Curtis Roads is a professor of media arts and technology with a joint appointment in music at the University of California, Santa Barbara (UCSB). He is also Associate Director of CREATE, the Center for Research in Electronic Art Technology, at UCSB. He is the author and editor of several books on computer music, including *The Computer Music Tutorial* (Roads 1996), which has since been published in French and Japanese editions, and *Microsound* (Roads 2002).

In the following discussion, I have chosen to focus primarily on Mr. Roads as a composer, rather than on his experience as a researcher in the field. Should readers require more standard documentation of his publications and a general curriculum vitae, they may wish to visit his home page at www.create.ucsb.edu/~clang. Special note will be made, however, of a new double-disc (CD + DVD) collection of his music, *POINT LINE CLOUD*, which has just been released on the San Francisco-based Asphodel label (Roads 2005). This collection was honored with the Award of Distinction at the 2002 Ars Electronica Festival in Linz, Austria.

Electroacoustic Perspectives

**Robindoré:** In an article in *The New York Times* (Crutchfield 1988), the instrumental composer Olivier Messiaen gave his rather remarkable perspective on electroacoustic music:

> The ancient musical modes lasted for ten centuries, tonal music only a few centuries, three centuries really. Serial music lasted about fifty years. Aleatory music should last for a few days, Minimalism a couple of weeks. What will last longer, I believe, is electronic music, or electroacoustic music. Some composers do this, some don’t; I don’t—but even for me it has changed music. I cannot hear the orchestra in the same way, for instance, because of electroacoustic music. It has not yet given us new masterpieces, but it has given us new timbres.

With the vantage point of 30 years in the field, can you concur with Messiaen’s opinion concerning the lasting nature of this genre? And what of his comment that the field has not yet offered [as of 1988, that is] any “masterpieces” such as those yielded by Western art instrumental and choral music composers over the centuries?

**Roads:** What provocative questions! Olivier Messiaen wisely encouraged new music to expand in multiple directions. In my classes, I play his *Fête des belles eaux* for six electronic Ondes Martenots, which he composed as a young man in 1937.

I would say that we live in a multicultural world where the different genres and styles mentioned by Messiaen never die completely. Because one of the ways that music evolves is through combining styles into a new hybrid, the historical styles continue to serve as an important gene pool for future music.

In the 21st century, many factors align in favor of the electronic medium. In my view, we are in the midst of a golden age of electronic music composition, supported by strong technical and aesthetic momentum. Edgard Varèse’s vision for the “liberation of sound” is our reality. In an imperfect world, I am very grateful for at least this.

As to the question of masterpieces, I would say that a masterpiece defines a genre or sets a standard for works that follow. The question of choosing masterpieces is tricky. What are the masterpieces for acoustic instruments since 1950? The choice would have to be quite subjective.

In any case, electronic music gives us more than new timbres; it offers new tools for organizing sound material. New materials and tools lead to fresh compositional strategies based on timbral mutations, spatial counterpoint, detailed control of complex sound masses, graphical sculpting of time-varying spectra, juxtapositions of virtual and real soundscapes, sound coalescence and disintegration,
and interplay between the microsonic and the other time scales that cannot be realized by acoustic instruments. Listen to *Forbidden Planet* (1956) by Louis and Bebe Barron, which defined the genre of space music. Karlheinz Stockhausen’s four-channel tape *Kontakte* (1960) not only created a fascinating sound world, but also defined a new musical code. Bernard Parmegiani’s *De Natura Sonorum* (1975) is a tour-de-force of stylized *musique concrète*. Jean-Claude Risset’s *Sud* (1985) is another brilliant piece. I have recently written an article on Horacio Vagione’s outstanding electroacoustic music (Roads forthcoming). I could go on. I play a great deal of music for my students.

I am reminded of a remark attributed to Richard Strauss in which he supposedly said: “I am not a great composer, but I am a very good composer!” A number of very good composers are working today in the electronic medium, so I am confident that certain pieces of our time will be considered masterpieces in the future.

Robindoré: A related question concerns the ability of the electronic medium to construct bridges between so-called serious composition and the pop culturati. Though this phenomenon is not new, it seems to be growing in momentum in unexpected ways. Perhaps the tired old issue of how to resuscitate the moribund “university” music scene is in some ways being addressed by the freshness of electroacoustic music [Roads forthcoming]. I could go on. I play a great deal of music for my students.

