviors (Di Scipio 1994a).

I used that in transformation of existing sound, too. I was not aware of the efforts that other composers like Horacio Vaggione were pursuing with micro-time transformations of instrumental sound materials. In 1993, during a residency at Simon Fraser University, working with Barry Truax's POD system, I composed a tape piece—*Essai du Vide. Schweigen*—mostly made by "recursive" granulation, i.e., granulating some material (a harp sound and a kettledrum sound) and feeding back the output into the granulation process several times, every iteration leading to finer and finer sound particles.

Anderson: So it was a kind of algorithmic process in the creation of granular textures, linking a formalized approach with more empirical sound design.

Di Scipio: Yes. The motivation behind that was a systemic one. The question for me was, "How can you create a micro-level system or process such that a higher-level Gestalt can emerge and develop in time?" It's the kind of question you ask when embracing micro-sound composition (Di Scipio 1994b; Roads 2001, pp. 75 and 331). However, it addresses a broader theoretical issue, too, concerning how partial elements get together and eventually disappear as such—only to let a coherent whole or form appear. And form is, in this case, the form of sound, the array of emergent properties of sound we usually call timbre.

More in general, I guess I was simply considering sound synthesis as composition (or micro-composition, as Xenakis indeed had already put it). Probably that's because of my humanistic background. (In high school, I took classes in Latin and Greek.) The Greek word "syn-thesis" and the Latin "com-posing" are equivalent; obviously, they both mean "putting together." Chaos and the dynamics of complex systems, as accessible with iterated numerical processes, represented for me a way to compose small sonic units such that a higher-level sonority would manifest itself in the process.

Anderson: However, chaos and noise have a broader conceptual meaning to them.

Di Scipio: Of course, yes. Chaos can be understood as a general paradigm, one that since time immemorial has contrasted with harmony. Is it possible today to understand the world we live in, the natural and the humanly devised, as part of a harmonic, well-proportioned design? Can the music we make today be understood still as part of the Pythagorean and Keplerian music of the spheres? The world we live in is caught in a perpetual exchange between energetic forces whose interactions sometimes reveal the dispersive and destructive, sometimes the constructive and coherent. We should only be happy to be part of a process within which harmony and order might happen, albeit only as temporary, transient phenomena.

Noise refers to a more experiential level. In my own and in other composers' efforts, noise moves from the periphery to the center of musical perception. Maybe that's not particularly original—I don't know—it's a question of according our attention to that which is normally considered marginal and hence discarded—that which we usually filter out and deliberately avoid taking into account. In the *Audible Ecosystemics* pieces, noise is crucial, as without it, the real-time process that they implement would have nothing to chew on, so to speak. Noise is systemically functional; it's necessary for living organisms to grow, develop, and maintain themselves, until the moment when they are not able anymore to incorporate it.

In music scored for traditional musical instruments, I often focus on the exploration of extended playing techniques, which for me represent another way to draw attention to, and corresponding relevance to, sonic events that normally slip out of control and disturb a more secure flow of events.

Anderson: The German composer Helmut Lachenmann, famous for his work with extended techniques, says there is no ugly or musically irrelevant sound in the world.

Di Scipio: He's right. Cage held a similar position, although not identical. The earlier Xenakis works have been described by philosopher Michel Serres as purposefully designed *bruits de fond* (Serres 1967). And, as you know, many younger musicians find it very trendy to label their own music "noise." Alas, what these latter musicians seem to be about is often just a cheap, nihilistic notion of noise, a gesture of aesthetic fetishism (no surprise they often quote, as a historical precedent to their work, the Italian futurists' *Art of Noise* from the 1920s, which itself entailed a fetishistic "aesthetization" of modern lifestyles that was rooted in fascist ideology).

In a broader perspective, I believe we are today in a position to better ponder the noise that music is in today's society. It's not just that music uses noise as raw material and then filters it, molds it, sculpts it, removes the irregularities in it, channels it, and hence distracts its impact from the social and the political (an older view held by Jacques Attali; see Attali 1985). Rather, music can really generate noise, liberate it, and be disruptive even when it stays completely silent or keeps itself extremely quiet. (Noise does not necessarily imply extreme loudness.) You have probably read that little essay of mine translated into German some years ago, "The Composer as Noise Generator" (Di Scipio 2002).

Anderson: Noise reflects a tendency not to abstract from reality, and instead to witness it in a more direct way.

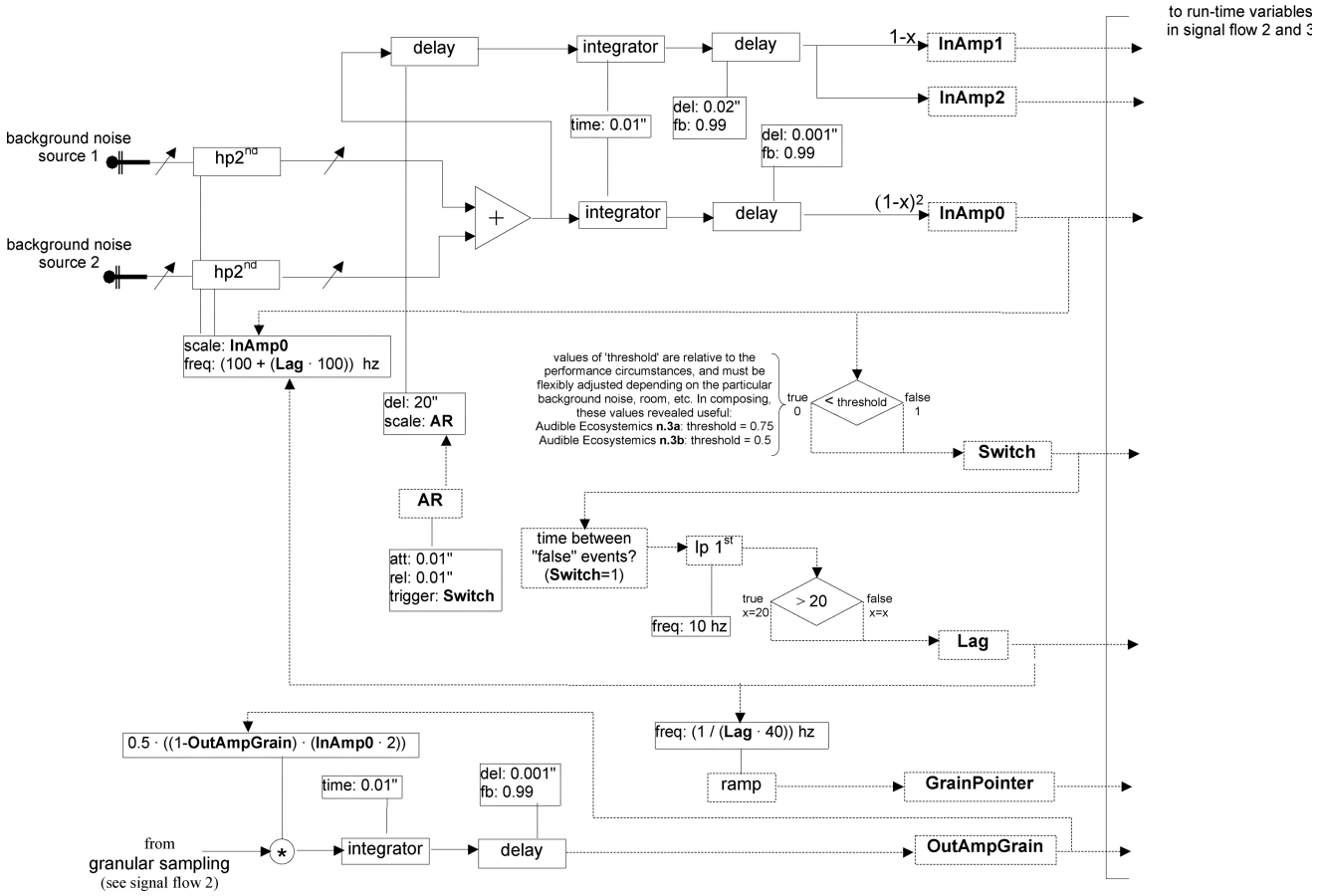
Di Scipio: A heightened sensitivity to the material and intellectual conditions that are given or socially allowed, such that we take responsibility over the changes we implement into those given conditions. No composer (not I, for one) can be granted that the end result of the labor can be called "music" instead of, say, "abominable confusion." It's the struggle—the sweat and thought one puts into the making of the noise—that turns the latter into a chance for communication between human beings.

