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The Liberation of Sound, Art-Science and the Digital Domain: Contacts With Edgard Varèse

Jean-Claude Risset

Varèse insisted that the same poetic impulse could move the composer and the scientist, and he strongly advocated the synergy between art and science, the only way to provide music with new means of expression and 'to infuse it with youthful sap', as he wrote in 1917 (in an article in Picabia's 391 magazine). Music has been at the forefront of many advances in the field of science and technology—including the implementation of new uses of the computer. In this article, I first recall historical instances where music was an influential inspiration for the developments of science and technology, rather than a mere field of application. Varèse coined the expression 'organised sound'; he pioneered the extension of compositional activity to the elaboration of sound—composing the sounds themselves, rather than merely composing with sounds. I relate this trend to the context of 20th-century music. Then I give some recollections of my meetings and discussions with Varèse, hoping that this mixture of anecdotal and musical comments may be of some interest (I have tried to quote the words of Varèse as faithfully as I could). After the evocation of two evenings in tribute to Varèse and his living ideas, I conclude with reflections on art-science and music research, activities called for by Varèse, in the context of present day society.

Keywords: Varèse; Max Mathews; Computer; Electroacoustic Music; Digital Sound; Liberation of Sound; Synthesis; Art-Science; Technology; Music Research

Varèse and the Computer

In the 1960s, I worked at Bell Laboratories with Max Mathews to explore the musical resources of computer sound synthesis. Between August 1964 and September 1965, I was privileged to have contacts with Edgard Varèse. Varèse had brought computer music to the public's attention for the first time as early as 1959, and he followed its developments with interest and critical sympathy.

The initial support of Varèse was of the utmost importance for those trying to

harness the computer for musical purposes. Varèse, the prophet of the liberation of musical sound, had experienced the equipment of electroacoustic music, with *Déserts* and *Poème électronique*, but he was still longing for ways to control sounds and shape them in ways obedient to the musician's inner thoughts, and he believed this could only be achieved by going beyond the possibilities of analogue electroacoustic music, with the help of science and technology. Varèse's interest—'le computer, c'est la nouvelle frontière' [the computer is the new frontier]—was most encouraging in the initially difficult and thankless task of making the computer a musically responsive tool.

When Varèse died, Pierre Boulez wrote: 'Adieu, Varèse, adieu! Votre temps est fini, et il commence' [Farewell, Varèse, farewell! Your time is over and it begins] (*Le Nouvel Observateur*, 1965, p. 39). Certainly the efforts of Varèse to liberate musical sound from the constraints of traditional instruments are now pursued on a large scale. Varèse liked the definition of music proposed by the Polish philosopher and mathematician Wronsky—'the corporealization of the intelligence that is in sounds' (see Varèse, 1967a, p. 199)—and he already realised that the computer was more than a tool, or a miraculous gadget: a material and intellectual workshop which would help to go further toward implementing this view of music.

At the end of Varèse's life, the computer was still an enormous and expensive device. Most people thought that in the future computers would be huge machines with plenty of remote terminals. Few people anticipated the phenomenon of the personal computer—Max Mathews was one of them. From the beginning of the computer, the essential was not in the hardware, but in the software, the know-how, the immaterial. Expertise in computer sound-synthesis was developed during the 1960s: it later materialized with portable digital synthesizers, and remains available for present-day personal computers—in a form that is less immediately accessible, but which can be exploited in much more flexible ways than in synthesizers, in terms of concepts, processes, knowledge—intelligence.

Today, the computer is a familiar machine, much more pervasive and less awesome than it was some 40 years ago. The field of sound has become more and more influenced by digital technology, with compact discs, synthesizers, samplers, audio processors, DAT, and other digital recording formats. Some people believe that the time for the computer and digital sound is over, since special digital equipment is commercially available, and is less expensive and cumbersome than general-purpose computers equipped for sound. However, this is commercially oriented equipment, adapted to traditional attitudes or concerns; it certainly does not fulfil Varèse's dreams: 'Je rêve le instruments obéissant à la pensée' [I dream of instruments obedient to thought] (Varèse, 1917). In fact I am convinced that the time for the computer and sound has only just begun: it will be a major challenge for the coming centuries to achieve a fruitful synergy between man and his new 'partner'—beyond the sonic domain.[2]

Music as an Inspiration for Science and Technology

Varèse thought that music had unduly drifted toward the disciplines of language, heirs of the *trivium*: grammar, rhetoric and dialectic. He contended that music should find its place again as 'art-science', which was the case in the *quadrivium*, where music was in the company of arithmetic, geometry and astronomy. This view was controversial; it still is, but it no longer seems weird. It is clear that music benefits in many respects from science and technology. Most music is now heard through technical channels, and there is a considerable development of electronic devices to make music, both in the popular and in the art-music scene. And important composers claim to be strongly impressed and even inspired by science—especially Varèse himself.

On the other hand, Varèse was also aware that music, rather than a mere field of application, had also been an influential inspiration for developments in science and technology. Indeed, one can give many examples where music brought scientific enlightenment. Studying the musical intervals of tones produced by a vibrating string, Pythagoras applied mathematics to the study of natural phenomena: the first physics was musical. Aristoxenes insisted that the musical phenomenon relied on the specifics of perception rather than on a mathematical explanation: he pioneered psychoacoustics. The first important 'machine' was probably the organ: the energy used to produce the sound does not originate from the performer, who concentrates on the specification of the musical information by touching his keyboard. The musical keyboard is the ancestor of other keyboards, which play most important roles: the typewriter and computer keyboard. As early as the 15th century, long before Fourier, organ makers intuitively implemented harmonic synthesis in the mutation stops of the instrument. The important field of harmonic analysis was also explored in the context of music by Mersenne, Sauveur and Rameau, and later by Euler and Helmholtz; new advances still take place today, thanks to endeavours to improve the processing of musical sounds, with the work of Andy Moorer, Mark Dolson, Tracy Petersen, Richard Kronland-Martinet, Daniel Arfib on analysis-synthesis systems such as the phase vocoder, the wavelet and the Gabor transform. In the 17th century, Kircher described musical automata where the score was coded on rotating drums as Cartesian coordinates—earlier than Descartes: these are the first examples of stored programs, long before Jacquard's automatic weaving loom. To establish the foundations of dynamics, Galileo resorted to the abilities of musically trained monks, who counted in rhythm as substitutes for non-existing stopwatches. Lee de Forest was trying to trigger electrical oscillations for the production of musical sound: thus he invented the 'audion', better known as the triode—a milestone of electronics. Many concepts were implicitly used in music long before they were explicated in mathematics, such as the notions of logarithms, of arithmetic 'modulo', of groups of transformations. Fifty years before Chomsky, the Viennese musicologist Schenker introduced a theory of tonal music, which called for the concept of generative grammar. Recently, the musical exploration of the digital sound domain has brought about the essential paradigm of analysis by synthesis, used for the exploration of timbre by Mathews, Chowning, Wessel, Shepard,

Sundberg and McAdams. Musicians have a detailed representation of the sonic domain that can be beneficial outside the musical field—many important contributions for speech research have come from scientists who are also musicians. Nilssone and Sundberg have shown that musicians are better than non-musicians in certain non-musical tasks, and one should not underrate the importance of music as a motivation for the researcher, from Pythagoras to Leibniz, Euler, Helmholtz, Raman, Mathews and Sundberg.

In the mid-19th century, Babbage designed and built the 'analytical engine', a mechanical ancestor of the computer. Lady Lovelace, who worked with him, envisioned the possibility of using this engine for non-numerical tasks, in particular that of musical composition: this makes her the forerunner of artificial intelligence. The demands of music helped important developments flourish in the computer field. Mathews' MUSICIII (1959), MUSICIV and MUSICV, general programs for musical sound synthesis, implement a modular, Lego-like concept, which inspired other programs for speech or electronic circuit simulation, and which antedates by many years the techniques of object-oriented programming. Mathews and Rosler's graphic system (1966) and Denes and Mathews's DDP224 (1968) were special purpose installations designed for man–machine interaction, in both the graphic and the acoustic domain: both of these installations resulted in music pieces using new processes, but they were also among the first examples of implementation of dedicated computers—which later developed into personal computers. In the early 1960s, the collaboration of the composer-performer Jon Appleton and the engineer Sydney Alonso produced the Synclavier, the first digital synthesizer, which included one of the earliest array processors, and which implements efficient paradigms of man–machine communication. MAX, an interactive graphic programming environment designed by Miller Puckette to implement computer-assisted musical performance, proposes ingenious processes for real-time scheduling problems. Claude Cadoz and his colleagues from ACROE wished to emulate with computers the experience of the music instrumentalist: starting in the 1970s, they pioneered 'virtual reality' by simulating mechanical processes that can produce images and tactile effects as well as sounds. Computer music experiments can help demonstrate that the computer can be harmonious and need not be dehumanizing—whereas it is too often used as an alibi for inhuman practices.

Despite all this evidence, Varèse failed to persuade scientists such as Harvey Fletcher that science itself could benefit from musical research. In fact, he did not really try to convince them for science's sake: he wanted science and technology to help produce sounds going beyond those of the acoustic instruments, so as to escape their specific constraints and their heavy connotations of the musical past. I shall try to put this quest in the context of the evolution of the musical language in the 20th century.

