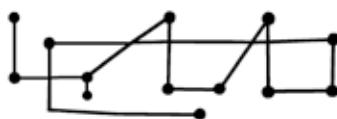


THREE USES OF VUZA CANONS



FABIEN LÉVY

TECHNIQUE IS NOTHING MORE than a means of translating an aesthetic. It would be difficult to summarise the ‘aesthetic obsession’ which has given rise to my own compositional techniques for two reasons: firstly, this would make for a rather voluble tract; secondly, in the case of my recent works, insufficient time has elapsed to allow any degree of objectivity; indeed, even with my earliest works, I now have only over-simplified notions, and cannot always summarize these effectively. Let’s say, at the risk of over-simplifying, that my first works were attempts to reject overly-transparent analytical transformations of one or more ‘traditional’ musical parameters; they sought to combine, in a balanced manner, perceptual paradoxes and musical ‘inflections’ which could not be understood analytically.¹

Meeting Italian mathematician Moreno Andreatta at IRCAM in 1998, and becoming familiar with his work on Vuza canons² was therefore of significant consequence for me. Vuza canons (named after Romanian mathematician Dan Vuza) are rhythmically augmented canons which are said to be ‘perfect’ because the combination of multiple

voices engenders neither empty space nor superimposition. The implementation of each voice is perfectly complimentary and thus expresses a perfect tessellation mathematically. A manual construction of these canons, of which there exists a finite number, is impossible; their creation calls upon the most complex algebraic theories. They were first calculated in the twentieth century by Vuza, and then more broadly studied and applied to digital algorithms by Moreno Andreatta.

Perceptually, this type of canon proves paradoxical; an attentive listener will detect multiple entries of the same rhythmic motive, until, at such a time when all instances are present, a unique monodic line emerges. Three of my pieces to date make use of Vuza canons, each in accordance with its own aesthetic preoccupations.

1. VUZA CANONS AS PEDAGOGICAL TOOLS

The transposition of a motive into different registers is a widespread pedagogical exercise, since it forces the student to explore extended techniques in different registers. In the last piece from *Pour la classe* [For class] from the cycle of pedagogical works *Où niche l'hibou* [Where the owl nests],³ this principle is applied in a ludic fashion with the use of Vuza canons (Example 1). Firstly, because of the use of these canons, motivic imitations are not superimposed upon one another; since each part is assigned its own distinct tessitura, the student can clearly hear his or her fellow performer reproduce a motive in a different register. Secondly, beyond the difficulties associated with transposing the motive, students are confronted with the challenge of maintaining the right tempo; errors in this regard will result in the undesirable superimposition of two voices.

2. WHEN VUZA CANONS PUSH THE LIMITS OF THE COMPUTER

Vuza canons are implemented, albeit according to a different principle, in my project for computer, *Soliloque sur [X, X, X et X], commentaire par un ordinateur d'un concert mal compris de lui* [SOLILOQUY on X, X, X and X—a computer's commentary on a concert it misunderstood].⁴ This is not a 'piece' in the traditional sense; rather, it is a 'meta-work' generated in real-time by a computer using analyses and extracts from other pieces on the concert in which it is featured. In each instance, the result is different, not only because the final sonic-mosaic is composed of samples derived from other works in the concert program (as if the computer *remembered* the sonorities it just

♩ 180 (+ ou - suivant niveau)

cl. 1

son filé

f pp \rightarrow f mf mf

l. 1

son filé

f pp \rightarrow f mf mf

l. 2

son filé

f pp \rightarrow f

l. 3

son filé

f pp \rightarrow f

l. 1

fl. mf

son filé mp

l. 2

son filé f p

l. 3

mf

son filé mf

l. 4

f pp \rightarrow f mf mf

l. 5

son filé mf

f pp \rightarrow f

EXAMPLE 1: *POUR LA CLASSE* (OPENING), EXCERPT FROM *OÙ NICHE L'HIBOU*, VERSION FOR TWO CLARINETS, (2001, EDITIONS BILLAUDOT)

heard), but also because the work's organisation, or *score*, is composed based upon variables taken from the analysis of the just-recorded samples. As such, *Soliloque* cannot exist in a concert setting without other works.

In early versions of the work, created using the now obsolete Mac OS9 and the programme *Supercollider*, computational limitations placed dramatic constraints upon the potential complexity of this sonic-mosaic. Each elementary 'cell' consists of roughly three superimposed sounds, taken from the corpus of longer samples. Each

sound is played back from a variable starting-point and looped, in order to be consistent with an imposed rhythmic framework. Furthermore, it is subject to other real-time treatments such as filtering, ring-modulation, playback in reverse and/or at variable-speed, and spatialization (Example 2). As such, the formation of such a ‘primary-cell’ requires many thousands of calculations in real-time. ‘Primary-cells’ are then combined according to the implemented compositional process. During the research phase, using OS9, it was not uncommon to see the CPU usage exceed 200%, limiting the output to a maximum of six cells at a time. It was therefore necessary to seek, within these limitations, alternative means of organizing the material. *Vuza* canons represented a particularly effective solution; indeed, the entire second section in *Soliloque sur [X, X, X et X]* consists of a sequence of eight different, augmented *Vuza* canons. These were calculated by German mathematician Thomas Noll (Technische Universität in Berlin and ESMUC in Barcelona). (See Example 3.)