Interactivity

Anderson: Your recent compositions reflect a very personal notion of interactivity. Could you describe it? How did you come to it?

Di Scipio: As a student (mid 1980s), I spent quite some time in writing microcode for real-time synthesis and processing, but only later (mid 1990s) did

Figure 2. Signal flow for Background Noise Study, illustrating a network of control signals generated in real time.



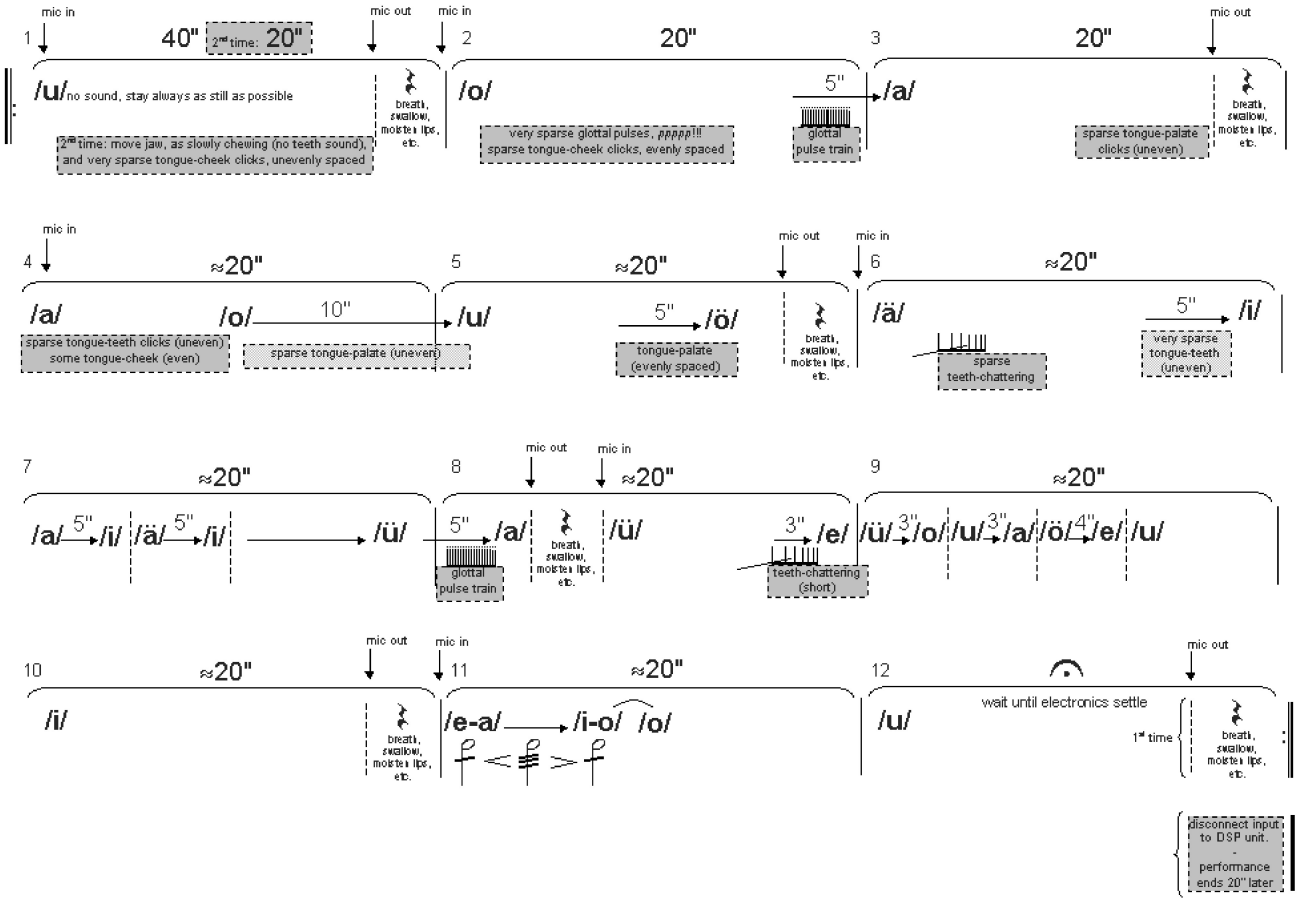
I seriously consider live computer music performance. Perhaps it was out of a need to directly confront the so-called interactive technologies in all forms of human-computer interaction that nowadays seem obvious and normal.

My first move was strategic and a little paradoxical: I tried a performance set-up where I would get rid of any planned interaction, and that would let me see if any residual interaction would still occur and in what particular dimensions of the performance it would occur. That's the strategy behind the 1994 composition *7 Small Variations on the Cold,* for trumpet and a digital signal processing unit. Every variation is announced by a taped voice ("*uno,*" "*due,*". . .), with a very detached tone. The trumpet player has a kind of improvisation schema, totally independent of the computer, requiring only the production of hisses, blowing sounds, everything extremely soft ("*ppp*"), and percussive effects on the mouthpiece and tube. The computer, on the other hand, runs on itself and processes the trumpet sound based on a thoroughly deterministic scheduling of time-domain signal processing transformations, totally independent of the instrumental part.