Composing the Sounds Themselves and Not Composing Only *With* Sounds

One way to look at the evolution in the music of the 20th century is to distinguish two main pathways out of the crisis of the tonal language.

Classical western music is tonal and polyphonic. Harmonic motion is submitted to specific rules, which form a genuine syntax. The 'parameters' of musical notes are not independent: accents, rhythm and melody are related to the harmonic motion. From the 17th to the 19th centuries, the tonal syntax was implicitly agreed upon. However, innovative composers insidiously tampered with the rules, occasionally stretching them to the extreme. In the 19th century, composers such as Chopin, Liszt and Wagner undermined the structural strength of tonal language; in order to achieve expressive goals, tonal resolutions were postponed or eluded, modulations were multiplied, chromaticism, already present from much earlier times (for instance in Gesualdo's madrigals), became pervasive. These developments blurred the clarity of tonal gravitation and eroded tonal hierarchies. During the 20th century, a few composers—Satie, Poulenc, Hindemith, Stravinsky for a long period—tried to re-establish a clear tonal syntax. However, most creators sought novelty rather than attempting to restore the past, an attempt which Varèse (1967a, p. 199) termed 'one of the most deplorable trends of music today—the impotent return to the formulas of the past that has been called neo-Classicism'.

Certain composers—for example, such as Schoenberg and Boulez—tried to be innovative by instituting new musical grammars, without changing the vocabulary: their sound material still consisted of notes uttered by traditional musical instruments. The new grammars specified relations between the note parameters—pitch, duration, intensity and timbre. This pathway continues the tradition of western music, where the sound material is 'purified': sustained instrumental or vocal tones with clear pitches, lending themselves to a complex polyphony. Timbre plays mostly a cosmetic role, although timbral differences help to separate the individual lines.

Other composers have been concerned above all in the renewal of the vocabulary, in the development of a novel sound material: these composers are keen upon elaborating, organising and composing the sound itself. This is the pathway of electroacoustic music—*musique concrète*, computer music—as well as that of certain composers of instrumental music, such as Ligeti, Crumb, or practitioners of *musique spectrale*, such as Grisey and Murail. Varèse was undoubtedly the pioneer of this concern with sound. As early as 1917, he wrote: 'Our alphabet is poor and illogical. Music, which should be alive and vibrating, needs new means of expression and science alone can infuse it with youthful sap.'

Clearly, one can be concerned with both grammar and vocabulary. This is the case for Stockhausen, for Cage, as it was for Schoenberg, who introduced *Klangfarbenmelodie* in his Opus 16. Yet the pathways I just mentioned do represent two poles in the dialectics of the 'sociology of sound', an expression of the French musicologist Edmond Costère. Sounds used in the music of the non-Western world often have complex or specific morphologies, characteristic accidents, glides, tremulations, noises. Such

sounds would be inappropriate for polyphonic music, which calls for simplified sounds with clear pitches, lending themselves to be part of a complex aggregate into which they can fuse and lose their individuality. If their identity is too strong, sounds do not lend themselves to being tightly organised: they need space and freedom to breathe and be themselves.

Adorno presents Schoenberg as the emblematic figure of progress, which he opposes to Stravinsky, the champion of restoration. Yet Schoenberg also endeavoured to restore order—a new order, certainly, but in the spirit of tradition. For him, Brahms was a model. As one can see in his *Fundamentals of Music Composition*, Schoenberg (1967), in a Hegelian sense, sought to be faithful to the historic evolution of music, which implied changing the syntax rather than the vocabulary. In particular, the 12-tone technique reinforces equal temperament, the division of the octave into 12 equal intervals, which was initially an acoustic compromise to facilitate tonal modulations. Following Schoenberg, Babbitt extended the serial principle to other parameters. Messiaen's *Etudes de rythme*—including *Modes de valeurs et d'intensité*—was probably influenced by Babbitt's students in Tanglewood in 1948. Boulez, initially inspired by Messiaen's *Modes de valeurs et d'intensité*, used rows of intensities, durations, even timbres.

In the 1950s, generalized serial music appeared as the main stream of new music, both in Europe and in the USA. Serial works are often difficult to perform, even though conductors such as Hermann Scherchen, Ernest Bour, Hans Rosbaud, Michael Gielen, Pierre Boulez, Jacques Monod, or performers such as Aloys and Alfons Kontarsky, Maurizio Pollini, Harvey Sollberger, Paul Zukofsky, Bruno Canino, Michel Oudar could achieve great precision. But the most demanding works using the generalized serial principle are just impossible for humans to render accurately. Also, the instruments have specific limitations and idiosyncrasies, which can conflict with strict serial constraints. This was the case for *Polyphonie X*, a rigourously organized composition withdrawn by Boulez because it did not sound appropriately. Electronic music appeared in the early 1950s in Cologne, where the emphasis was not on the quest for new sound materials, but on the requisite for a compliant material that could realize faithfully a complex serial organisation into sounds. However, the electronic sounds themselves were often dull; they lacked presence and life. Morton Feldman likened them to a bald woman. Varèse used electronic sounds as early as 1934, in *Ecuatorial*, but he was often turned off by their lack of dynamics, energy and identity. Later, electronic music often tried to manufacture livelier sounds—actually through complicated manipulations, which destroy the precise control of the composer upon the structure of the sound.

One may say that this preoccupation about the formal organisation of the music corresponds to the trends of our western civilisation, which has culminated in the industrial society, but also in the digital computer, a convenient tool to proliferate permutational mechanisms. Formalism forces one to envision the implications of novel combinations: the generalized serial principle has produced one style of music and with occasional great works. However, its 'over-determination' results in a covert and

complicated musical organization, the principle of which is generally not perceived, hence the music often sounds disorganized, complex, discontinuous, event incoherent or chaotic.

In different ways, Cage and Xenakis took that into consideration. Cage carefully 'disorganized' the music by making compositional decisions through chance procedures. Varèse disapproved of this process, which he considered an abdication by the composer. Xenakis noticed that the listener could not perceive the individual lines organized in terms of the serial principles, but only mass effects resulting from uncontrolled encounters: he thus decided in the 1950s to control the salient aspects of these masses—fluxes, densities, statistics—hence his stochastic method of composition. As one can judge from a text written by Varèse in 1936 (for a lecture given in Santa Fe), such concerns are quite Varesian:

> Today, with the technical means that exist and are easily adaptable, the differentiation of the various masses and different planes as well as these beams of sound could be made discernible to the listener by means of certain acoustical arrangements. . . . In the moving masses you would be conscious of their transmutations when they pass over different layers, when they penetrate certain opacities, or are dilated in certain rarefactions. (Varèse, 1967b, p. 197)

Varèse himself was hostile to totalitarian music systems. He respected Schoenberg's high level of artistic demand, and his often successful quest for loftiness and spirituality. But he was unwilling to accept any imposed, unconditional rule—be it ethical (he hated Calvinism) or aesthetical. Like André Masson, Varèse was extremely defiant of ideologies. He described to me (personal communication) the 12-tone technique as '*les douze çons*' [the twelve fools] (quite a derogatory joke). And he often commented that architects needed full knowledge of the reactions of the materials they used in their constructions. Thus, he did not want to resort to ready-made musical architectures, conceived without taking into account the properties of the new sound material. 'I don't like to lie in the thinking of others.'[3] He was even reluctant to speak about the processes he used: arcana, secret garden, or simply refusing to take the spectator backstage, when the magic is only in the show? 'No one wants to see scaffoldings. Moreover, if I make my method explicit, someone might believe that it is *the* method. But there is no winning formula (martingale). Every one must invent his own.'[4]

Varèse's attitude was sound and modern. It requires strength and confidence to dispense with the authority of others and to refuse ready-made solutions. Mechanisms can relentlessly grind to catastrophes. A formalism is a refuge, a protection—against the adventure of living. Protected against doubt, one gains efficiency—but for what? The recent collapse of European Communism, long after that of Nazism, makes us fully aware of the awful consequences of the certitudes brought by ideologies. The most dangerous theories are those that can claim scientific foundations: such foundations seem reassuring—yet they are fallacious, since science can say what is, not what should be. Varèse took sides with Goethe, who complained about the greyness of all theories, while 'the tree of life is green forever'. Varèse's *Intégrales* has a complex logic, like a living world that is not immediately harmonious but which effectively lives through conflicts.

Biological factors are neither to be denied nor to be abused. Varèse's position (Nietzchean, Bergsonian?) was individualistic, personal, inventive and bold.

Many composers are inspired by constraints. Ravel and Stravinsky, for example, were stimulated when they had to write for a very unusual set of instruments. But Varèse felt corseted by the limitations of traditional instruments—actually he felt that most music he heard was enclosed, lacking freedom and spaciousness. He wanted to go beyond the bounds of the instrumental world, to liberate sound, to sculpt it, to project it into space. His attitude was by no means a Roussauist, regressive one, a refusal of the benefits of culture and civilization: on the contrary, for Varèse, the only way to come out of what he considered a musical dead-end was to pursue research in collaboration with science and technology, in order to develop new materials that could be used in conjunction with or independently of the musical instruments, but that would not be burdened with the connotations of too rich a musical past: 'Respecting horses is no reason for not rather using trains or planes' (Varèse, personal communication).