Roads: Earl Howard, who excels both on the saxophone and in live electronic music performance using a Kurzweil sampler, is able to bridge this gap as well as anyone. His ensemble performances mix and transform sounds played by other instrumentalists onstage with his own sound sources. The key to success with this approach is to develop virtuosity, which he has certainly done. Ultimately, however, one must admit that certain musical paths require a new means of production. For these paths, we need entirely new instruments. This is why I developed the Creatovox [see Figure 1] with Alberto de Campo. My book *Microsound* [Roads 2002] describes some of these possibilities, and I am continuing research in this direction.

**Robindoré**: When I think of composers such as Gérard Grisey and György Ligeti, both of whom were impacted by electroacoustics, the more ethereal aspects of the natural world come to thought, as they do for many listeners. This highlights the point that perhaps one of the preeminent qualities in this area? After all, electroacoustics has offered us a window on the threads of pure acoustics, a perspective which would allow us to “remold” traditional instruments according to universal laws or typologies of sound production and transformation—laws that tend towards erasing the distinction between, for example, a bassoon and violin, by focusing on what they share acoustically—primarily in spectrum and energy. By demanding this commonality—this continuity—the different orchestral instruments could to some degree be released from their traditional roles or personages. The point, of course, is not the loss of a unique identity, but rather the expansion of it so that the instrument can keep pace with the contemporary ear accustomed to the abstract. The bassoon would no longer be the “buffoon” of the orchestra, or even the straining, primitive wail in the opening of Stravinsky’s *Le Sacre du Printemps*, but, in its own way, an quasi-infinitely variable acoustic sound source [Robindoré 1997].
of electroacoustics has been to capture and access nature itself, if you will, and thereby open this domain to more traditional compositional writing. I don’t mean simply recording natural sounds, but offering the means whereby one can mine and sculpt synthetic timbres and structural aggregates that closely approximate nature’s utterances while still remaining a crystallized form of creative expression. The “imitation” of nature has, of course, been many a composer’s preoccupation for centuries, both in the Orient and the Occident. Twentieth-century visionaries such as Varèse and Xenakis were inspired by physical phenomena and scientific and astronomical discoveries. Louise Varèse recalled of her husband, “He told me that once watching a display of the aurora borealis he felt an ‘unbelievable exaltation—an indescribable sensation’ and that as he watched those ‘pulsating incandescent streamers of light’ he ‘not only saw but heard them.’” Later he attempted to transcribe them [Mattis 1992]. Continuing this lineage, perhaps one of the clearest contemporary examples is actually your own foray into and compositional fathoming of the realm of microsound. These works have yielded kinetic strategies that seem to reflect an auralization of atomic activity. And some of your titles, such as Fluxon (2002), echo Varèse’s Ionisation and Density 21.5 in their scientific tone.

Roads: Yes, I relate to Varèse’s emotions. Under certain atmospheric conditions, one can observe rapid cloud formation and evaporation on a time scale of seconds. I love to watch how clouds emerge out of nothing, mutate through various degrees of transparency, merge with other wisps, and then dissolve into nonexistence. These natural processes are beautiful models for musical formation.

I am also inspired by images produced using bubble and cloud chambers that depict subatomic interactions (see Figure 2). I am especially interested in the causal behavior they depict: the power of attraction and repulsion. I try to incorporate these forces in my music. For example, in one movement of Clang-Tint [1994], the macroform revolves around two points of attraction. Gravitating around one of these, over eighty short sounds transpire within a three-second period. One also sees in bubble chamber images the spectacular consequences of particle collisions. In my music, when certain sound streams converge or collide, the musical texture immediately changes and can never be the same.

Robindoré: Your work could almost require a new terminology, falling under a category I’d like to coin as quantum sonics. This term brings to thought a parallel with nanotechnology. You are juggling sonic particles according to compositional will, and the nanoscientist is seeking to deconstruct and reassemble particles of matter within the exigencies of quantum mechanics. Art and science are charting parallel universes and may coincide to bring out a broader perspective than either could achieve in solo. Arthur Koestler [1964] had a beautiful thought about this interplay:
Einstein’s space is no closer to reality than Van Gogh’s sky. The glory of science is not in a truth more absolute than the truth of Bach or Tolstoy, but in the act of creation itself.

Roads: Indeed, the boundaries between disciplines are artificial. They correspond to sociological groups, not ideas. Ideas float freely above walls of the institutions (religious, governmental, artistic, scientific, academic, and corporate). For example, pure science is similar to art in the sense that it is driven by curiosity, not by practical applications. Major areas of science and mathematics are creative idea incubators that serve little purpose besides inventing interesting theories and experiments that stimulate other scientists and mathematicians. They speak of beauty, of aesthetic fitness, in the most refined results. Every once in a while someone finds a practical application for a result, and this seems to justify the research. The function of the arts is to sensitize and awaken human consciousness. This is a most practical application; indeed, it is desperately needed!