Anderson: You were not leaning on any auditory exchange or feedback?

Di Scipio: Exactly, no feedback, no real-time controls, no MIDI messaging around, no interaction, only an indeterminate plan for sound production on one side and few DSP algorithms following a deterministic plan on the other.

Figure 3. From the score to Background Noise Study, with Mouth Performer.



Of course it was a failure (in a sense, it had to be a failure), as some interaction did take place on the part of the trumpet player, in the performances I had (a good one was at the 1995 ICMC, in Banff, Russel Whitehead on trumpet, with most of the audience loudly booing at it, and few others enthusiastically whistling). Now, this residual interaction that I noticed was a question of auditory perception, yes, but especially a sense of timing, of timely coordination, a kind of opening of the ears to microscopic nuances in the sound and to the way it travels through the room. I repeated the experience with *4 Variations on the Rhythm of the Wind* (1995), for double-bass recorder and digital signal processing, composed for the exceptional recorderist Antonio Politano.

I should mention that, in composing these pieces, I started working with the Kyma sound-design language and its number-crunching engine consisting of several Motorola processors. I enjoyed working with it so much, it then became for me a rather stable computer music platform with which to work.

Anderson: So what was your next move?

Di Scipio: I then started to think in terms of composing a network of sonic interactions, and I tried to accordingly revise a work I had sketched one or two years before, *Texture-Multiple* for small ensemble and live electronics. I wanted to shape out the relationships among performance components, the audible interconnection among all the actors involved. I would ask myself several questions:

How might the instrumental sound affect the computer process? How might the computer's output sound affect the instrumentalist(s)? What response might the sound elicit from the room where the performance takes place, and how might that response itself drive the computer process and/or suggest changes in the instrumental performance? Each partial element in the performance influences, by the sole means of its sound, all the others, and is in turn influenced by them. In a sense, it's a view closer to system theory and to biocybernetics. And it's an anti-reductionist view: you cannot remove any component without also substantially changing (or even killing) the whole itself.

Anderson: From your writings, I see that you describe this approach, too, as a nonlinear process, where feedback has a major role.

Di Scipio: It has to do with feedback, inevitably, but more precisely with circular causality as a broader cybernetic principle (von Förster 1993). Interaction is too often understood as a determinate machine reaction to a planned human action. I like much more the way Heinz von Förster used to put it, when he said (I am paraphrasing him here), "Interaction is when you see yourself with the eyes of the other." For some interaction to happen between two systems, two organisms or processes, either one should be able to welcome the other's viewpoint in its own view and actions.

You don't have to imply that feedback is audio feedback. Yes, some works of mine are indeed based on audio feedback and use the Larsen Effect as the only sound source, but at the beginning I was mainly interested in sub-audio feedback, that is, feedback in control signals. I would employ feature-extraction methods to track sonic properties in the sound source, instrumental or otherwise, and then turn that information into one or more viable control signals, driving with them the run-time variables of DSP audio transformations. The result is a kind of feedback loop in the low-frequency domain, or rhythm domain.

Anderson: The room space is also involved in this loop, isn't it?

Di Scipio: In some works of mine, the room is part of the network of performance components. Some sound source elicits the room resonances, which are analyzed by the computer, and the analysis data is used to drive the computer transformations of the sound source itself. What is implemented is a recursive relationship between human performer(s), machine(s), and the surrounding environment. Each action or reaction in any of these three elements has short- or long-term consequences on the whole, depending on the particular connections I design. Because it's a recursive process, and because the recursive mapping of information from one element to another is far from being linear and void of noise, the overall process actually materializes a dynamic system. Let's say it at least gets complex enough to blur any sense of a stable, recurrent input-output relationship.

That's the strategy taken in *Texture-Multiple,* whose initial project dates from 1993. The live part of *Natura allo specchio* also works that way. In the string quartet with electronics, *5 difference-sensitive circular interactions,* the transformations of the quartet sound are controlled by the numerical difference between the total sound in the room and the sound of the bridge of the string instruments. The difference-signal represents the room response to the string sound when the computer is quiet; it represents the response of all the sound transformers (room plus signal processing) to the string sound when the computer does make some sound. The whole interaction depends on that, which explains the rather complicated title.

Anderson: The use of musical instruments is peculiar.

Di Scipio: Well, musical instruments are devices usually meant to deliver sounds, but I like to also use them as devices to exert controls over the digital transformations of the sounds they themselves deliver. I do that with any other sound source, even in composing for the so-called tape medium, for that matter: I let the signal processing automatically change its internal configuration upon changes in the input sound.

In other words, in this line of research, sound sets the conditions and boundaries for its own transfor-

mations. I call it sound-specific signal processing, or adaptive DSP. When "sound" includes the room's resonances, then it becomes room-specific, or room-dependent signal processing.

Audible Ecosystemics

Anderson: That leads us to the *Audible Ecosystemics* project that you mentioned at the beginning. Could you describe, step by step, the process of any one of them?

Di Scipio: Let's consider the *Feedback Study.* The sound source is Larsen tones that the person in charge of the electronics deliberately causes in the room. The computer, running some DSP transformations, processes this feedback material. The loudspeakers are used both to create the Larsen tones and to make the computer transformations audible. A few microphones are standing in the room, some of which create the Larsen tones, while others route the room sound back into the computer.

Because the computer output is also heard in the room, it actually interferes with the Larsen Effect itself, causing changes in frequency and other by-products. The computer also executes a variety of feature-extraction methods, using the extracted data for internal self-regulation. For example, it traces the input amplitude of the feedback events and scales the output amplitude down by an inversely proportional factor. It's a kind of "self-gating," useful to avoid saturation and to ensure that a more balanced situation is eventually restored whenever louder feedback events or some thicker computer sound perturbs the system. Self-gating and other self-regulating methods I use reflect a broader systemic principle of "compensation." If some sonic variable happens to build up to a critical point, some other variable automatically counterbalances that occurrence by releasing some energy.

A peculiar aspect in this approach is that later developments are the consequences of (much) earlier events. It's a sign of the system's sensitivity to the external conditions and reflects the fact that the sound we hear at any given time is the outcome of the whole history of the system's process. The system thus implemented has a memory, but not a symbolic one. That's important for large-scale developments in a performance and directly affects the overall musical form.

Anderson: The role of the microphones is decisive, as well as that of the room acoustics.

Di Scipio: The microphones are used as interface between room and machine. Their placement is crucial, perhaps even more so than their technical characteristics. The variety of sounding results depends on the room's acoustical properties, but also on how well the microphones capture these properties.