Varèse refused shivery nostalgia, but also conformism to industrial civilisation, as exemplified by his criticism of the Italian Futurists: 'Why, Italian Futurists, do you reproduce only what is most superficial and boring in our daily lives?' (Varèse, 1917). His attitude incites the artist to be present to his time, to face the future boldly and even to shape it, to be active, energetic, demanding, to help bring forth a science and a technology with human concerns and an aesthetics without precedents.

Trying to Harness Electronic Technology for Music

Varèse was—and still is—the genuine prophet of the 'electric revolution', as the composer and philosopher Hughes Dufourt (1991) calls it. The irruption of electricity in the sonic domain could bring about overwhelming changes in our way of dealing with sounds, which could thereby escape mechanical constraints. Varèse saw it as the path toward the liberation of sound (Ruscol, 1972).

Varèse (1967a, p. 20) denied that he was ahead of his time: 'contrary to general notion, the artist is never ahead of his own time, but is simply the only one who is not way behind'. Indeed, his quest for a new vocabulary had probably been triggered by hearing about the possibility of generating sounds electronically. Yet his ideas were faster than the advent of the new means he was calling for. The first serious attempt to manufacture sounds and make music with electricity was made by Thaddeus Cahill, who, at the turn of the century, built an enormous electrical sound factory, called the Dynamophone or *Telharmonium*.[5] The Dynamophone did not live long—the technology of dynamos was too heavy. But the news about this music machine brought enthusiastic comments from Ferruccio Busoni. In turn, Busoni set into motion the visionary imagination of Varèse, who wrote:

> I dream of instruments obedient to thought—and which, supported by a flowering of undreamed-of timbres, will lend themselves to any combination I choose to impose and will submit to the exigencies of my inner rhythm. (Varèse, 1971, p. 132)

In the 1920s, the electronic technology resulted in electronic instruments built by Theremin, Martenot, Bertrand, and others. However, these instruments were too conventional. For many years, Varèse used every endeavour to make his vision come true. He made contacts with Bertrand, and later with Theremin, who demonstrated to Lenin in 1920 his singing antenna—the first electronic instrument—and who then spent a few years in the USA in the 1930s. Varèse used Theremin's instruments for his piece *Ecuatorial*, which ends with shrill electronic glissandos. However, there was no support for the research on the new instruments, and Theremin went back to the Soviet Union, after attempts to build his antennas for traditional music purposes.[6] Varèse tried to convince Harvey Fletcher, a brilliant acoustician who directed research at the Bell Telephone laboratories before the Second World War, that it would be advantageous for Bell Laboratories to perform research on the electrical production of music. However, Fletcher, who had no interest in contemporary music, either could not or would not follow Varèse's advice. Varèse also failed to persuade the Hollywood movie industry to pursue research on the electrical production of sound, which could benefit the realisation of sound effects as well as the new art form of 'organized sound'. Only at the end of his life could Varèse go beyond the conventional instruments and use electronic technology for his music.

In the early 1950s, *musique concrète* had already been introduced by Pierre Schaeffer at the *Club d'Essai* of the French Radio in Paris, and 'electronic music' was starting in Cologne. In New York, Luening and Ussachevsky developed 'music for tape' constructed from sound materials obtained either from recordings or from electronic gear (oscillators, filters, etc.). Needless to say, Varèse was most interested. He received a tape recorder as an anonymous gift. Ann McMillan helped Varèse get to grips with this machine, which he much enjoyed since it gave him some possibilities for organizing sound. Varèse started the realisation of *Déserts*. He recorded sound material—in particular industrial noises—and he put them together in 1954, at Pierre Schaeffer's 'Studio de musique concrète', in Paris. Much of the audience resented the irruption of the electronic sounds when *Déserts* was presented at the Théâtre des Champs Elysées in 1954 between two traditional works of the orchestral repertoire. There was no empathy between Schaeffer and Varèse, and the latter despised the *groupe de musique concrète* as a clique. Varèse did not get along either with the technicians of the Philips studio in Holland when he realized the *Poème électronique* a couple of years later. Le Corbusier had imposed Varèse as the composer, whereas Philips wanted their home composer Henk Badings. Varèse had bitter memories of this time, and he remained resentful and impatient towards the Dutch.

The works of Varèse calling for electronic sounds on tape—*Déserts* and *Poème électronique*—are frequently heard in disastrous conditions, detrimental to their potential impact. Tapes are often badly handled. Not enough people know that a tape played on a tape recorder with magnetized heads is deteriorated for ever: the high frequencies are weakened and contaminated with noise. Vladimir Ussachevsky helped Varèse revisit his tapes. He told me that Varèse often wanted them to sound more brilliant—but, as Varèse's hearing had lost its sensitivity to high frequencies, a typical phenomenon of

ageing, he tried to compensate this loss by increasing the loudness. However, the consoles at that time did not have the dynamic overhead they have now, so this demand resulted in saturation and distortion. In the late 1960s, after Varèse's death, Vladimir Ussachevsky proposed to replicate Varèse's tape pieces in better technical conditions: he could get hold of the mixing elements and notes or instructions about putting them together again in order to obtain a much cleaner version. However, Louise Varèse was not sure that Varèse would have approved of it, so Ussachevsky, who died in 1989, never realized that project, which is unfortunate.[7]

In the late 1950s, Varèse wanted to make a new version for the electronic part of *Déserts*. He was offered work at the Columbia-Princeton Electronic Music Studio, then directed by Ussachevsky and Milton Babbitt. Varèse actually worked at 117th Street, with the help of the Israeli-born composer Bulent Arel, based at Columbia, and Max Mathews and Newman Guttman, both of Bell Laboratories. Max Mathews, a brilliant engineer trained at MIT, had just begun his pioneering work on computer music at the Bell Laboratories: in 1957, he had realised the first synthesis of sound by computer, and also the first digital recording of sound. (On this occasion, a few seconds of speech had been turned into numbers coded on punched cards—a bunch of cards several feet thick.) Mathews was assisted in his early computer music experiments by John Pierce, a famous scientist and engineer, who is responsible in particular for the idea and implementation of communication satellites, and Newman Guttman, a bright psychologist investigating auditory perception. Varèse was highly interested in the computer music project. His musical aspirations were more welcome at Bell Laboratories than they had been 30 years earlier with Fletcher. Varèse made several visits to Bell Laboratories, situated in New Jersey, west of New York—rather close to Greenwich Village, where Varèse lived; except he did not want to go through the Lincoln or Holland tunnels because of his claustrophobia, so he had to go north all the way to Washington Bridge. On April 26, 1959, a Cage–Varèse concert was organised at the Village Gate in New York; Varèse decided on this occasion to present to the public the first piece of music synthesized on a computer. This very short (1 minute) and 'tongue in cheek' piece was called *Pitch variations:* it had just been produced by Guttman with tones synthesized to study certain aspects of hearing. The other pieces presented were Cage's *Winter music* for piano, *Fontana mix* for tape, Richard Maxfield's *Stacked deck* for electronic equipment, *Last pieces* for piano by Morton Feldman, *Music for cello and piano* by Earle Brown, and Varèse's *Poème électronique.*

Pierce, Guttman and Mathews became friends with Varèse; they offered to set up a studio for him at Bell Laboratories—alas, they could not provide a technician, and Varèse could not work by himself. Varèse paid occasional visits to Bell Laboratories; he recorded some sounds and took interest in several experiments. He once spent a frustratingly long time trying to assess the octave location of sound with ambiguous pitch produced by Newman Guttman for a psychoacoustic experiment conducted by Jim Flanagan.

Recollections of Meetings and Discussions with Varèse

Before I came to the USA in 1964, Varèse was a living myth for a number of people in France, including myself. The first time I heard about him was in 1954, on the occasion of the scandal of *Déserts* in Paris. I then lived in Besançon: contemporary music was virtually unknown there, and the music of Bartók was still considered an offence by the audience of the yearly music festival, where Dinu Lipatti had given his last recital in 1950. I did not hear the radio broadcast of *Déserts*, but a schoolmate described it to me as an incredible cacophony of noises, boos and applause. I was told that Varèse was an engineer, not a musician. The radio programmes were quite conservative, and the music of Varèse was almost never played in France. It was only much later that I had a chance to hear it and to appreciate its sheer strength, its novelty, its evidence. In the early 1960s, I studied composition with André Jolivet: through his comments, the figure of Varèse became even more legendary. In 1963, I composed a piece for orchestra, which had been broadcast on French Radio. The experience was both exhilarating and disappointing. It confirmed my burning interest for sound and timbre. At the same time, I was struck by the inertia of the large orchestra, which was so strongly geared to the music of the 19th century. Yet I did not want to relinquish the fine musical control one could exert when writing instrumental music: I was not interested in the group of *musique concrète* in Paris, since I found the manipulations of concrete sounds rather crude. But I did long for new materials besides instrumental sounds. My Physics Professor, Pierre Grivet, now a member of the French Academy of Sciences, made contacts with John Pierce and Max Mathews to arrange my working at Bell Laboratories in the exploration of the musical resources of a new 'instrument', the computer. My training in both music and science was a valuable asset, because the context at Bell was thoroughly scientific: the musical activity was slightly underground, and musicians could only be sneaked in as inconspicuous and relatively self-sufficient parasites (I shall return to that point in the last section of this article).

