The Upic upside down

I will first apologize for the title of my lecture as well as for its contents. I used the Upic not only as a graphic synthesizer transforming drawings into sounds, but also the way back, transforming sounds into workable drawings, and I intend to suggest my reasons for such a choice. Being here in an important temple of technology applied to composition, I realize that a great amount of the facts and statements I will bring forward are already familiar to many among you. But as the original form of the Upic is now more a memory than a still available device, and since I may have been its first user, after Xenakis, I must begin reminding you of some historic landmarks which characterize the origins of the Upic system, and justify the way I intended to make use of it.

Xenakis had abandoned Schaeffer's *Groupe de recherches musicales* in **1962**. He was disappointed by the hostility of Schaeffer against *Bohor*, a piece dedicated to him, though. He was as well hurt by Boulez' criticism of his piece *Eonta* in 1963, and started teaching the same year in the US at Tanglewood, then at Bloomington. But neither Schaeffer nor Boulez, nor his American employers, were willing to support his project of a center devoted to music synthesis by digital means. His use of mathematics and references to physics had to remain purely intellectual till, eventually, he could found in **1966** the EMAMU (*Équipe de Mathématique et d'Automatique musicales*), with the support of three high level computer scientists, and philosophers like Dufrenne, Francès, Revault d'Allonnes and Claude Levi-Strauss. The EMAMU, first hosted in the *École pratique des Hautes Études*, was connected to the nuclear physics laboratory of the Collège de France in 1969 thanks to Leprince-Ringuet. The same year **1969** Xenakis was requested by Georges Pompidou to collaborate with Pierre Boulez in a new institution called IRCAM, devoted to Science allied to Music, and they both publicly presented the project. But soon Boulez, being more skillfull than Xenakis at dealing with politicians, got rid of Xenakis and remained the only responsible of IRCAM.

In **1972** the EMAMU became the CEMAMU, which at last was equipped with a digital-analogic converter built by the *Centre National d'études des télécommunications*. The system was a digital drawing table, the same size as the desk on which Xenakis had been elaborating his scores as well as his architectural projects. Here one wrote on a tracing paper with a special pen, both electric and graphic. The scale of the millimetric surface could be chosen, so that the vertical axis could correspond to any interval, and the horizontal one to any duration. Practically no limits either were fixed to the amount of simultaneous time and pitch units, called "arcs", since one single so-called "page" could count up to 2024 arcs. One page had 128 envelopes in one bank, and they could be used together. Similarly 128 waveforms were stored in one bank. The normal ambitus of a page was 6 octaves, but it could as well be fixed to 10 octaves, including infra- and ultra-sounds, or to a very small interval. One could choose either discrete pitch steps or continuous. Such a "page" could be used to elaborate one sound, one sequence, or the whole composition.

Keynote 1 schéma de l'Upic

The same year **1972** I had composed *Korwar*, for harpsichord and tape. The tape organised sounds taken from speech (in xhosa), frogs, birds, boars, whales and rain. I also published a paper entitled "La musique est une fonction biologique" – "Music is a biological function" – The main themes of my paper were :

• There is no purely acoustic difference between noise and music, or between natural sound and manmade music. What means is an encounter between thought and sounds, which depends chiefly from context.

• The musical atom is neither a note nor any *quantum*, but a *quale*, a difference similar to the existing one between phonetics and phonology.

• music is not basically a message, but a biological function, which is not entirely limited to the human species, and which probably has its roots in playing.

• Cage is wrong in rejecting any voluntary action on the sounds. Nature alone acquires a meaning when responding to man's respectful action.

The same year I shared with Xenakis a monographic issue of the review *l'Arc*, where I published an article entitled "Xenakis and nature" . We were close friends, but we had different orientations. Xenakis appreciated nature as much as I did rationality, but with different outcomes. I was both willing to support the Upic, and curious of exploring its possibilities, some day, in spite of a basic distrust about any systematic approach such as serialism. My experience of "musique concrète" since 1958 had taught me that there is often something more interesting and rich, in acoustic, natural, sounds, than in synthesized *a priori* structures following some system.