As to the room acoustics, I must say, there's no good or bad acoustics to the *Audible Ecosystemics* pieces. They just welcome the acoustics of the particular room as it is—as the room's own "soundmark." However, more varied room resonances in principle should yield more varied sound results. In a space with walls and other surfaces made of several materials (wood, glass, concrete, textile materials, etc.), it is relatively easier to exploit a variety of sonic reflections. In a space with fewer surface materials, it may be trickier, so I would put one microphone in an angle and another in the middle of the room, for example, looking for places with different geometrical shapes. Also, I would place some microphones far removed from the loudspeakers, and others closer to them. Just like the microphone, the loudspeaker is not an element foreign to the process; it's part of it, something used to generate the music, not to play it back.

In the *Impulse Response Study,* synthetic impulse material elicits the room's resonances, and the computer transforms these into control signals driving audio transformations of the impulse material itself (Di Scipio 2003). In the *Background Noise Study,* as I said, the only sound source is the background noise, either in the room, or in a human performer's mouth.

Anderson: How is the microphone utilized, in the last case? Does the performer bring it into the mouth?

Di Scipio: Yes. The performer holds a very small microphone with the fingers and brings it well into the mouth, avoiding audible contacts with the mouth itself. In passages, the performer also pulls

the microphone out but keeps it close to the lips, and then swallows, moistens the lips, etc., doing all sorts of small movements (and sounds) that are physiologically necessary every now and then. The computer transforms these mouth sounds, but in so doing it is driven by properties in the sound itself, mainly amplitude, density of events (i.e., how frequently these tiny events are delivered), and some spectral properties. The analysis data then drives simple filters and granular transformations of the mouth sound. When the performer changes the mouth posture, the resonances of the vocal tract cavities change, and the computer adapts to the new situation.

Anderson: Isn't the performance of such works always at risk, so to say, of breaking down?

Di Scipio: Indeed, it is. [*laughs*]. The overall infrastructure depends on so many details and fortuitous circumstances—it's literally fragile—you're right, there's a sense that at any time the whole thing may collapse and crash; not the equipment itself (hopefully not!), but the dynamic process.

You know, I accept that risk and even try to make it tangibly present to the listeners. Facing critical circumstances, I may adjust things on the mixer and in the computer, yet the essential concept to these works is that the real-time process should be capable of self-regulation even in unforeseen circumstances. The performance instructions for *Background Noise Study, with Mouth Performer* include a separate section on "Emergency Situations and Security Measures." It describes how the performer, by changing the mouth posture or delivering some special sounds, might handle the situation where electronic transformations seem to take over and lead the overall process adrift.

In some of my pieces with solo instrument and electronics, one can clearly hear that, were the instrumentalist to refrain from delivering some sound, the whole fabric of polyphonic sound the computer creates from it may vanish immediately. On this topic, there were some questions in the seminar [referring to a lecture delivered in the Elektronisches Studio of the Technische Universität Berlin]. One person observed, correctly, that this fragility is an element that livens up the performance, and that instrumentalists may be more profoundly involved and made attentive by this risk of imminent failure.

Sonic Dust

Anderson: Sometimes you use the term "sonic dust," and I wonder if it is related to this thin line separating an effective performance from failure.

Di Scipio: Maybe. I never thought about it. "Sonic dust" is a loose definition for the by-products of a network of sonic interactions, a shortcut term for thin, noisy artifacts, finely grained textures, maybe closer to a sand—dispersive systems and processes that leave light but audible traces behind (Di Scipio in press).

As you know, Herbert Brün used to say that one thing is composing, and another is the music. The latter is the traces left by the former—a residue, if you like. That was especially in his *Sawdust* computer music project. My efforts are very different, but the conceptual separation of composition (or, responsibility on premises and conditions, in my wording) and music (sonic features arising from premises and conditions) perhaps attests to a shared perspective. The implication is that sound is the epiphenomenon of a lower-level process: you design a low-level process, and the interactions and interferences among particle components taking part in the process are heard as a dynamic shape of sound, a process of sonological emergence.

We touch here on a music-theoretical issue that became clear to me when studying Xenakis's pioneering electronic and computer music efforts (Di Scipio 1997). Taking a broader music-theoretical perspective, in essence all music that is primarily concerned with timbre involves to some extent a phenomenon of sonological emergence. I'm not a professional music theorist, but I have occasionally written on the subject (Di Scipio 1994b).

On Performance

Anderson: Is the performance of your works with live electronics bound to your presence or supervi-

sion? Today it is difficult or even impossible to perform some important electroacoustic compositions from the 1950s and 1960s owing to a lack of documentation.

Di Scipio: Do you refer to the *Audible Ecosystemics* pieces? I perform them myself, yes, but sometimes I have other people do it. The *Impulse Response Study* has been set up by two different live-electronic performers besides myself (Kurt Hebel, for the premiere, in Keele, 2002, and Alvise Vidolin, for the Italian premiere, Florence, 2003). I provided them with instructions as to all that is necessary. The *Background Noise Study,* too, is precisely documented. I am far behind with the documentation for the *Feedback Study,* though.

Yet, I believe that the problems raised in live performance of electronic music are not really overcome with the simple availability of precise technical descriptions. Some amount of "oral tradition" is always needed. Surely, composers should do their best to provide a good technical documentation, but some implicit knowledge is necessary, especially when musical endeavors are able to renew themselves, opening technical and musical ideas that did not exist before.

Anderson: With works like *Texture-Multiple,* could one say that each performance has the status of a version? Not only do works like this involve a variable number of musicians; they consist of a process involving the particular room where the performance is presented.

Di Scipio: *Texture-Multiple* has been for ten years, and to some extent still remains, a work in progress. Maybe it's correct to say, as you do, that there are as many versions as rooms where it has been played. I was thinking rather of multiple versions, owing to the variable number of performers (three to six), which of course determines a very different system dynamics. In the score, the timing is also very flexible, and from what I learned, it roughly depends on the room's size. There have been longer and shorter performances, depending on how big or small the room is.

In *6 studi* (piano and adaptive DSP), not only the tempi, but also the intensities are entirely flexible (no dynamics marks are found in the score). In five passages, the computer processes the piano sound, stretches its duration, and eventually pulverizes the sound by extremely de-correlating the grain signal. These transformations are driven by the speed and amplitude of the piano performance. In turn, the pianist changes intensity and tempi upon perception of the density and thickness of the computer-processed sound. A chain of causes and effects is created that regulates itself and manifests itself primarily in sound and in the way it is articulated in time.

In such works, the computer creates strands of textural material or gestural events of various types. Sometimes the sonority is neat and clean, sometimes dirty—a kind of powder of sound of variable thinness, a sound artifact very dear to me. Sound is central in my work, but it is not an end in itself; I do my best to let it take on a functional role in the performance. In *Texture-Multiple,* the qualities of the sonic texture arising from the computer are for the instrumentalists like a direct auditory display of the current balance between their playing, the computer transformations, and the room resonances. The same criterion applies in large passages of the string quartet, *5 circular interactions.*

Anderson: Properly speaking, there is no score to *Texture-Multiple,* but separate musical materials, rules for using those materials, and instructions for the live electronics.