I crossed the Atlantic by ship, the *France* in the summer of 1964, and I first met Varèse at a concert of the New York Avant-Garde Festival, only a couple of days after my arrival. This festival, organized by Charlotte Moorman, abandoned the concert hall in favour of most unusual settings—such as a night on board the Staten Island ferry, or a parade along Central Park. But that year, the Festival took place in Judson Hall. With Charlotte Moorman were James Tenney, Carolee Schneeman, other active artists of the New York avant-garde. Varèse loved this group of young activists, even though he did not approve unconditionally of all their wild activities, which were much influenced by John Cage. Varèse liked Cage, but disagreed with Cage's aesthetic stand: for Varèse, letting chance intervene in composition was the token of a lack of compositional motivation: 'I want what I want, not what chance sets up.' Much earlier, he had opposed the futurists who wanted to make music with any sound material: 'Why, Italian Futurists, do you reproduce only what is most superficial and boring in our daily lives?' For Varèse, the liberation of sound did not mean 'anything goes'. Charlotte Moorman appeared naked in happenings she presented together with Nam June Paik, which

brought from Varèse the following comments: 'avant-garde or derrière?' After the concert, we went to the Russian tearoom, at the back of Carnegie Hall. One of the first things Varèse told me:

> Generosity is on this side of the Atlantic. Here people will help you go forward. They will not try to hold you back for fear that you might go past them. None of the pettiness of Paris. This is a free country. (Varèse, personal communication)

Even though New York, where he was revered, had not always been so congenial to his projects, with Paris, Varèse had a love–hate relationship: 'This local brothel where those in power are so petty.'[8] But he enjoyed remembering Saint Germain des Près: 'Ah, la place Furstenberg' and Montparnasse.

As a person, Varèse more than stood up to his mythical aura. Under most circumstances, he was kind, warm, attentive, convivial, not in the least pompous—a refreshing surprise for me. His speech was direct, picturesque, savoury, often spicy, with a strong Burgundy accent in French or English. He was not awesome. But he was naturally fascinating and commanding. At times he looked anxious: anguish of the time passing, of the coming of night, a night after which the sun would not come back, and yet so much to do, so many dreams yet to be fulfilled, grand projects barely touched upon. A basic dissatisfaction with the past. 'I never composed anything for the piano,' he insisted when I asked him after playing my *Instantanés*. He had, but he had destroyed his piano pieces. He was a fiercely independent mind, unwilling to accept any system, any orthodoxy, any paternalistic or autocratic authority.

This powerful man, so much turned toward the future, nonetheless cherished his memories. He wanted to create a new music without references or nostalgia: but he deeply knew and loved the great music of the past. He was grateful to the personalities who had sensed the validity and the strength of his motivations, even though their own universe was completely different: among those, the French composer Massenet, hardly a figure from the avant-garde. Varèse mentioned the poet Léon Deubel, born in Besançon, when I mentioned that I had grown up there. Clémenceau, the French politician, was a connoisseur in art and music. He had been impressed by Varèse, whom he told: 'You have better things to do than war.' Thus Clémenceau helped Varèse get a discharge from the army during the First World War. 'But never trust a politician—decisions are too serious to leave them to politicians,' Varèse added, ironising on Clémenceaus's motto, 'War is too important to trust it to the military.'

Even though he loved the *terroir* of Burgundy, Varèse was strongly pacifist and anti-nationalistic: he had the feeling of being 'a citizen of Europe', an exceptional experience in 1914.

Varèse talked about his friend Paul Le Flem, whom I later met in Brittany, his native province. Le Flem died in 1985 at the age of 104. He had been a fellow student of Varèse at the Schola Cantorum, the music school headed by Vincent d'Indy. Le Flem testified that Varèse was very iconoclastic, but that he deeply knew and loved the music of the great masters of the Middle Ages. Both Varèse and Le Flem studied with Albert Roussel—whom Varèse esteemed and liked—and Vincent d'Indy. D'Indy wrote

compositions, some of which are not without interest, such as his *Symphonie sur un chant montagnard*, and also a treatise of composition which is interesting in certain respects: but he was academic in his taste, his teaching, his manners; he was also a fatherly figure—two reasons for Varèse to hate him deeply. So many years later, Varèse was still incredibly derogatory when he would speak about d'Indy: '. . . an old miser who took himself for some sort of Don Juan—as if that is not ridiculous! One day I called him an old idiot. It would bring luck to tread on him . . .'.[9]

When Varèse was invited, as a former student and renowned composer, to participate in the celebration of an anniversary of the Schola Cantorum, he replied that he would be glad to accept, provided the music of Vincent d'Indy would not be played and his name never mentioned in the course of this celebration—a condition hard to meet, since d'Indy was the founding father of the Schola. Varèse's rejection of his own father extended to fatherly figures—he could never get along with Pierre Schaeffer and his paternalistic behaviour at the Club d'Essai.

Varèse and Le Flem shouted their enthusiasm together at the première of *Pélléas et Mélisande*. They were not wealthy, and they had taken the cheapest seats—*les sièges à vingt sous* (costing one franc at that time). Both Varèse and Le Flem gave colourful descriptions of Montparnasse at the turn of the century. This was, at the time, a hot, wild area, with plenty of 'apaches'—bad boys, who had gang clashes: one had to be careful about stray bullets. More and more artists clustered around Montparnasse, having long conversations in the cafés, drinking beer—*un bock ou un demi-setier*. Cocteau had told Varèse, 'You have got to move quicker than beauty itself,'[10] and Varèse brought Cocteau to Picasso's atelier. Varèse had himself a burning interest for other forms of art, and he often preferred the company of artists to that of musicians, 'old-fashioned, traditional fools'.[11]

Varèse and Paul Le Flem met again at the beginning of the war (they finished together fine bottles of Saint-Julien—'*toujours ça de sauvé!*' [at least we have saved that!]) and in the late 1920s, when Varèse spent a few years in Paris. Paul Le Flem wrote a number of rather traditional compositions influenced by Debussy. One of these pieces was conducted several times by Villa-Lobos. Le Flem succeeded Roussel as a professor of harmony and counterpoint at the Schola. One of Le Flem's students was 14 years older than he: Erik Satie had decided to go to school again when he was past 50.

Varèse was fond of Satie, 'a good friend—who stayed as long as the bottle was not empty, though it occasionally made him miss the train at midnight forty, the last train for Arcueil', and liked his early works *Sarabandes* and *Gymnopédies*, but also later works like *La messe des pauvres* and *Socrate*.

Jolivet and Varèse

André Jolivet, my composition professor, initially studied with Le Flem. In spite of his own relatively conservative style, Le Flem was open-minded. He recognized Jolivet's strong temperament. I believe that the music of Jolivet is generally underrated at the present time: many of his works evince strength and personality. After teaching Jolivet his own skills, Le Flem decided to send him to Varèse. Varèse had come back to France in 1928, and stayed in Paris for five years. Jolivet always described his contacts with Varèse as an extraordinary experience, going far beyond the field of music: almost an initiatory journey. Jolivet had been stunned by Varèse's *Amériques*, conducted in 1929 by Gaston Poulet. It must have been difficult to accommodate the huge orchestra on the stage of the Salle Gaveau, a hall better suited to chamber music. The performance created a scandal, but for Jolivet it was breathtaking. Jolivet's first works, *Incantations* for solo flute and *Mana* for piano—his masterpieces, in my opinion—were strongly influenced by Varèse. The pieces of *Mana—la vache*, *la chèvre*, etc.—refer to objects that were given by Varèse and which Jolivet kept as fetishes, hence the title *Mana*, meaning the magical power in the familiar objects. (Two of these objects were metallic sculptures made by Calder, in particular a wire outline of a cow, which inspired a beautifully melodic piece.) Jolivet was also influenced by Varèse's cosmic conception of music. Jolivet often said that he tried to restore the ancient significance of music as a magic expression of the religiosity of human groups: he endeavoured to go along these lines in *Incantations* and *Mana*, but also in *Five ritual dances* and the *Piano concerto.* Hilda Jolivet (1973), the composer's wife, relates contacts between Varèse and Jolivet in her book *Varèse*.

Later, Jolivet's style became more traditional, which disappointed Varèse. Varèse also disagreed with Jolivet's nationalist aesthetic position: for Varèse, *la musique française* was too often a synonym of well-behaved insignificance[12]—with some exceptions: Pérotin, Machaut, Marc-Antoine Charpentier, Berlioz, Debussy, and very few others! As I mentioned above, Varèse had been, so to speak, a citizen of Europe before the First World War: he had related with Busoni and Strauss as well as with Debussy and Roussel. On the contrary, Jolivet had been drafted during the Second World War and remained hostile to the Germanic world.