All Roads Lead to Microsound

Robindoré: How did you personally traverse the electroacoustic road to microsound? Up until the last ten years or so, it was a solitary path—Xenakis,
Robindoré, Truax, perhaps a few others. Was it a compositional imperative, a theoretically inviting domain, or both?

Roads: It came out of my first encounter with Xenakis, at his short course at Indiana University in May of 1972. He presented the theory of Markovian stochastic music, in which is embedded the notion of granular synthesis. His book *Formalized Music* (Xenakis 1971) described a theory of granular synthesis in some detail and pointed out its relation to the work on sound quanta by the physicist Dennis Gabor in the 1940s. So in 1974, when I first gained access to a computer that could synthesize sound, I tried to implement granular synthesis. When I heard the sounds coming out of the computer, it was obvious that this would have major consequences in the future. Yet it took twenty years for technology to evolve to the point where I could explore the full range of these techniques in composition. Even so, I consider myself fortunate when I compare the experience of Varèse, who was tragically ahead of his time.

Robindoré: May we digress for just a minute on the question of Varèse’s quality as a visionary? You mentioned earlier that, “Varèse’s vision for the ‘liberation of sound’ is our reality.” While this is clearly true, his unique conception of spatialization seems yet to be fully realized. Most readers will be familiar with his words when he wrote:

> When new instruments will allow me to write music as I conceive it, the movement of sound-masses, of shifting planes, will be clearly perceived in my work, taking the place of the linear counterpart. When these sound-masses collide, the phenomena of penetration or repulsion will seem to occur. Certain transmutations taking place on certain planes will seem to be projected onto other planes, moving at different speeds and at different angles. There will no longer be the old conception of melody or interplay of melodies. The entire work will be a melodic totality. The entire work will flow as a river flows. [Varèse 1936]

Do you see his dream as a foreseeable achievement based on current research, and do you find your own work in some manner contained within his vision?

Roads: I would say yes—resolutely—to both questions. A host of technical trends are emerging, including loudspeaker arrays for wavefield synthesis, directional sound beams that project sound to a specific point in a space, loudspeakers with variable dispersion patterns, and real-time convolving spatializers, among others. The widespread use of pluriphonic [multiple-loudspeaker] sound-projection systems, such as the Bourges Cybernéphone (Clozier 2001) and our own Creatophone [at UCSB] is bringing Varèse’s dream of spatialization ever closer. Another trend is the construction of special-purpose halls for the projection of electronic music, such as the Sonic Arts Research Centre in Belfast, where I recently played a concert over 48 loudspeakers around, above, and below the audience.

At the same time, composers are becoming more aware of the complexity and importance of spatialization. Spatialization has two facets: the virtual and the physical. In the virtual reality of the studio, composers spatialize sounds by imposing delays, spectral filters, panning, and reverberation, lending the illusion of sounds moving in imaginary environments. Through convolution, one can take a sound portrait of an existing space and impose its spatial characteristics on any sound object. An extension of this idea is to use particle synthesis to design artificial impulse responses. This opens up an unlimited territory of virtual spaces. The performance of a piece, by sound projection in a hall, intersects these virtual spaces with a pluriphonic physical space.

The point is to fully integrate spatialization with other aspects of composition so that spatial morphologies articulate musical structure and vice versa. The domain of space has multiple dimensions: lateral position, vertical position, image width, and image depth, all of which can vary on different time scales. One needs to take into account foreground versus background layers, fixed versus moving sources, different rates of motion, as well as variations in the shape of the movement (smooth or discontinuous, etc.). When I project my music, I deploy spatial “chords” or unusual groups...
of simultaneously sounding loudspeakers. A simple case is a diagonal pair, like high left front and low right rear, so that sounds pan across and through the audience in three dimensions, rather than simply from one side to another.

Early electronic music was characterized by a fixed spatial perspective, such as a global reverberation applied to every sound in a piece. Today we can control spatialization on multiple time scales. In the limit, each particle can be projected from its own virtual space.

Multiple Time-Scale Composition

Robindoré: You have offered us some elements from your inspirational palette. Speak to us, if you will, in more detail of the actual compositional processes and tools you employ, if this is not betraying the composer’s “secret recipes.” It would be valuable, I feel, for you to give us a panoramic view of your more recent oeuvre.

Roads: In my role as professor, I evangelize techniques of sound production, transformation, and compositional organization, so I have no technical secrets left!