Di Scipio: You're right, I said "score," meaning the written musical materials and the accompanying rules. The musical materials consist of six independent musical parts, identical except for small details and for the specifics of each particular instrument. In the percussion part of *Natura allo specchio,* there is one only musical line: the first percussionist plays from this line, and the second (using the same set of percussion as the first) follows, quickly imitating the first, independent of the notated materials. When more than two percussionists are involved, each subsequent percussionist imitates the previous one. I don't know what to call it—maybe "algorithmic performance"—anyway, such an arrangement is not at all without consequences on the very quality of sound! It's a system of performance rules, but it translates into a sonority.

In *Texture-Multiple* and *5 circular interactions,* the performance rules have less to do with the interactions between the instrumentalists themselves (as would be the case with Christian Wolff's early work, for example), and more with the way they react to the computer sound, i.e., their own sound either slightly altered or completely transfigured by a few DSP transformations. The instrumentalists's actions are mediated by the electronic setup, but precisely how the latter transforms their sounds and influences the further actions of the electronics is in turn mediated by the room's acoustics. Depending on the sonic features of the total sound in the room, the instrumentalists make real-time decisions regarding their own playing. For example, they may speed up if the sound gets denser or slow down if it gets sparser. One may refrain from delivering new material and take a longer rest, if a lot of one's own sound is heard in the computer output. Or one may, instead, intervene as soon as possible, were the computer to predominantly feature material of another instrument. When all performers share similar intentions, they comprise an ensemble, a group, a small community. When they manifest different or incompatible intentions, the community tears apart.

The oscillation between "many individuals" (mass) and "one whole" (community) is structural. The community is more likely to arise in later passages, as the instrumentalists's relationship to the total room sound consolidates. In the beginning, players are "on their own," and, although some special "sync" moments are requested, a sense of dispersion and drift prevails.

The sonic features based on which the instrumentalists in *Texture-Multiple* change their playing include textural density, total volume of the room sound, and some simple spectral distinctions, like bright versus dark, or narrowband versus broadband.

Anderson: Pitch is not included. It seems to me that in all of your work, pitch is not a primary element.

Di Scipio: No. For me usually pitch is not the main dimension of musical structure. I know, this sounds like anathema for many, including cognitive psychologists who can promptly illustrate with scientifically sound arguments that pitch is the only reliable form-bearing dimension of sound. Some frequency-related properties are of course relevant to me, and they certainly have some relationship to pitch, but musical pitch as notated is not very important in my work. I don't want the computer and the electronics to deliver notes. And even in the way I use musical instruments, I try to minimize any sense that the way pitches are organized is the musical structure per se. My attention is more focused on timbral, textural constructs, noise transients, etc. The instrumental parts of *Texture-Multiple* involve basically two pitches: one very high (a shared note, F-sharp), one very low (the lowest available on each particular instrument), and only occasionally some notes in the middle; same with many other pieces.

In works without instruments, there is no precise pitch at all, no notes. Or, if there is anything resembling a note, that is a local feature, a "singularity" if you like, of the system dynamics particular to that piece, not something I prescriptively wanted to be there. The *Feedback Study* is indeed rich in pitched sounds, all of which are a manifestation of the room acoustics and the electronic setup.

Anderson: Does your new percussion piece, premiered in Paris some weeks ago, also include a direct link to the room?

Di Scipio: No. *Pulse Code (on wood)* is in a line of work involving no direct interaction with the space—at least not of the kind we have discussed so far. The performer plays some woodblocks and any wooden surface available in the concert place, provided it features some basic characteristics described in the score. That's the only direct connection to the room.

The percussion part consists of tremolos and simple rhythmic patterns. It not only provides the sound material, but also acts as a program code, a stream of binary instructions (hit = 1, pause = 0) that sets the internal state of the computer, which in turn transforms the percussion material itself. In some passages, the percussionist can modify his or her reading through the score, depending on the computer output. The computer, in its turn, has ways to cope with improperly delivered binary instructions, prompting the performer with special audible signals.

I'd like to extend this project to also work on glass, on metal—maybe on paper too. But I don't know if I will find time for that in the near future. The miking is so crucial; I have to work it out again, before I move forward—same problem with *Book of Flute Dynamics* (flutes and electronics), which is a piece played mostly by hitting the keys, and only in passing blowing into the mouthpiece. The computer turns the tiny key noises into a polyphonic sound structure, and the particular way it does so is, again, partially driven by the performance nuances. A good miking is decisive, just like in *Pulse Code*. I guess it's one of those very fragile pieces, yet it sounds powerful.

Processes and Methods

Anderson: What signal-processing methods in particular do you employ in your live compositions?

Di Scipio: For the most part, it's time-domain processing transformations. But let me say that what is really important is their systemic function in the performance. To put it simply, some signal-processing methods are for me "operators of diversity;" others are "operators of homogeneity."

As "operator of diversity," I often use granular processing. The output sound could be very distant from the original input material, yet it preserves a coherent internal articulation if you properly control the grain variables. One and the same granular-processing patch may behave as a kind of reverberator (prolonging the input material in time), or as a signal chopper (yielding separate clicks and blips, making impossible to understand their sound source). But it can also act as a kind of band-pass filter bank (augmenting the noise transients in the input sound), and in many other ways. It all depends on the controls exerted.

The good point in granular processing is that, owing to the underlying time-finite representation, each control variable is perceptually connected to one or more other variables. This means that, when you change, say, the grain duration, the texture density also changes; when you change the density, the total loudness also changes. You can hardly separate the perceptual meaning of any one variable from that of others. (This was already clear in Dennis Gabor's ground-breaking theoretical work in the 1940s, which he in fact presented as a theory of hearing; see Gabor 1947.) In a reductionist view, you would consider the sound parameters as independent variables, and any mutual influence between them would be considered a limitation. On the contrary, for me that is a perceptually significant connection among sonic features.

As "operator of homogeneity," I often resort to simple sampling-and-playback. You may still come up with some transformations (changing playback rate, reversing or otherwise controlling the memory read pointers, inverting or otherwise shifting the phase, etc.), but except in extreme cases, the nature of the input sound is preserved.

So, when it comes to audio signal processing, I don't do things more complicated than that. But I do a lot of control-signal processing, though, to create an array of control signals out of the feature-extraction data, using delay units, filters, transfer functions, etc. The output sound is not just a question of what audio signal processing is involved, because it also reflects—more than we usually may consider—the very controls exerted over the audio signal processing.

Anderson: There's no filtering, though, no vocoders, no reverb.