Jolivet insisted that learning harmony, counterpoint, chorale and fugue was essential for a composer—Varèse was less intransigent on this point: 'It is useful to train one's hand, and to better understand the great masters.' Varèse had himself a deep science of counterpoint and harmony: he occasionally proposed to submit arrogant and denigrating critics to an examination of their capacities. But he thought that a rigourous training in another type of music or even another field, might be just as helpful or stimulating—he complained at having seen too many impotent scholars! Also, he did not believe one should first write the music and then orchestrate, a process that Jolivet advised to students. For Varèse, sound was the substance of music, not a mere appearance: its role was to be organic rather than cosmetic or decorative. Yet Varèse's own quest for a thorough modernity did not prevent him from enjoying the tonal music of

Villa-Lobos—*Amazonas*, which was premiered in Paris at the same concert as *Amériques*, or *La découverte du Brésil* ('*un magnifique foisonnement, un fleuve de musique*' [a magnificent profusion, a river of music])—and also the music of Honegger. He respected their wide breath and their longing for human communication, their broad vision of *l'humanité en marche* [humanity on the march], and this also deeply impressed Jolivet.

In his teaching, Jolivet mentioned several processes originating from Varèse. One of them was the notion of reserved pitches. Rather than repeating the 12 tones in the same order, as prescribed by Schoenberg's dodecaphonic technique, use only 11 of them: gradually the absence of the 12th will be felt, and it will acquire a strong significance when it appears. There was also the paradoxical notion of 'development by opposition' rather than by consequence, which can be linked to notions of transmutation. Indeed, Varèse acknowledged he used such processes and many others, but did not like to expose them—'*on ne visite pas le cuisines dans les restaurants*' [when you visit a restaurant, you don't go to see the kitchen]. This position, shared by Jolivet, was generally not adopted in contemporary music, and Varèse was often irritated by obscure and pompus programme notes supposed to be essential to the appreciation of the work.

New York and New Jersey

New York had been the siege of a diaspora of artists; Varèse had known many of them. Marcel Duchamp was almost a neighbour. Varèse could not understand the love of Mondrian for dance: 'He danced so badly: he was tall, stiff, and awkward!' (Varèse was still alive when Michael Noll presented his Mondrian experiment. Noll used a simple computer program to imitate a Mondrian drawing: but of course, the drawing by Mondrian was the creative model.) André Kertész, a great photographer, and a very independent mind, had difficulties in New York. Hans Richter realised, in 1921 in Zurich, *Rhythm 21*, probably the first abstract movie ever made, and later came to New York, where he taught at the Film Institute of the City College (among his students was Jonas Mekas, the prophet of underground cinema, a very lively movement in New York during the 1960s). There had been the basis of a collaborative project between Richter and Varèse, which, though, was never to be completed.

John Cage had given influential courses at the New School for Social Research in the early 1960s: he had impressed much of the New York avant-garde, beyond the field of music. The happenings, then a popular from of art, were illustrated by artists such as Allan Kaprow, Robert Rauschenberg, Carolee Schneeman, Nam June Paik, 'underground' moviemakers such as Stan Brakhage or Jud Yalkut, as well as by musicians like Earle Brown, Christian Wolff, Jim Tenney, Philip Corner, Malcolm Goldstein and Max Neuhaus. Many of these avant-garde artists revered and loved Varèse. The music of Varèse had had a lot of success in New York. Ralph Shapey conducted the Chicago Players in a Varèse concert on March 31, 1965, in Carnegie Hall. We had hoped to hear that evening the première of *Nuit*, a new work based on a poem by Henri Michaux,

which was announced on the programme. Alas, the piece was not complete, and never would be: it was replaced by *Ecuatorial*, based on the *Popol Vuh* of the ancient Mayas and terminated (as early as 1934) by shrill electronic sounds played *fortissimo* on the Theremin. The concert was a triumph. We went backstage with a crowd of friends and fans. Many composers were there—Babbitt, Carter, Ussachevsky—Varèse, exhausted but happy, kept saying what a good job the performers had done.

In New Jersey, close to New York, work was pursued to synthesize and process sound with the unprecedented precision of the computer—a project that was more Varèsian than Cagian. I shall return to the aesthetics and to the computer later.

One of my most vivid recollections of those days is that of an afternoon with Varèse and Louise in Warren Township, New Jersey, in May 1965. This was at the Pierces', with my wife Rozenn, James Tenney, Carolee Schneeman, Max and Marjorie Mathews. 'Have an armchair, Maître. –An armchair? That's for women or old folks: me, I'll take the chair.'[13] We played a number of pieces on the piano. We first proposed Fauré's *Dolly*: 'Well—he threw me out of the Conservatory. He used to smooth and perfume his moustache! He was not my cup of tea. *Mais jouez quand-même* [But play it all the same].' With Rozenn I played Satie's *Trois morceaux en forme de poire*, and with James Tenney, Satie's *Cinéma*. I also played my piano *Instantanés*, which Varèse enjoyed despite their serial style, and Messiaen's *Courlis cendré*.

> Messiaen visited us a while ago. He does beautiful music. What is the name of his wife, *la petite pianist*? Loriod, *c'est ça*. She plays so well, *elle est épatante, et pourtant elle est si petite*! *J'espère qu'ils reviendront bientôt ici*.[14] Boulez was also very nice. He conducted my music extremely well. Recently I met a young French composer, Luc Ferrari. He wants to do a film on my music.[15]

We all signed a postcard to the composer Carl Ruggles, a close friend of Varèse and an individualistic American figure.

I had hoped to spend two years in a row at the Bell Laboratories, but I was drafted by the French army in the summer of 1965, which upset me a great deal, since I had plans to continue my research, to exploit it in musical compositions, and to reinforce my interaction with Varèse, who was to come semi-regularly to Bell Laboratories during the following school year. Varèse tried to help me get a deferment through the cultural attaché, Monsier Morot-Sir: but it did not work. Before our return to France, Rozenn and I went to say goodbye to Edgard and Louise Varèse. This was a sad day: Varèse had just heard of the death of Le Corbusier, dear to him since the sour adventure of the *Poème électronique*. Le Corbusier drowned while diving off Roquebrune Cap Martin, between Nice and Italy, where he spent the summer in a little shack built with the proportions of the modulor. The Varèses had just come back from a nice country break—the Mac Dowell Colony in Vermont, where Louise later spent much time, but Varèse preferred the city and his Greenwich Village. Sullivan Street was then a very nice neighbourhood, even though the flower children movement was beginning to attract crowds. The apartment of the Varèses, number 188, extended on several levels, with walls covered with works of art—by Miró, Léger, Hartung, and Varèse himself. Rozenn presented to Varèse a collage sculpture she had built: he said

kind and personal words about it, linking it to interests he had in the art of the Middle Ages. It was striking to see Varèse's studio downstairs, with a beautiful gong, hand sirens, all sorts of objects, and a number of bits of paper with musical excerpts, hand-drawn profiles—'seismographic notation', as he said, or even one single note with a slur. I was reminded of this later when I read a section in *Le temps retrouvé*, where Proust writes about building his work not as a cathedral, but rather, more modestly, like a dress, by assembling small patches like a needlewoman. Varèse reminded us to greet the Calders in Saché, and also the Charbonniers in Paris: 'In Paris, I was often fed up with all these pretentious idiots: to escape the Parisianisme, I took refuge with a few friends at the Charbonniers. They were so kind and generous.'[16] We were moved, but we could not imagine that we would never see Varèse again: although he had some health problems—breathing difficulties, occasional confusions or lapses of memory, that would later come back vividly—one could hardly be aware of them when he was so enthusiastic, lively and volcanic. I heard of Varèse's death while I was in the army. I was very depressed, especially since I was looking forward so much to a closer interaction on my return to the States. Gradually I came to realize that I had been very fortunate to have met him still longing to go further in the liberation and mastery of sound, and displaying an incredible curiosity, insight and hunger for novelty.

Discussions on Computer Projects and Aesthetics

The day of my arrival at Bell Laboratories, I talked with Max Mathews, and I decided on my first project. We wanted to develop the musical possibilities of the computer, and Max proposed two directions, corresponding to the two pathways of 20th-century music that I presented above: working compositionally, and working on the sound itself. Max had been designing compositional algorithms and suggested to me that I develop this field.[17] But this was not my interest. There was work to be done also at the level of sound: computer sounds tended to be just dull and impersonal electronic sounds (actually computer sounds are electronic, strictly speaking, but the possibilities to control them are more flexible and precise than for analogue electronic sounds). It was not possible then even to evoke certain types of instruments by computer synthesis. So Max proposed we try to understand why attempts to imitate brass and string sounds with the computer had failed completely.

The fascinating field for me was the potentially limitless world of sound that the computer could give access to: but the little I had heard of computer music demonstrated that this world was not yet within reach, and that it had to be conquered. Trying to adjust the sound parameters almost at random had not been fertile: even by changing the values by large amounts, it seemed difficult to introduce genuine subjective variety. It was clear that much more had to be understood about sound. Under what conditions does a physical change matter to the ear? What are the auditory 'erogenous zones'? How should one go about synthesizing sounds with life and identity? Of course, I considered this research on imitative synthesis as a necessary

passage rather than an ultimate goal. I elected to investigate the timbre of brass instruments, which completely resisted attempts at simulation, and which were very lively, unlike many electronic or computer sounds.