In **1977**, two years before the appearance of the first digital sampler by Fairlight, I started exploring the Upic, that is the first version of it. At that time, it was far from real-time computing, and needed long waits before one could discover the sounds corresponding to the drawing of a page. I particularly realized that remarkable drawings did not assure remarkable sounds, or even simply meaningful results, and that they often conveyed misleading illusions.

Keynote 2 : page 12.12.77 (tracing paper 5 octaves, ½ ton = 1cm). This was part of my first essay on Upic

In **1978** Xenakis composed *Mycènes alpha*, the first piece entirely made on the Upic which had its première the 2nd of August at Mycenes in Greece, where the composer was at last authorized to return, 30 years after his death sentence.

Keynote 3 : page of *Mycènes alpha* and extract from L. de Vinci's notebooks

In **1979** I heard of the first digital sampler. Unfortunately, its cost was exceedingly high and as such first reserved to entertainment music. The same or next year, Publison commercialized its DHM89B2 and KB2000, later nicknamed "the *French Infernal machine 90*", (an English name, probably so as to look more serious and reliable…), and it had an immediate success. I talked about it to Xenakis, who taught me that the Upic had an analytical feature which might yield some comparable results.

Keynote 4 : images of KB2000 and DHM

Among other possibilities the DHM offered : a harmonizer, an envelope generator, an evolutive vibrato, a delay, a reverb etc. The keyboard allowed separate treatment of pitch and duration, for example automatically keeping the duration of a sample when transposing its pitch. I used that in the finale of *Aulodie* in **1982**, where a soloist synchronizes in unison with the complex rythms of two recorded tracks.

Keynote 5 : finale *Aulodie*, extract by Ruth Velten, soprano sax pages 16 and 17

I must now mention some other details of the historic context in order to explain which were my expectancies about the Upic. In March **1980**, Xenakis was the supervisor of my doctorate upon "*The idea of model in today's music"*. Four months later I got a commission for a music accompanying an exhibition near Avignon, whose theme was Water, and I composed four "*Phonographies de l'eau*", a term I had coined 17 years before to refer to an art in parallel with music just like photography was in parallel with painting. *Wochenende* by Walter Ruttmann, in 1930, a talking movie without pictures, being probably the first example of such an art. My phonographies accompanied the exhibition from July 4th. One of them, entitled *Proteus*, used the possibility, which then existed on the Upic, of sampling a sound, but it could simply change its rhythm, without changing the pitch. The Upic worked already then as a crude sampler, respecting the pitch of the sound signal, but allowing some rhythmic invention. Unfortunately, I was the only composer interested in such a function, which soon disappeared from the new models of Upic. Otherwise the Upic could easily have developped a full sampling function.

Keynote 6 : amphibian with given rhythm (39") from *Proteus*

At that time Jean-Claude Eloy composed "*Points lignes paysage*" on the Upic, and I myself composed *Hyperion* entirely on the same system. On Xenakis' request I was teaching at Paris-1 University a course entitled *Music composition in the biosphere*. In tune with my practice of natural models, I used the ability of the Upic to extract two features from different sounds : dynamic envelope and spectrum waveform. Most of my models were different animals, plus a few non-european instruments like the ethiopian bagana. For the second time I used a technology allowing to analyse natural models with greater accuracy than pure listening. I had done something like that in 1964, with a Kay electric spectrograph allowing speech analysis in *Le son d'une voix*, a piece stemmed from a phonetic model, which Michael Gielen conducted at the Royan Festival, and which anticipated the spectral school by some ten years.

Keynote 7 : Very simple spectrum of marsh warbler (acrocephalus palustris).
Complex envelope of white-faced storm petrel (pelagodroma marina),
and still more complex envelope of frog hyla cinerea.
Waveform of bagana, the great lyre from Ethiopia.