Di Scipio: I use simple dynamically controlled band-pass filters, but not too often. In the *Audible Ecosystemics* project, and also in sound installations, it's the room itself that acts like a filter or an array of filters. (That's probably where these efforts of mine come closer to Alvin Lucier's work, however different it may be.) Actually, the infrastructure of the *Audible Ecosystemics* pieces is akin to a physical model, except that I do not implement a computational model, but a process partially mechanical (acoustical) and partially computational: the sound source acts as the exciter, the room acts as the resonator, and the computer acts as the coupling between the former two.

Sometimes, the feedback loop between microphones and loudspeakers itself becomes a delay line, and the process translates into a kind of reverb

unit. That happens in passages of *Pulse Code*, for example. However, that remains just one of many byproducts of the underlying dynamic process, not a goal of the process.

Anderson: In a sense, the *Audible Ecosystemics* project abhors artificial reverb, as it is rather meant to elicit the real room reflections.

Di Scipio: Yes. But that is also the case with some tape compositions of mine, like *5 piccoli ritmi* (1996), *Intermittence* (1997), or *3 Untitled (sound synthesis, October 2001)* (2001). They also abhor artificial reverberation. The piece *3 Untitled* (made with iterated nonlinear functions as a direct sound synthesis technique) presents the listener with abrasive sound textures that largely take on the spectral coloration of the loudspeakers used to listen to them. In this sense, it points the listener to the nonneutrality of loudspeaker technology, turning a problem in high-fidelity engineering into an element of musical experience. Other composers have works with similar implications (among others, the U.S. composer Michael Hamman). Such works try to play the loudspeakers more than the loudspeakers play them. Another example of "noise," I guess.

Anderson: By the way, do you keep in contact with other composers?

Di Scipio: Well, I travel frequently, so I meet with many people, often with younger composers and students, too. I can't think of any special relationship, but surely some of these exchanges had a significant impact on me. I would often discuss technical and compositional issues with my former teacher, Michelangelo Lupone, who is so talented both technologically and musically. But today I meet him only rarely.

First Steps

Anderson: How were your days as a student with him, in L'Aquila?

Di Scipio: Oh, we were deep into programming real-time sound synthesis, because that was the focus of his work then. Lupone brought the *Fly* system into the classes (that he was himself developing, at the CRM, Rome), and I learned programming assembly code for the Texas Instruments 32010 chip that was incorporated into it, doing simple forms of real-time synthesis. In the mid 1980s, real-time synthesis and processing was quite a difficult challenge, especially outside of mainstream computer-music institutions. I made my first tape piece, *Punti di tempo* (1987), by programming an 8086 processor to control 16 analog oscillators in real time, achieving a very rough form of granular synthesis.

At that time, I had classes in Padova, too, with James Dashow and Roberto Doati, and I learned Music360 and Music V. At some point, Tisato and I compiled a Csound version including new synthesis opcodes implementing iterated nonlinear functions, but I never used it in compositional work.

Lupone's enthusiastic support was very important to me. We would be busy fixing program bugs until three o'clock in the morning, but always with the awareness that this was part of our commitment in this society. In making a direct link between technology and society, I guess we were on the same path as Franco Evangelisti (who had taught Electronic Music in L'Aquila in the late 1970s). Evangelisti had already died—I never met him—but his early intuitions about technology and society, as well as about hearing and the environment, were and still are significant (Evangelisti 1991). Walter Branchi had been a student and collaborator of Evangelisti, and I was interested in his work, although I met him only much later.

Social Relevance

Anderson: Do you see, in your approach to composition, any implication or metaphor as to the social impact and role of music and art?

Di Scipio: Yes, I usually refrain from addressing this aspect directly, because I want it to rise from within the auditory experience, not as a kind of manifesto or a set of ideological assumptions. This aspect should be clear in the idea itself that every component in the performance—human beings, equipment, the room—has an influence on all

other components and on the behavior of the whole system. Our discussion of *Texture-Multiple* has already illustrated this point, I think. In the *Background Noise Study, with Mouth Performer,* the performer must literally face the consequences of their own muscular movements, voluntary and involuntary, once the latter are amplified and processed by the electronics. In a recent work, *4 Esquisses de Surveillance et de Contrôle,* for instruments and electronics, each performer has an individual "surveillance policy" for guarding off what the others are doing.

A more general way to address your question concerns the way by which we—composers, performers, people confronting this world in this particular point in history—establish a desirable and honest relationship to the technology we live in. I personally don't view computers as an aid to make music better, but as a technology with its own specific limitations and possibilities. Different from other technologies, however, digital technologies and media have the power—whose power?—to enframe other technologies. Surely computers have opened up enormous musical possibilities, but these possibilities are relevant for me only to the extent that they cannot be reduced to a commodity that makes it easier for artists to materialize their own imaginations. That would reflect a purely instrumental notion of technology, an oversimplification of an artist's relationship to the tools of their trade. It would reflect, too, the computational paradigm of "problem solving," and, to tell you the truth, I am skeptical that artistic endeavors are "problem-solving" activities. Art is made less by solving problems and more by raising (a lot of new) problems—or at least by articulating unseen problems.

Anderson: Therefore, addressing the technological element of composition is a way to deal with broader social-cultural issues.

Di Scipio: Oh yes, it is. We live in an overly "technologized" world. We can either try to establish some relationship to this thoroughly technical environment (Heidegger's *Gestell*), or presume to get rid of it altogether (a romantic reaction) (Heidegger 1953). Avoiding technology is impossible; such an attempt would be crazy. But it would be just as crazy to simply let it go and enjoy the commodities with which it provides us. As artists, we'd better know the technology we live in and work with, at least well enough to bend it to our purposes. I think it was Adorno who said that, by struggling with the materials and the techniques of one's labor, an artist struggles with society (Adorno 1970).

If you just think about it, all art is made by making, in the first place, the tools themselves needed for it to be made (Di Scipio 1998). Today, we as artists should be in principle designers of our own tools, more than mere users of "high-tech" commodities designed by others. But of course no one is in the position to control the complete range of tools and means one employs.

We all face a number of contradictions in our daily life owing to the heavy expropriation of all tools and means and things with which we live. The fact that we own them doesn't mean that we know and appropriate them. I am not very optimistic, on this point. As an example, today too much electroacoustic music is more precisely defined as "Pro Tools music."

Still, I believe that an effort in the appropriation of technology is necessary to disclose a margin of maneuver within which we may then compose our tools and our music, not letting the software, for example, compose our music. The freedom musicians take in creatively dealing with their working tools and means could be an important sign to convey to listeners.

Anderson: Does it have to do with responsibility?