EXAMPLE 2: USER-INTERFACE FOR *SOLILOQUE SUR [X, X, X ET X]* COMMENTAIRE
 PAR UN ORDINATEUR D'UN CONCERT MAL COMPRIS DE LUI

EXAMPLE 3: A MUSICAL REPRESENTATION OF ONE OF THE VUZA CANONS (BY AUGMENTATION TO SEVEN VOICES), USED IN *SOLILOQUE SUR [X, X, X ET X]*;
 NB: THIS FIGURE IS GIVEN TO ILLUSTRATE RHYTHM ONLY;
 THE PITCHES ARE CHOSEN AT RANDOM

3. VUZA CANONS AS A PARADOX OF PERCEPTION

In my opinion, one of the most interesting musical applications for Vuza canons must lie in the relationship between polyphony and monody; the successive entry of voices creates not the former—as one would expect—but, once all voices are present and superimposed upon each other, the latter.

In *Coïncidences*, voices from the Vuza canons consist not of motivic sequences of notes as in *Où niche l'hibou*, nor of cells of material generated electro-acoustically, as in *Soliloque*, but rather of complex and oriented gestures of orchestration (Example 4: these gestures are annotated according to their directionality and other characteristics: a/=, b/, c/, g/, etc.). Each voice is identifiable by its orchestrational color and register. However, when all voices are present, gestures are extended until a single, continuous, monodic figure forms (Example 5).

* * *

a/4 : montée vers accord
 b/4 : "morceau en pulsation" (montée à un alto, descendant)
 c/4 : montée vers accord (série de a/4)
 d/4 : "morceau en pulsation" en diminution (fin de a/4)
 [a/4] : accord mes en "trois rythmes" (durée double)
 [c/4] : acc. descendant puis remontant
 [a/4] : accord mes en "trois rythmes" (durée double)
 [c/4] : acc. descendant puis descendant avec accent
 b/4 : "son à l'accent"
 F : deux impacts brève et longue

Coincidences - Fabien Levy : déroulement du canon (mes. 158 à 226)
 (Chaque impact fait 3 temps)

EXAMPLE 4: A SCHEMATIC PLAN FOR THE VUZA CANONS IN *COÏNCIDENCES* (1999, EDITIONS BILLAUDOT), FOR 35 SOLOISTS—BARS 158 TO 226; THIS IS AN ABSOLUTE CANON (RHYTHMICALLY) FOR SIX VOICES

Vuza canons may be used as a basis for the discrete temporal organization of a diverse array of musical elements; furthermore, their use responds to a broad range of aesthetic preoccupations. As a composer, not a scientist, and one who composes based upon perception rather than theories, it is the potential for practical musical application, and not purely theoretical significance, which interests me. Of the qualities found in these canons, it is the singular relationship between counterpoint and monody, between the part and the whole, which strikes me as the most interesting; indeed, this notion has long been at the core of my work as a composer. Another characteristic of interest is the rhythmic organization of voices which, when combined, constitute a Vuza canon. In general, rhythmic motives are expressed over a long period of time (or over multiple timescales when an augmented canon is used; this is perceptually more interesting) and relatively fragmented. Over a long duration, the ear does not perceive the canon as such, nor does it recognize exact repetitions; nonetheless, there is, in my opinion, a perceptive sense of structural coherence. Both perceptual paradoxes, at odds with a more analytical perception, were real inspirations for me in using these canons.

—Many thanks to Paul Clift for his help in the translation into English.

The image displays a complex musical score for an ensemble of 35 soloists, covering bars 220 to 224. The score is organized into 35 individual staves, each labeled with a number from 01 to 35 on the left margin. The notation is dense and intricate, featuring a variety of rhythmic patterns, including sixteenth and thirty-second notes, and rests. The score is divided into four measures, with bar lines clearly marking the boundaries. The notation includes various musical symbols such as clefs, time signatures, and dynamic markings like 'ppp' (pianissimo). The overall appearance is that of a highly detailed and technically demanding musical composition.

EXAMPLE 5: *COINCIDENCES* (1999, EDITIONS BILLAUDOT),
FOR ENSEMBLE OF 35 SOLOISTS—BARS 220 TO 224

NOTES

1. For further information, see Lévy, Fabien: *Chronique diurne d'un insecte nageur* [Diurnal chronicle of a swimming insect], *Filigrane* number 4, ed. by J. Caullier, J.-M. Chouvel, J.-P. Olive, M. Solomos; Delatour, Paris, II-2006.
2. Andreatta, Moreno: *La Théorie Mathématique de la musique de Guerino Mazzola et les canons rythmiques* [Mathematical theory in the music of Guerino Mazzola and rhythmic canons], Master, University of Paris IV & EHESS & Ircam, Paris, 1999.
3. These works, composed for a young student of the clarinet (GB7885), saxophone (GB6984), or flute (GB6983) and his or her professor (with the exception of the last piece, composed for the class as an ensemble), published by Editions Billaudot.
4. The X's in the title are to be replaced with the first names of the other composers whose music is performed in the concert. The work's premiere, *Soliloque sur Francesco, Emanuele, Agostino et Nicola* took place on July 5, 2002 at the Staatsbank in Berlin; *Soliloque sur Ludger, Jean-François, James, Tonino, Daniel, Laura, Rolf et Allain* was performed the following evening at the Parochialkirche in Berlin; both performances were part of the *Inventionen Festival*. The work has also been performed in Rome (Teatro Palladium, 02/03/04), Berlin (Deutsche Guggenheim, 29/04/04), Paris (Bouffes du Nord/IRCAM, 13/11/06), and New York (Symphony Space, 17/01/06), etc. . . . *Soliloque* is freely downloadable as an easy-to-use stand-alone application at: www.fabienlevy.net/Compositions/SOLILOQUE.html