While experiencing some morphing, that is combining dynamic envelopes and waveforms coming from different analysis, I noticed that using complex envelopes with simple waveforms was much more efficient than the opposite (complex waveforms with simple envelopes). The nature of synthetic timbre did not so much depend on the common

view of steady spectrum contents, but chiefly on the multiple small dynamic movements of the envelope. At the same time Jean-Claude Risset was scientifically developing his analysis of sounds and could describe the same phenomenon with great accuracy, leading henceforth to more subtle synthesis of acoustic instruments. The beginning sequence of *Hypérion* is made with the simplest sine waveform associated with complex envelopes, and with a background using slow continuous glissandi. Première at Lille 4.11.1980 (partial) and Paris 19.6.1981 (complete).

Keynote 8 à 10 : *Hypérion*, extract 1' ou 2' . page 1b (waveforms from « exotic » instruments) page 6 page 2 (end) and T1 page 10 (duration 29'')

Keynote 9 : one page from *Hypérion* (T1)

Keynote 10 : notation of evolving unisons in *Hypérion*

One year after *Hypérion*, in **1983**, I tried an experience quite different for *Nocturne*, a piece for piano and tape. The electronic tape was made on the Upic as a complex canon of melodic contours. A basic outline of some 20 "arcs" was varied at different durations, registers, ambitus, intervals, and waveforms, initiating complex canonic counterpoints between the soloist and the tape, and between different layers on the tape itself. The intervals of the contour could change in many ways, without ever, though, changing their direction.

Keynote 11 : page 6 of *Nocturne*

The idea of such a particuliar canon had some affinities on one hand with Xenakis' arborescences, as in *Synaphai* (**1969**), and on the other hand with Mandelbrot's fractals, which at that time had been more and more fashionable among artists for 10 years or so.

After **1983** I more rarely used the Upic, in spite of the new possibilities of listening in real time the results of drawings, which transformed it in a kind of music instrument fit for the stage at that time. The reason is that samplers were now becoming affordable, and I thought they could cumulate the benefits of handling any kind of sounds, any scales, with all the flexibility of the music instruments, while conquering all the liberty to overcome their limits and routines. Hence, from 1983 on, my use of the *French infernal machine* which I already mentioned. And as soon the Mirage was in sale, I managed to buy one. That was in **1985**, which was also the year when the "Upic workshop" was founded. I managed it for several years, and, in France and abroad it hosted a great amount of training sessions, concerts, resident foreign composers, and educational activities.

Two years before, I had been elected Professor of musicology, and Director of the Music department of Strasburg University. There I could raise the funds to buy a Upic system, and in **1987** in that University I organized a curriculum called Primus, which was still missing in France, in order to train Tonmeister (sound engineers) capable of reading a score, of possibly writing one themselves, and of managing recording and post-recording sessions. They also learned to work with the Upic system. We had it along with a Fairlight VT5 Voicetracker (january **1986**) to transform sounds into midi data. Personnaly I owned a

Commodore computer (May 1986) and soon got a better sampler than the Mirage, namely an Akai S900, which I used for my pieces *Aliunde* (1987), *Tempora* (1988) and *Kengir* (1991). Among the samples I used, many were borrowed from the Upic.

Tempora was written for three samplers, each one with a Midi keyboard, and they played animal sounds as well as synthetic or acoustic samples, all working as imaginary instruments. I believed that whole orchestras made of, or including, samplers would soon be available and grant electronic sounds the same possibility of expression which the traditional acoustic instruments had kept. The Upic itself would acquire the flexibility of a real-time music instrument. The common place of endless crossfades between audio fluxes would no longer be the main way of developing an electronic work. What a deception when I soon realized that such a beautiful dream was hopeless! Everything in the electronic business, and specifically in the digital acoustic domain, was ruled by the unique obsession with profit and for that with innovation at all cost, be it smoke and mirrors or real, and that this made programmed obsolescence a rule. For many electronic compositions, the only hope for a long survival is henceforth inevitably brought back to unchanging recordings, since porting to new sampling platforms is hardly possible, and anyhow, even when successful, doomed again to lower and lower life expectancy. Most of time, digital archives will die before their authors. As regards the Upic, its current survival in the University of Rouen, under the new form of "Upix" (for Windows in 2001, and more recently for other platforms like Upisketch in some smatphones), is so far one of the few notable exceptions.