Di Scipio: Right, it has to do with one's own responsibility over the actions by which one bears and brings forth one's artifacts, designs, proposals to this world. The fact is, all too often we address the artistic qualities of an art work, and we appreciate its aesthetic content, disregarding that the work itself comes out of social mediations and negotiations embodied in the technologies by which it is made. Artistic achievements are traces of artists' awareness of the technological processes involved in their work. My personal opinion is that this awareness is captured in sound—it somehow can be heard. Music always bears audible traces of the composer's relationship to society.

Anderson: Is it important for you to be independent of large studios and electroacoustic music institutions?

Di Scipio: Well, you know, the possibility of working in my own studio (which includes very few pieces of equipment) is a prerequisite for being musically independent. It allows me to pursue efforts and experiments I feel are necessary to do, regardless of academic expectations. And it allows me to respond to institutional invitations based on my own ideas of what must be done.

A certain degree of independence from large studio facilities is not uncommon today, but pursuing a kind of personal research agenda and related experiments—that is indeed a privilege, one for which I had and still have to strive. It's not easy to hold such a position, considering that I was not born into a wealthy family.

Anderson: The emphasis on noise, on the room—that too has social resonances.

Di Scipio: Sure, it fosters a direct experience of sound in the real space welcoming us, with its geometrical and architectural, and hence also cultural, connotations. That is at odds with approaches of "spatialization" and concepts of "virtual reality," however technically refined they may be. I don't want to take the listeners to a distant, inexistent space-time, and then put them back into their chairs after a nice, but illusory, journey. I'd prefer work with that which is before our ears and eyes. That's especially the case with the *Audible Ecosystemics* project and with installation projects.

Anderson: Other composers, like David Behrman, have worked from a similar perspective.

Di Scipio: The installations of Behrman's that I could visit (here in Berlin) are interesting. I have a special interest for all endeavors where sound, including the sound of architectural spaces, is the only or primary medium of communication. As should be clear from earlier answers, I refrain from using visual interfaces, MIDI controllers, heat sensors, photocells, etc., and keep myself to sound as the only interface among humans, machines, and environments. This is a bit ideological, maybe, as after all we use all of our senses to get in touch with the environment and with things we encounter in the environment. But, when it comes to the art called music, or to any form of sound art, that's my way into it.

(Not) Thinking About Form

Anderson: You describe yourself as a composer of sounds. How about musical form?

Di Scipio: Oh, that's a difficult point to tackle. I don't think much about musical form.

Anderson: That's surprising for a European composer.

Di Scipio: I just limit myself to lay down the premises based on which some overall form or orientation may appear, but I can't say much regarding the shape itself that eventually appears. All I can say is that some people tell me that they find my compositions to have a very "good form," a so-called "good shape" [*laughs*].

Anderson: Do they mean a sense of drama?

Di Scipio: It may be drama or deliberate lack of it; I don't know. I myself ask what they mean. I don't think I am in a position to answer. Being somehow naturally able to shape up an overall coherent gesture, I mainly focus on things that I'm not able to do and that need more experimentation from me.

Once I was told that *Natura allo specchio* has a very clear overall form. Probably so, but I had always thought of it in terms of a rather magmatic sonic matter that only in a couple of passages acquires some direction owing to speaking voices clearly heard on top of it.

Musical Theater

Anderson: *Natura allo specchio* is a work largely based on iterated nonlinear functions of the kind you mentioned at the beginning. Like other similar works, it is part of a larger-scale composition, *Sound & Fury.*

Di Scipio: Yes, *Sound & Fury* consists of five sections predominantly made with iterated functions

as a synthesis engine (Di Scipio and Prignano 1996), some of which can be played separately, as is the case with the first section (*Natura allo specchio*) and with the third (*Intermittence*). The complete staging of *Sound & Fury* calls for two reciters, two percussionists, eight-channel tape, live sound synthesis, and computer-controlled slide projection. There is a libretto, based on selected lines from Shakespeare's *The Tempest.*

Anderson: What brings iterated nonlinear functions and Shakespeare together?

Di Scipio: *The Tempest* asks questions as to what is Nature and what is Artifact. Prospero stages a powerful thunderstorm by sole means of his arts of magic. The other personae believe it is a natural—albeit extraordinary—meteorological event.

In its own way, *Sound & Fury* also addresses questions as to the relationship between Nature and Artifact. At the beginning, the sound is overtly synthetic, but it somehow bears enigmatic traces of hidden natural agencies. By the end, the sound is almost entirely natural, but bears traces of a mechanical element to it, something unnatural hiding beyond the surface.

Relevant in *The Tempest* is also the relationship between Prospero and Caliban, the colonizer and the colonized. At the end of the play, Prospero leaves the island he had colonized and sets the native Caliban free again. In *Sound & Fury* (following poet W. H. Auden's interpretation of this point), Caliban is incapable of enjoying his freedom anymore, and he is not able to properly speak his own language. Of course, colonization is not just a question of geographical occupation; it's a cultural process. Today, colonization takes on peculiar forms. What is called "globalization" is a kind of worldwide cognitive colonization.

For years, *Sound & Fury* has been for me a platform to experiment with the weird sonorities I could get using iterated non-linear functions as a direct synthesis method—low-frequency turbulences, intermittence phenomena, and other peculiar artifacts—but so unique, I could not see how to convey them to listeners. I needed a framework to do so, and the plot of *The Tempest* revealed a useful framework. It was an exception, for me. I usually avoid setting existing poetry to music; I more enjoy collaborating with living poets (as I did in *Tiresia,* co-composed with poet Giuliano Mesa).

Anderson: How did you use the Shakespearean excerpts?

Di Scipio: In the simplest way possible. The text is spoken by two reciters (and by taped voices, too), in a plain and comprehensible way. I use the original English text, partly overlapping with its Italian translation and with the translation in the native language of the reciters. (For example, in Portugal, five years ago, we had this three-part language counterpoint.)

I must recall that, beside the Shakespeare material, the libretto to *Sound & Fury* also includes some lines from Auden's commentary to *The Tempest* and few lines by Eugenio Tescione, an Italian poet and friend I have known since high school. I asked Eugenio to re-write in his own way what Auden had himself written in his own way as a commentary to Shakespeare's *The Tempest.*

Anderson: How about the visual element?

Di Scipio: It's mainly naturalistic images, eventually becoming quite abstract to the viewer's eyes. The photographer I worked with, Manilio Prignano, took close-up photos of details of a seashore, in Nettuno, not far from Rome. The seashore is where Caliban stands still, watching the horizon, after Prospero's departure. Taking Caliban's viewpoint, in the concert we first watch a red sun setting down at the horizon, beyond the sea. Then, following the sunset, we watch the sea surface, and finally the ground under our feet. First, wave ripples creating abstract images in the sand, then a dryer sand and grayish stones.