The following day, the New York Avant-Garde Festival had scheduled an all-Varèse concert, which Varèse, in good humour, presented with his savoury Bourguignon accent. The excellent performances, conducted by Jim Tenney, were very successful. After the concert, I talked to Varèse about my project of investigating the characteristics of brass sounds. I have heard many people object that one could not discover a new world of sound by studying traditional instruments: indeed, this looks like 'entering the future backwards', as Marshall McLuhan put it. But Varèse knew better. He listened with attention and briefly approved of the project. The next day, Varèse called me at the labs.[18] He had been turned on by the project, and I could sense an extraordinary enthusiasm—I would even say appetite—in his tone of voice. He insisted that it was essential to find ways to inject life into synthetic sounds. He was too often turned off by the fixity of electronic or computer sounds. He hated embalmed sounds, sounds prepared by morticians—'one does not make music with corpses'. He was fully aware that the issue was not making ersatz of instruments, but understanding the cues of the life, the richness and the identity of brass tones: such understanding could be used for inventing rather than imitating.

On that occasion and in other discussions, we talked about notation. Varèse liked to resort to quasi-seismographic notation, describing the contours of the sound sculpture. He had used it to notate filtering, which he liked as a way to organise sound colour: 'At the moment, I need to experiment with it. Only thereafter can I organise my piece from my inner experience.'

When I later explained to him the main finding of my brass study—the fact that its quality can be ascribed mainly to the fact that the spectrum gets broader as the level increases—he grasped the implication that the cue for the timbral identity was a law, a pattern of relation between physical parameters, rather than a physical invariant. He envisaged more structural notations, specifying processes of generation as connections or relations: 'The new notation must embody the new concepts—it will give important suggestions for composition.' We talked about weaving together natural and synthetic sound: 'Their contrast can be powerful, perhaps more theatrical than musical. But filtering can make the two worlds come closer.' He evolved harmonic blocks as big Mexican statues or powerful rocks in the desert—anchors, symbols or permanence. But the impalpable sand could erode them: 'One should compose in terms of energy and fluxes. There are interplays and fights between different states of matters—like confrontations between characters in a play. Form is the result of these confrontations.'

Varèse had a clear notion of the dialectics between singularity and multiplicity: a set of sounds uttered together can be heard either as a single or multiple, as one entity or as separate components. Computer synthesis later enabled the composer to control fusion or segregation and to use this dialectics musically, as in my piece *Inharmonique*, in Chowning's *Phoné* or in Reynolds's *Archipelago* (Risset, 1991a).

> The ductility of the electrical sound makes all systems relative. The evolution of tonal music was like climbing up the harmonic spectrum. Why confine oneself with that, now that one can generate other kinds of spectra and compose the sound at will?

Such statements confirm the view of Hughes Dufourt, according to whom Varèse resorted to intuitions that were substitutes for the possibilities of digital sound synthesis, 'instruments obedient to thought—and which, supported by a flowering of undreamed-of timbres, will lend themselves to any combination I choose to impose and will submit to the exigencies of my inner rhythm' (Varèse, 1917). Varèse did not like to hear his music called 'experimental music':

> They should just say they don't like it, but they should not call it experimental—it is not. It is a finished product which I submit to the public—I perform my own experiments privately. You would not present as music all of your experiments with the computer, would you? But maybe the listener should himself make experiments: it might open his ears—his mind.

Debussy had been very helpful to Varèse, but he had been, above all, an extraordinary inspiration. Varèse often quoted his motto, 'Works of art make rules, rules do not make works of art.' This is by no means a typical French motto—it is reminiscent of Schelling rather than of Descartes. According to Descartes, the senses are a source of errors, which the reason should correct: hence science should not have to do with the senses. Varèse was of the contrary opinion. As computer synthesis experiments progressed, he realized more and more the importance of perception as an unavoidable and often unintuitive interface between the physical world and its inner representation. Also the principle of problem fragmentation, advocated by Descartes, was unacceptable to Varèse. The interest of Varèse for Paracelsus, the great alchemist of the 16th century, had to do with the global approach and the ambition for the absolute praised by alchemy, not with a taste for theosophy. Varèse understood the quest of alchemy as the embracing of a totality that Cartesianism unduly dispersed and scattered. Varèse did not try to construct music in a contrapuntal way: instead, he dealt with basic cells of density, rhythm and timbre. The musical figures are distinct and often repeated in an obsessive and incantatory fashion. Jean-Charles François (1991) noticed that Varèse achieved quasi-linguistic oppositions in his own musical language, articulated by novel functions like rhythmical articulation, speed of projection, dynamic profile, instead of the traditional contrapuntal and harmonic oppositions. This way, Varèse could organize material devoid of clear pitches—sounds from percussion instruments: *Ionisation* for percussion instruments (1931) avoids all pitch logic. The proportions and recurrences give rise to the rhythm, which ensures the stability. Such alternate logic can also function for unpitched concrete and electronic sounds. Through dramatic tensions and breaks, Varèse tried to suggest an equivalent of transmutation. Dufourt (1991) noticed that Varèse's work, uniquely devoid of memories of the past, of traces of historical precedence, merges immobility and paroxysm.

Varèse was defiant of systems; he refused to conform, to borrow from existing styles. Although he rebelled against every imposed limitation, Varèse was reluctant to accept gross or rough innovations, mocking '*les bruitistes et les bruiteurs*' [the noisy faction

and the noise makers]—the latter word alluding to *musique concrète*, which took some inspiration from microphonic sound effects—refusing to yield to randomness or chaos, to collect the '*sons poubelles*' [garbage sounds], or the '*objets trouvés*' [found objects] dear to the Italian Futurists, and to Duchamp and Cage. He felt a need to deepen the musical treatment with a sound material that would be amenable to subtle and intimate transformations. Varèse did not accept the political image of the demanding composer as a dictator, a man of power who decides how things should be. He was intrigued with the mysterious links between different domains—mathematics, music, astronomy, microphysics—about the unity between the various workings of the mind despite the specificity of each field. He believed social metaphors did not fully apply to art, which is not an ordinary 'production', but a creation of the visionary mind illuminated by 'the star of imagination'.

Two Evenings in Celebration of Varèse

With Le Corbusier

Le Corbusier and Varèse had become friends since they collaborated in 1957. One of Le Corbusier's major architectural works is the *Cité radieuse* [The radiant city] in Marseille. This impressive building, where nearly 2,000 people live, embodies the concept of a self-sufficient, low-cost housing unit proposed by Le Corbusier. After an initial period of rejection by the local population, who called the building '*La maison du fada*' [House of the madman], the *Cité radieuse* is now very successful: many inhabitants are proud of being part of the community envisioned by Le Corbusier. On the roof, overlooking Marseille, Le Corbusier designed a playground for children, a gymnasium, but also a kind of stage with a concrete screen, visible on photographs of the building. Le Corbusier had wanted artistic events to take place on the roof; and there were a few, in particular evenings by the scenographer Polieri and the choreographer Maurice Béjart, shortly after the completion of the building in the early 1950s.

For the centennial of Le Corbusier, in 1987, the resident's association asked me to propose a commemorative concert on the roof of the *Cité radieuse*. I decided, of course, to organise an evening around the common project that started the friendship between Varèse and 'Corbu', namely the *Poème électronique* realized for the Universal Exhibition of Brussels in 1957. With the help of equipment provided by the Groupe de Musique Expérimentale de Marseille (GMEM), we tried to project the *Poème* in space, as Varèse had imagined his music being long before he could achieve it: but the space trajectories were of course less elaborate than what could be done in Brussels with 27 independent groups of loudspeakers.

One could also hear the short section of organised sound *Procession du Vendredi Saint à Vergès*, which Varèse composed for the film by Thomas Bouchard on Miró, and *Density 21.5* for flute, played by Gérard Garcin. I also took advantage of the built-in screen to project films, namely *Lightplay: Black-white-grey* (1932), by Moholy-Nagy; *Site* (1964), by Stan Vanderbeek, on the dancer-sculptor Robert Morris, both part of

the New York avant-garde of the 1960s, which Varèse enjoyed; and *Rhythm 21*, made in Zurich in 1921 by Hans Richter. On that same evening, *Diamorphoses* and *Concret-PH*, two tape works by Iannis Xenakis, a powerful creator strongly inspired by Varèse, were also performed. Xenakis, erstwhile assistant of Le Corbusier, was to a large extent responsible for the design of the Philips Pavilion, the 'bottle' containing the *Poème électronique*. The title *Concret-PH* suggests the saddle-like, hyperbolic, paraboloid surface used for the pavilion—actually, the piece was built from recordings of sounds of fire. Varèse suggested Xenakis to play that piece in the Pavilion as a prelude to his *Poème*. The high-frequency sounds gave striking kinetic effects on the Brussels' loudspeaker system. *Diamorphoses*, realised in the studios of the Groupe de Recherches Musicales (GRM) in Paris, organises gliding sounds—reminiscent of the parabolas Varèse tried to suggest when he resorted to acoustic sirens.

In addition, my piece *Sud* (1985), also made at the GRM, was performed on the same night. In this piece, I endeavoured to weave together synthetic and natural sounds, as I had discussed at length with Varèse. Natural sounds were manipulated digitally in several ways, in particular through digital filtering, introducing a filigreed non-octaviant pitch structure, while synthetic sounds were precisely composed in non-tempered pitches and imprinted with energy fluxes abstracted from the wind or the sea. The programme was completed with *Phrases* for flute and tape, by Georges Boeuf. Georges Boeuf, the founder and president of the GMEM, composed pieces such as *Le départ pour la lune*, for organ and tape, *Abyssi symphony* and *Les filles du sommeil*, for tape: his composing vocation was triggered when he heard Varèse's *Déserts* on the radio in 1954.