My approach to composition usually begins with the creation of sound source material—an exploratory process. This is the most playful part of composition—a direct, uninhibited, sensual experience of interaction with sound waves. At this stage, there are no constraints. It is like playing an instrument, but both “playing” and “instrument” have expanded meanings in electronic music. For example, Volt air (2001–2003) began as a collection of sound clouds generated by the CloudGenerator program. Pictor alpha (2003) started with pulsar trains generated by the PulsarGenerator program. To make the source material for Thither (a work in progress), I played an Ondioline (an old electronic keyboard instrument) and recorded it onto analog tape in a studio in Paris. One could also consider a composition algorithm as a generator of source material, as did Xenakis. Indeed, I think of PulsarGenerator as an algorithmic sound engine with an interactive graphical interface.

Sometimes, an extramusical idea or emotion drives the work. For example, in Nuage gris (another work in progress), the music is a direct reflection of a deeply felt mood. Tenth vortex (2000) and Eleventh vortex (2001) are also the product of intense emotions. In the four parts of Clang-Tint (1994), each part’s sound and organization reflect a conceptual theme [Purity, Filth, Organic, Robotic].

The second phase of composition is the important phase of classifying and editing the source material. I divide the various sounds into types. Within each type, I then organize the sounds by time scale (micro, sound object, meso). I am usually pruning the material at the same time, discarding some, and editing and transforming the rest.

Through this rather intense studio labor (see Figure 3), I become intimately familiar with the material. I am imagining how it might organize itself into larger scale forms, and I start to plan the organization on multiple time scales. This is where the game becomes complicated. Before this point, I tend to work intuitively. To plan a macroform is to set a goal, so one has to shift to a rational problem-solving mode of thinking. In effect, the piece becomes a complicated jigsaw puzzle. It is as if each piece in the puzzle is a sound object with a potentially unique morphology. As I assemble the puzzle, certain objects appear to be natural matches: they fit in sequence or in parallel. Other objects seem out of place. How they will ultimately fit together is not evident at the beginning.

Figure 3. Curtis Roads in his studio, July 2004.
The difference between a conventional jigsaw puzzle and a composition is that one can construct new sound objects to fill in gaps or transform existing objects so that they fit better. The more objects one constructs, however, the more combinatorial possibilities accumulate. The game of composition may slow down, as each object carries additional implications, some of which can only be realized by further editing or yet more synthesis.

As the puzzle takes shape on the higher timescale of meso structure, the trial-and-error process of montage, of rearrangement and refinement, should lead to the illusion that the puzzle could be solved in only one way. Of course, there is no perfect solution. One is not obliged to fit all the original source material into the puzzle. The puzzle is solved when I say it is, and the solution is not necessarily final. A composition is never perfectly formed. Even great works have stray threads and loose ends. They are human products. It makes no sense to talk of a perfect solution to a compositional puzzle: perfect according to what criteria? It can always be remixed or regranulated.

Robindoré: What have you found to be the particular compositional challenges germane to working with microsound? Aren’t you often faced with the old adage of not seeing the forest for the trees, i.e., not hearing the morphologies for the particles? This is certainly the impression that some receive when listening to a variety of works in the genre. It’s almost a type of sonic uncertainty principle, akin to Heisenberg’s! As if the more precisely you portray a sound particle in audible space, the more unsure you are of its trajectory or musical dimension. Is it a grain or is it a wave? Or could it be that microsound, to some degree, commands its own forms, where more traditional notions of musical architecture recede before the sheer sonic delight of textured globules and their interplay—a kind of atomic punctus contrapunctum?

Roads: I do not see new sounds as replacing old material but rather augmenting the palette. In any case, material and form have always been related. Microsonic materials and procedures tend to shift the aesthetic focus toward fluid morphologies. The flowing structures that we can create with microsound do not necessarily resemble the usual angular forms of musical architecture. To the contrary, they tend toward liquid-like or cloudlike structures.

The question for the composer is, “How can I articulate trends on various time scales within an evolving process?” Intervals [metrical beats and pitched tones] may emerge, but they are not the indispensable grid. There is rather an interplay between intervallic and nonintervallic material.

Within these flowing structures, the quality of particle density—which determines the transparency of the material—takes on prime importance. An increase in density induces fusion. It lifts a cloud of sound particles into the foreground, while a decrease in density causes evaporation, dissolving a continuous sound band into a pointillist rhythm or vaporous background texture. Keeping density constant, a change in the characteristics of the particles themselves induces mutation, an open-ended transformation.

Works such as Tenth vortex, Eleventh vortex, Sculptor (2001), Fluxon (2003), and Nanomorphosis (2003) are based on constant-Q filtered granulations. By contrast, I see Pictor alpha as a traditional piece of melodic music spawned by a repeating melodic cell.