My last commitment for a composition entirely made with Upic was in **1987**, when I started composing *Tithon*, the piece which is going to be played in tonight's concert. In 1980, in a greek island, I had the opportunity of making a close recording of an interesting insect, probably a "wart biter" (*decticus verrucivorus*), which had ventured into my house. Contrary to the monotony of many insects, the song of this one was rhythmically varied and containing even a hidden melody. I decided to adopt it as a model. Here are some extracts of its song and of the treatments I applied on them, thanks to the Upic and some other devices.

Keynote 12 : 1. extract from the original recording (46").
2. Other extract, at a slower pace : minus 1 octave (13")
3. same kind of rhythmician insect (wart biter = decticus verrucivorus) 19",6
4.a hidden melody emphasised with the Ircam Audiosculpt software : image.
5. sound of the hidden melody (30").
6. Same melody minus 3 octaves. 45",6
7. A midi file from the same melody (through Melodyne), (just for fun, for eventually I did not use the melody at all…) 45",6

Tithon is not a program music, even if the title refers to a beautiful greek legend, which I cannot help telling. Dawn is in love with Τιθωνός , a beautiful Trojan prince, brother of Priam and nephew of Ganymedes. He is also in love with her since the day when she abducted him one morning while he was leading his flock. At that time princes would also be shepherds. Some time after they had two children, and Dawn started feeling worried about their future. Her husband Tithonos, being a nephew of Ganymedes, had an access to Olympus. She decided to beg Zeus to grant Tithonos immortality. Zeus is usually very thrifty for such a favour, but he accepted, taking into account the extended, distinguished service of Dawn. The only problem was that she forgot to also require eternal

youth for her lover. Day after day Tithonos was decaying, till he shriveled and shrunk to such an extent as he became a poor grey thing hanging to some sprigs, hereinafter referred to as a « cicada ». But he is still in love with Dawn and will greet her loud and clear every morning.

Tithon is not a program music, but nearly every sound originated in insect recordings, and the piece is imbued with different moods typically blooming in Summer, like insects' songs.

Keynote 13 : page 13 for *Tithon*, each of the 7 colours representing a particuliar waveform for the chosen contour

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Now, after mentionning a last use of Upic samples for my string quartet *Moires* in 1994, I should like to move from an historic recapitulation to a tentative reflection about the future of what Upic and the like represent. In spite of their many drawbacks, there are so many benefits in computer music and bioinformatics that I think they will not be abandoned. With data processing, the composer can conceive as a whole the laws of assembly and the sound identity of what is assembled. Instead of dealing with all the limited possibilities and constraints which a music instrument would offer, it seems that he has no further limits but those of his own competences and imagination. He can charge the computer with producing such or such sequence of preset sound events according to laws which he will have formalized in a program, and this program, for example, can itself present all the complexity and the training ability of a neural network. Instead of subjecting his writing to the auditive anticipation of the result in the future execution time, he can launch algorithms whose final sound realization is not entirely any more foreseeable. This approach, which as lately as yesterday allured more than one follower of musical data processing, presents the double character of a total rationalization, - because eveything, until the indetermination, must be specified in a program -, and paradoxically of an adventure where what is produced by the computer has the multifariousness and sometimes mysterious character of one second, dummy, nature. Instead of composing a work, some aim at composing a program suitable to generate an infinity of achievements. One will thus explore the algorithms of which he believed being the author, arousing an external universe of a strangeness sometimes threatening. An approach which ends up returning the composer, so at least he was not absorbed there in the attractive illusion of an absolute power, with his most traditional, and least rational, responsibilities : the taste, the intuition, the experiment, the aptitude to feel in advance the emotions which he will organize in the duration, all capacities without which no choice is legitimate nor even possible among the sometimes innumerable proposals of the machine. The formalization of such selection criteria would be possible in its turn only if the knowledge of the human brain were completed, a still remote Utopia. Thus the way followed for one half-century by musical data processing has not been without reminding of certain aspects of what the revolution of writing music had been producing near the end of the 14th century. The proportional notation had then proposed to the successors of Machaut much more than the facilities for which it had been elaborated. The "*creative power of the machine",* as Michel Philippot said, had already appeared « avant la lettre » with what the musicologist Ursula Günther baptized the "Ars subtilior". This term indicates the complex musical experiments of the generation of 1400. Rhythmic refinements often came from a temptation to push to the extreme the potential of the writing, so as to see what that would produce.