This commemorative event was attended by an enthusiastic public—it was a stormy, late-September evening: the rain did not fall, but there was beautiful lightening. Roaring rumbles occasionally evoked thunderous voices, as though Varèse were impersonating Zeus. Eric Broquère, who lives in the *Cité radieuse*, took an eerie photograph reproduced here, in Figure 1.

With Francis Bacon

Christopher Columbus was the 'inventor' of a new continent. Even though he thought he was going to the Indies, this land had to be there, in the middle of the ocean, because he imagined it and longed for it so strongly. Similarly, Varèse 'invented' the new continent of electric music: he was the first to have a clear concept and a genuine desire for this new world, and he was the main proponent of 'art-science'. A precursor of this concept was Sir Francis Bacon, English philosopher and writer who became lord chancellor of England, who described in his book *The new atlantis* the utopia of a continent where scientific progress would be taken into account in the daily life of the community. The most striking passage is perhaps the description of experiments on sound:

> We have also sound-houses, where we demonstrate and practice all sounds, and their generation. We have harmonies which you have not, of quarter-sounds, and lesser slides of sound. Divers instruments of music likewise to you unknown, some sweeter

Figure 1 Photograph by Eric Broquère (the original is in colour) from the Evening *Poème électronique* Given in Tribute to Varèse and Le Corbusier on the Roof of the *Cité radieuse* in Marseille (1987).

> than any you have; together with bells and rings that are dainty and sweet. We represent small sounds as great and deep; likewise great sounds extenuate and sharp; we make diverse tremblings and warblings of sounds, which in their original are entire. We represent and imitate all articulate sounds and letters, and the voices and notes of beasts and birds. We have certain helps which set to the ear do further the hearing greatly. We have also divers strange and artificial echoes, reflecting the voice many times, and as it were tossing it: and some that give back the voice louder than it came; some shriller, some deeper; yea, some rendering the voice differing in the letters or articulate sound from what they receive. We have also means to convey sounds in trunks and pipes, in strange lines and distances. (Bacon, [1624]1989, pp. 78–79)

Here is an amazing prophecy of the recent possibilities of digital sound synthesis and processing. Like that of Varèse, the visionary imagination of Bacon had been set in motion by the suggestion of the devices invented in his time—especially the development of the organ and the music machines described in *Musurgia universalis*, written by the Jesuit friar Athanase Kircher. At the request of Blaise Calame, I conceived an evening around Bacon's *New atlantis*. I excerpted a script that guides the listener throughout a kind of journey through the new continent imagined by Bacon. The purpose was to explore a new sonic continent, that of digital music. It is a different world: digital sounds can be pure constructions, they are not necessarily the trace of visible objects, and the sounds can be unreal, even paradoxical. Programming the synthesis of sounds permits us to play with perception, to probe our innermost hearing

mechanisms so as to give the appearance of presence and identity to illusory and immaterial sound objects, escaping mechanical constraints. Sound processing also helps us to metamorphose natural sounds and to create hybrids that retain certain features of a given sound and other features of another one—sonic chimeras.

The idea of the evening was to show that the computer does not have to make our sound world duller or smaller: on the contrary, digital sound should be used to expand the sonic world, as Varèse longed to do, to take advantage of our perceptual features, to explore new territories, and to invoke powers of the inner self. The experiments that Bacon had in mind were demonstrated, and the music presented was chosen with the hope that it would convince the listener that the computer can also foster imagination, dream and fantasy. The prophetic text of Bacon, read by actors, was illustrated by significant milestones of the continuing exploration of the digital domain, notably by John Chowning and myself (simulations and metamorphosis of acoustic instruments or the human voice, paradoxical sounds which go up and down, which speed up and slow down at the same time, illusions of sound movements in space). Besides my own pieces, *Sud*, for computer-synthesized sounds, and *Dérives*, for chorus and computer-synthesized sounds, one could hear John Chowning's *Phoné* and Michel Redolfi's *Immersion*. *New atlantis* was presented in 1988 in the Giacometti Yard of the Fondation Maeght in Saint Paul de Vence, with the essential contribution of Bruno Meyssat, a refined and musical sculptor of light. The evening was later presented in Tokyo, with the text projected in Japanese translation: it fascinated spectators of the TATA festival. Indeed the island of Japan is in some respects similar to *The new atlantis*, since science and technology have vastly influenced Japan's daily life—even though they too often support conservative artistic trends, which would have thoroughly upset Varèse.

The Aftermath: Art-Science and Music Research After Varèse

Varèse was a unique musician. He had direct influences on few composers—Jolivet, Xenakis. Indirectly, his influence is considerable. He was the eloquent prophet of music as organized sound.[19] For many years, he was the only advocate of art-science and music research—not research on past music (Varèse often despised musicologists), but research to help the creation of future music.

Such research, now a meaningful part of the adventure of contemporary music, began in institutions that were not dedicated to music—such as the Bell Laboratories—or to research—such as the French Radio. The policy of Bell Laboratories with respect to musical research was ambiguous. Clearly, the management of the Bell System did not want to develop a substantial activity in that field, despite the wishes of researchers like Mathews and the requests from musicians like Varèse or Stokowski. Yet spectacular advances in music research took place at Bell Laboratories: they were sometimes advertised, insofar as they could be justified in the general framework of research on communication, an obvious, legitimate field of research for a large telephone company. In fact, it was thanks to the work and influence of John Pierce and Max Mathews, two efficient and highly respected scientist-engineers, that computer music could develop

at Bell Laboratories. Both Pierce and Mathews felt that Bell—almost a public service—had a duty to communicate to society the benefits of the technical developments it was responsible for: but they also knew that good scientists and engineers could be strongly motivated to work in the field of music, as they were themselves, and that work in computer music was likely to bring useful advances in other fields as well, as I discussed earlier. Their position was quite in agreement with that of Varèse, who had tried for many years to initiate research work that would develop new tools for music. Pierce and Mathews welcomed Varèse at Bell, a revenge of his dismissal by Fletcher 25 years earlier: they could not arrange for an assistant for him, but he was to have come more often in 1966, had he still been alive.

Both Pierce and Mathews worked with John Chowning, who created in Stanford University the Center for Computer Research in Music and Acoustics (CCRMA)—a major centre devoted to the quest for new music possibilities, as Varèse had dreamed of for so many years. At CCRMA, composers and researchers—they are often both—develop know-how that will endure. Some of it will be put to practical application only much later: research must always keep long-term perspectives. The proposals made by Varèse in around 1940 to the Hollywood movie industry to conduct research on sound failed to elicit a positive response: it is ironic that in the 1970s, after Varèse's death, the Walt Disney Foundation was the main sponsor of the California Institute of the Arts in Valencia, which supported experiments in music and technology.

The Groupe de Recherches Musicales (GRM), created by Pierre Schaeffer in the early 1950s at French Radio, was probably the first institution officially devoted to music research. Schaeffer wanted to explore at length the properties of new sound material before using it in music. But composers, of course, want to compose rather than follow those prescriptions. Schaeffer criticised the music of the GRM composers, even his own (although he did not withdraw it, whereas Varèse had destroyed many of his works). In fact, Schaeffer seems to dismiss most of contemporary art, looking at it as a symptom of a sick society. As I mentioned earlier, there was no empathy between Schaeffer and Varèse. Yet GRM, previously directed by François Bayle, is the institution that has most defended music for tape—'organized sound.'

In the late 1960s, EMS, an expensive electronic music studio, was built in Stockholm using advanced electronic technologies of the time, including the digital computer. This was inspired by the composer Karl-Birger Blomdahl, who died before the completion of the studio. A large UNESCO meeting took place for the inauguration, with Pierre Schaeffer, Max Mathews, Gottfried-Michael Koenig, Jon Appleton and others, including myself, present.[20] The first director, the Norwegian composer Knut Wiggen, expected this studio would produce the music of the future; but the studio appeared to be ideal mostly for re-synthesising efficiently *Electronic study no. 1*, composed 15 years earlier by Stockhausen, and there were difficulties between Wiggen and the Swedish music community. Yet the electronic and tape music scene is very active in Sweden, with composers such as Lars-Gunnar Bodin, Sten Hanson and Ake Parmerud.

In the early 1970s, György Ligeti almost succeeded in getting support for a major

centre of computer music in Hamburg, in association with John Chowning's team. For political and non-musical reasons, the project collapsed at the last minute.

The Institut de Recherche et de Coordination Acoustique Musique (IRCAM) inaugurated in 1977, also fulfils in a way the quest of Varèse. Pierre Boulez had earlier tried to set up a musical research centre at the Max-Planck Institute in Heidelberg, but the famous physicist Werner Heisenberg opposed the project because of his conservative ideas about music (just as Fletcher had opposed Varèse's project). Boulez succeeded in setting up an important centre in Paris, thanks to his prestige as a composer, but also to his widespread reputation gained as a conductor in traditional contexts (Bayreuth, the BBC Symphony Orchestra, the Cleveland and New York Philharmonic Orchestras). The French President, Georges Pompidou, wanted to attract Boulez back to France, and offered to create an orchestra for him. However, Boulez was not interested since this orchestra could not be better than the ones he already conducted. On the other hand, he did want to create a substantial institute, and he was in the unique position to obtain that from the French President.