A Telescope on Other Terrains

Robindoré: Since we are in the domain of composition, for the sake of historical completeness, please briefly speak to us of your earlier years as a composer and then of your future perspectives for the field. Are there any particular works or trends—or even musical moments within a work—that greatly impacted you? I think the composer’s ear searches for epiphanic moments where a musical flow is transparent to some undergirding idea. And this search enriches one’s capacity to consistently transcend sonic material so as to reach a type of unharmed reality, utterly laid bare. This compositional integrity may be the rarified standard Iannis Xenakis was referring to when he wrote:

Art, and above all, music has a fundamental function; it must aim towards a total exaltation
in which the individual mingles, losing his consciousness in a truth immediate, rare, enormous, and perfect. If a work of art succeeds in this undertaking even for a single moment, it attains its goal. (Xenakis 1992)

Roads: Yes, I love that quotation, with its emphasis on the experience of art. Great music comes in many forms. Certainly in my youth I was strongly affected by all kinds of external trends. I played several different instruments and played in various styles. Obviously, at the age of 21, Xenakis’ thought had an impact on me. The sound of the early electronic music and musique concrète remains a strong point of reference. But at a certain point one matures. One finds one’s own path. My path is to explore certain uncharted territories of sound and sound organization. I am very happy to be on this path. I can see a few other people who are out there with me exploring this land, Horacio Vagnione for example. Through a telescope I can see Luc Ferrari and others off in the distance exploring other interesting terrains.

Robindoré: And your perspective on the future? Turning this telescope in another direction, what do you perceive to be some of the as-yet relatively unmined terrains of sound or sound structuring? And should we look for, as in your case, a composer’s vision and auralization of sound to be at the vanguard of this exploration?

Roads: Through a telescope I can foresee my future quite clearly, predestined by a backlog of unfinished pieces! I am also writing a book on the composition of electronic music. Beyond this, I am engaged in research with graduate students at UCSB that I expect to bear fruit. These projects involve deeper exploration of microsonic territories.

The first research project comes out of my general interest in visualizations of sound, including new
ideas of notation as well as artistic and scientific renderings of sonic processes. In the past several years, I have worked with a number of graduate students on different facets of this topic, including Francisco Iovino, John Thompson, Woon Seung Yeo, and Brian O’Reilly. (See also Ingram 2002.) One thread of research is based on new methods of sound analysis. Recently, Garry Kling has been working on the analysis of sound using the matching-pursuit wavelet technique. This technique produces high-resolution images that reveal the fine granular microstructure of sounds (see Figure 4). It decomposes any sound into a collection of individual sound particles. This representation is robust, in that one can alter a given particle without affecting other particles. This is very powerful. I am interested in using such visualizations as tools for probing inside sounds and transforming them on a molecular level. Our research faces multiple challenges. As you mentioned earlier, nanoscientists can rearrange individual atoms, and likewise we can rearrange individual sound particles. The challenge faced by both the nanoscientists and us is to find interesting handles on larger patterns within the material. Another issue is that the matching-pursuit analysis is quite time-consuming when it is run on a single machine. However, I believe that the algorithm could be recast to run much more efficiently on a multiprocessor cluster, which we will have available in our new building next year.

I am also excited about my student David Thall’s project. We wanted to generalize particle synthesis so that the disparate techniques that I demonstrated in my book Microsound could be unified within a single program and manipulated in real time by means of a matrixed control scheme. Without going into too much detail, let me just say that this new design combines the possibilities of multiple particle synthesis techniques to create a greatly expanded space of sonic potentialities. I could discuss many novel aspects of this program. To cite just one, it can realize multiple streams of granulation in parallel, each of which can operate on a single source or on dozens of sources. Certain of these streams can be higher-order granulations, that is, regranulations of other streams. Using my own programs in multiple steps, I have explored higher-order granulation in pieces such as Now (2003) and Never [in progress]. Having this capability available in a single real-time step is a breakthrough. I know that I will be using this program in my future compositions!

References


### Appendix A: Catalog of Recent Works by Curtis Roads

<table>
<thead>
<tr>
<th>Title</th>
<th>Year(s) Composed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sculptor</td>
<td>2001</td>
<td>Electronic sound. Based on acoustic material provided by John McEntire.</td>
</tr>
<tr>
<td>Fluxon</td>
<td>2002</td>
<td>Premiered April 2003 at All Tomorrow’s Parties, Camber Sands, UK.</td>
</tr>
<tr>
<td>Now</td>
<td>2003</td>
<td>Electronic sound. Premiered 1 May 2004 at the Sonic Arts Research Centre, Belfast, Northern Ireland.</td>
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