Keynote 14 : fancy score of rondeau *Belle, bonne, sage* by Baude Cordier (Chantilly manuscript). The red colour for some notes implies some rhythmic modification of the note. 19”

Keynote 15 : short extract by Ciconia 56”

In a somewhat comparable way, some six centuries after, the computer contributed to prolong the experimental spirit which had dominated the Fifties and Sixties of the 20th century, by proposing novel facilities. It is however necessary to be disillusioned a little when certain provisional appraisals are made. The computer certainly allows incredible time-savers. But a short handling error can also sometimes cause the instantaneous loss of several work days. The complexity of certain software involves sometimes anomalies that the best data processing specialists pain to identify, even with the help of their best software of repair. Sorry if I am flogging a dead horse in front of so many expert riders…

Paradoxically, the sound synthesis transformed the production of amazing sonorities into a kind of standardized category. Those, as a result, lost so much of their attraction that they could be used as negative argument in favour of some reactionary aesthetic choices. Whereas it is easy to simulate an organ or a vibraphone almost to perfection, for their part the synthetic string instruments avoid with difficulty appearing caricatural. And in any case, the results always come out of loudspeakers, with the constraints and the characteristics inherent in these transmitters. Data processing seems dedicated to rather provide prostheses to the acoustic instruments than to replace them, and it is the C.A.D. (computer-aided design) which is undoubtedly one of the best possible uses of the computer, wisely retrogressed from the role of demiurge to that of secretary. It can help to outline and write scores, without the listener suspecting even its intervention. Even on this ground, the commercial availability of innumerable software of harmonization, orchestration, arrangement, composition, can unfortunately support, along with some advantage of amateurism, a certain idleness of mind. By spreading an illusion of creativity which would put up with a sleep of imagination, and a careless listening, it often caused sound floods where the best is drowned in the worst. Matching the irresponsibility of the listener, transformed into passive and inattentive consumer, looms the irresponsibility of composers fascinated by the complex proliferation of sounds of which they control neither the birth nor the evolution. In other cases, on the contrary, their irresponsibility consists in getting a completely formalized control of a production process, without much worrying about the thought, or the absence of thought, which will result for those which he is supposed to address. To over-estimate an algorithm so much that you dare not improve its productions, or to decide that these principles are more important than the listening of their of the robots.

The composer as a data processing specialist is finally always constrained to admit that the music is completely formalisable only at the cost of one sometimes dangerous reduction. The principal challenge with which data processing confronts, by so much facilitating certain tasks to him, is to have to reflect, rather than about the difficulties inherent in this work, even about its very finality. Ultimately, music, like any art, rests on the desire, much more fundamental than the intelligence. Data processing gives the opportunity to check what the ancient Greeks already knew : Eros, born much before Zeus and Athena, is nevertheless always young. Data processing, be it with Upic or any other device, should remind the artists that they should be still rather philosophers than technocrats.

Personally I always tried to combine my interest in the powerful computer resources with a vision broader than technology or language. They maintain the musician (creative and

listener) in the circle of the social relationships and social emotions, while music has also a more mysterious function of harmony with nature, not only with the feelings, but also with the consciousness of the limits and the natural requests, to harmonize with the invention, in order to avoid the divorce of mankind with nature. Music can contribute to spare us certain disadvantages of hybridization with the “artificial intelligences”. But that would be the subject of another lecture. I thank you for allowing me to propose this one, and listening to it.

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