Boulez was very intent on the development of theory, and he hoped that his institute would contribute to putting back some order into the Babelian explosion of musical language. He longed for general solutions; he considered Varèse as a great but marginal figure. Boulez was initially more concerned with syntax than with vocabulary: he was more interested in the instrumental world than in the whole field of electronic or digital music. He insisted that the experimental hall or IRCAM, *l'espace de projection*, should have its variable acoustics realised by means of acoustic panels, without resorting to any electronic or digital manipulation, and he still claims that loudspeakers have a distinctive, unmistakable colour. Boulez is clearly defiant of the electronic revolution. None the less, it turned out that the novel and distinctive feature of IRCAM was the irresistible extension of the role of the computer.

At the time of the creation of IRCAM, other music research groups in France feared that it would monopolize the available support. In fact, IRCAM created an impetus: other centres were supported or created. A large centre, ZKM was founded in Karlsruhe. It is essential indeed to avoid monolithism and to diversify the contexts of musical research (Risset, 1985, 1986). Genuine music research is quite active in France, largely through the action of the action of the Ministry of Culture, although the traditional rivalries that Varèse complained about often prevents cross-fertilization. Music research has developed of course in other countries, especially in the USA, and a substantial body of knowledge has grown, so that the domain of digital sound is beginning to be musically explored, although often not mastered. The results of these are not exploited enough. The intellectual investment, the know-how and the software are more important than the hardware; but the fetishism of the technological object is long-lived in mentalities.

Moreover, in western countries, industry was too blind or lazy to take advantage of this knowledge and know-how to develop a truly novel and powerful technology for musical creation: in France, it accepted the benefits of an occasional state support for industrializing a music processor, but it was never ready for the effort that would have

been necessary. Japanese industry made good use of the music research accomplished in the USA and other countries, and gained almost complete monopoly of the market of digital music tools. Unfortunately it is mostly driven by the quest of the largest possible market, which orients it towards developing ready-made and rather conventional digital instruments rather than truly novel, demanding and powerful systems. After the collapse of Communism, the obsession of marketing appears as the dominant driving force. This is disastrous in several respects. Culture is jeopardized by the tepid flow of inanities that attracts the largest public, thereby the largest share of publicity sponsorship. The obsession of immediate returns, typical of a shopkeeper mentality, pervades more and more activities. Haste often prevents musicians from pursuing ambitious and long-term projects. Even artists are often obsessed, just as politicians are, by the idea of projecting a strong and clear image, a concept coming from the field of marketing (Risset, 1991b).

In his book *Musique, pouvoir, écriure*, Hughes Dufourt (1991) gives a brilliant analysis of the social conditions surrounding the creation of music. He describes the position of Varèse, with its unique ambition to give our century an art that would be worthy of its science (Dufourt, 1991, p. 114). Varèse left Europe, which he regarded as crippled by the weight of traditions and nostalgia for the past: yet he had difficulties even in the USA, more modern than Europe, but plagued by social inertia and conservatism in musical tastes. Thus Varèse, after producing powerful and innovative instrumental music whose paroxystic expression revealed an intense crisis, undertook huge projects, which aborted, failing to gain the necessary support, despite the interest, even the fascination he often elicited. The failure of Varèse's project reveals the cultural failure of our civilization.

Varèse was premonitory in pointing to goals that appear fertile and feasible. But, even though his dreams are not yet fulfilled, they still point to higher exigencies. Varèse appears as a courageous and demanding figure who stands against easygoing trends, weaknesses, cowardice and stupidity. No bounds can constrain the speculations and the desires of man. As Varèse insisted, something in man is not within reach of the oppressive and normative forces: despite inertia and conformism, it cannot be tamed, it projects into the future, beyond any material limits. Varèse exemplifies the ultimate virtues of man—independence and imagination.

Notes

[1] This paper was authored in 1991.

[2] Computers are no longer what they used to be, and they will continue to change as they grow with us. The computer is neither a tool nor a machine—it is rather a workshop to design, test, and build, new tools and new machines, as well an interface between men, between material and intellectual processes, knowledge and techniques, sensory modalities and abstract information. The evolution of mankind today lies in the advent of new concepts, new tools, new achievements, which are transmitted culturally rather than genetically. The computer is not a mere technical object: rather, it opens a huge field of new interactions. It has already completely changed from its origins, and will continue to do so.

[3] 'me coucher dans la pensée des autres'.

[4] On hearing the comment that a piece of music had a beautiful hidden structure, John Pierce remarked: 'praising the piece for this reason is akin to loving a woman because she has a beautiful skeleton'.

[5] In June 1991, I met Luening in Bourges, where the Groupe de Musique Expérimentale had also invited Pierre Schaeffer, Max Matthews, Robert Moog, Peter Zinovieff, John Chowning and other pioneers of 'experimental music'. At 91, Otto Luening was very dynamic and enthusiastic. He recalled that he first heard about electroacoustic music when his father read to him news about the Dynamophone—that was in 1906! He had a vision of new galaxies of music: for him, Varèse was the first to explore these galaxies, the first 'astronaut of music'.

[6] Theremin was still active at the age of 97: he played in a concert in Bourges in 1990, and in 1991 with Max Mathews at CCRMA in Stanford, USA.

[7] Louise Varèse was fascinated by Varèse—primarily by his person. About music, her personal judgement was not assured—actually she does not speak much about music in her memoirs, *A looking glass diary* (1973), but she entirely trusted Varèse's artistic projects. She was a wonderful person and she helped Varèse a lot in his periods of doubt. Certainly, the quality of the tapes realised by Varèse are problematic, in part because they were badly handled. Sometimes, *Déserts* is performed without the electronic interpolations—it has been recorded this way under the direction of Boulez: however, this was not satisfactory to Varèse. A compact disc (ElectroAcoustic Music Classics: neuma compact disc 450-74, 71 Maple Street, Acton, Mass 01720,1990) included a 'cleaned up' version of *Poème électronique*, accompanied with a graphic score obtained by a time-frequency analysis of the sound itself. However, cleaner, the resulting quality remains disputable, and there seems to be some pitch distortion in the final glissandi. (The CD also includes Babbitt's *Philomel* and *Phenomena*, Reynolds' *Transfigured Wind IV* and Xenakis' *Mycenae Alpha).*

[8] 'ce bordel de ville où les gens au pouvoir sont si mesquins'.

[9] '. . . un vieux grippe-sou, qui avec ça se prenait pour un Don Juan—si c'est par ridicule! Un jour, je l'ai traité de vieux con. Lui marcher dessus, ça porterait bonheur . . .'.

[10] 'Il faut courir plus vite que la beauté.'

[11] 'con-passés et traditionnels'.

[12] Varèse did not like Mozart: too orderly, too predictable and well-behaved, too classical. 'One can hear the wigs in his music.'

[13] 'Have an armchair, Maître. –Un fauteuil? C'est pour les femmes ou les vieux: moi, je prends une chaise!'

[14] 'Messiaen visited us a while ago. He does beautiful music. What is the name of his wife, the little pianist? Loriod, that's it. She is amazing, and yet she is so small. I hope they come back soon.'

[15] Luc Ferrari actually realised that film at the *Groupe de Recherches Musicales* in Paris, but only after the death of Varèse. The film shows Maderna conducting *Déserts* with passion and rage against the orchestral members, who were too tepid in their playing. Ferrari was interested in the way Varèse used energy contours as early as 1923, when he composed *Hyperprism.*

[16] The late Georges Charbonnier was an exceptional radio producer, with a sharp understanding of artistic and scientific issues. In 1955, he interviewed Varèse at length for a series of radio broadcasts. He initially irritated Varèse by his direct, inquisitory questions, then Varèse came to like him. The publication of these *Entretiens avec Edgard Varèse* (Paris: Belford, 1970) is an invaluable description of Varèse's opinions. Janine Charbonnier, George's wife, is a composer who resorts to the computer to assist her in the composition process. The Charbonniers confessed that, while the visits of Varèse and his friends were memorable experiences, they occasioned them financial difficulties at the time!

[17] For Varèse's 80th birthday—we only learned after his death that he was actually 82—Max Mathews had presented him algorithmic variations on 'Happy birthday to you', which he had composed and synthesised with the computer. Varèse was very touched, and at the same time

he could hardly hide his dislike for both the systematic composing procedures and the sounds, which he found dull.

[18] I could not believe it. In France, noted composers were so pompous and aware of hierarchies: and here was this grand old man—he did not sound old though—calling a young and inexperienced musician!

[19] 'That he farthered forth noise—that is to say, into 20th century music—makes him more relative to present musical necessity than even the Viennese masters' (Cage, 1961, p. 84).

[20] Please refer to the *Music and Technology* (1970) proceedings (articles by K. Blaukopf, H. Brun, G. Ciamaga, W. Kaegi, G. M. Koenig, C. Lesche, M. V. Mathews, A. Richard, J. C. Risset, P. Schaeffer, M. Shibata and K. Szlifirski). There is also a French translation (*Musique et technologie*) of these proceedings.

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Further recommended reading

Since authoring the above article, there have been several important publications on Varèse that I wish to draw the interested reader's attention to:

Horodisky, T. (1998). *Varèse: héritages et confluences*. Doctoral thesis, Université Paris VIII.

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