We didn't want anything more complicated. The sunset adds a symbolic meaning to the work. *The Tempest* deals with issues that were of the highest relevance at the time when it was written, a time when the Western Modern world started to be forged, and when the West Indies (later baptized "America") were colonized. As you know, the Latin word *occidente* [west] stands for the place where the sun sets, and in many modern languages we call ourselves *occidental* [Western]. Our world is one that, while increasingly raising up based on an ide-

ology of progress, it's also going down—to use an Escherian image.

Teaching

Anderson: You are a professor in Electronic Music, in Naples. How is teaching there?

Di Scipio: Naples is a very, very complicated town—messy and lively. I was born there, I love it, yet I prefer to live in L'Aquila, a small and quiet mountain town, not far from Rome.

The students I have are very committed, and, although in Naples there's little echo of the international scenario of electroacoustic and computer music, they pursue interesting experiments. One of our long-term projects addresses the overlap between early music and folk musical instruments on the one hand, and computers and other modern equipment on the other. It's like staging the encounter or clash of deeply different cultural rationales, which mirrors broader cultural processes taking place in Naples and other parts of Southern Italy nowadays.

The problem is, except for my classes and the concerts we happen to do around there, there's little context in Naples to what the students do. There are good researchers in the local university, but they have scarce interest in music. On the other hand, many composers and professors in the Conservatory have not even the slightest idea of what electroacoustic and computer music is. The divide is extreme.

That said, teaching is for me a very rewarding experience. It keeps me in contact with younger musicians and with musical trends and technological practices that by myself I would not be able to get to know.

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Table 1. List of Compositions

Tape (stereo, unless otherwise indicated)
Punti di tempo (1987–1988)
Estensioni (CSC Padova, 1988)
Essai du Vide. Schweigen (Simon Fraser University, 1993)
5 piccoli ritmi (1996)
Intermittence (1997)
Paysages Historiques (1998–2005) 2-, 8-, and 16-channel tape materials
- *No. 1: Rome. Cantor Set.* In cooperation with Michael Rüsenberg
- *No. 2: Berlin. Bad Sampling*
- *No. 3: Paris. La Robotique des Lumiéres* (IMEB Bourges)
- *No. 4: New York. Background Media Noises* (IMEB Bourges)

3 Untitled (sound synthesis, October 2001) (2001, 6-channel)
2 Remixes (2002, in cooperation with Fred Szymanski)
30 seconds piece (2003, 5.0-channel DVD)

Instrumental
n/phasis (1989) for percussion (1 player), keyboard with pedal, and low-pitched reed instrument
Index (1990) for 4 percussionists (4 timpani)
Ektopos (1997) for guitar solo (or many guitars in unison)
3 pezzi (2003–2005) for amplified string quartet

Instrument and Tape
Fractus (1990, CSC Padova) for viola and tape
Plex (1991, CSC Padova) for double bass and 4-channel tape
Kairos (1992) for soprano saxophone and tape
Some strings (1993, Simon Fraser University) for harp and tape

Instrument(s) and Live Electronics
Event (1990) for flute, clarinet, 4-channel tape, and digital signal processing
Texture-Multiple (1993, rev. 2000) for 3–6 instruments and room-dependent digital signal processing
7 piccole variazioni sul freddo (1994–1995) for trumpet and digital signal processing
4 variazioni sul ritmo del vento (1995) for double bass recorder and digital signal processing
6 studi 'dalla muta distesa delle cose' (1996–1997) for piano and adaptive digital signal processing
5 interazioni cicliche alle differenze sensibili (1997–1998, Istituto Gramma, L'Aquila) for string quartet and room-dependent digital signal processing
Book of flute dynamics (2001) for flute and adaptive digital signal processing
Os, oris (2002) for trombone and adaptive digital signal processing
2 di 1 (2003) for violin, piccolo recorder, and adaptive digital signal processing (Note: two more versions are available for one instrument and adaptive digital signal processing)
Pulse Code (on wood) (2002–2004) for wooden objects and adaptive digital signal processing
4 Esquisses de Surveillance et de Contrôle (2003–2004) for string quartet, bassoon, sub-contrabass recorder, and digital signal processing

Live-Electronics Solo
Craquelure (2 pezzi silenziosi, a Giuliano) (2002) for sound synthesis and adaptive multichannel diffusion
Audible Ecosystemics (2002–2005)
- *No. 1: Impulse Response Study* (CCMIX, Paris)
- *No. 2: Feedback Study* (Istituto Gramma, L'Aquila)
- *No. 3a: Background Noise Study*
- *No. 3b: Background Noise Study, with Mouth Performer*

Table 1 (continued).

Sound Installations
Suoni e colori dal mare (1996, in cooperation with Manilio Prignano)
Feedback Study, with Vocal Resonances (2003–2004), an installation visited by two or more performers
Untitled (2004) pulse feedback voices, July '04
Untitled (2005) small reverberant room, June '05

Special Projects
Sound & Fury (1995–1998) for 2 reciters, 2 percussionists, 8-channel tape, sound synthesis, and room-dependent digital signal processing
No. 1: Natura allo specchio
No. 2: L'isola (SACMUS, Helsinki)
No. 3: Intermittence (see also tape works listed above)
No. 4: Caliban, to the (future) audience
No. 5: Specchio alla natura
Tiresia (2000–2001, in cooperation with Giuliano Mesa), a poetry reading (1 or 2 reciters) with electronics

All works were produced in the composer's studio unless otherwise indicated.

Table 2. List of Recordings

7 piccole variazioni sul freddo. Audio compact disc. Graz: ArsElectronica ORF pae95.
5 piccoli ritmi. Audio compact disc. Acton, Massachusetts: Neuma 450-93.
6 studi. Audio compact disc. Recorded on Limen, Milan LM322-12 and *Hörbare Ökosysteme.* Berlin: Edition RZ.
5 interazioni cicliche alle differenze sensibili. Audio compact disc. Recorded on Cemat, C001, Rome; ICMC 2000 Audio Compact Disc; and PanAroma, San Paulo.
Rome. Cantor Set. (*Paysage Historique No. 1*). Audio compact disc. Cologne: NoteWork 5101-2.
Tiresia (two excerpts). Audio compact disc. New York: Capstone CPS 8693.
Natura allo specchio. Audio compact disc. Melbourne: Bug Records BUG108. Also recorded on the *Computer Music Journal* 2002 Audio Compact Disc Compilation.
Natura allo specchio. DVD. Toronto: 12th root DVD RA01. (See www.twelfthroot.com/ra01.)
Paysages Historiques. Audio compact disc. Bourges, France: Chrysopee Electronique. (See www.imeb.net/EDITIONS/chrysopee.html.)
Hörbare Ökosysteme. Berlin: Edition RZ. (See www.edition-rz.de.) Includes *Audible Ecosystemics, Texture-Multiple* (version with six instruments), *5 interazioni,* and *Craquelure.*