Communicating a World View: *figer,* a Manifold Composition

Sever Tipei

Computer Music Project, University of Illinois
Urbana, Illinois. USA

s–tipei@illinois.edu

Abstract

A composition, *figer*, for computer-generated sounds, is analyzed in some detail. The formal architecture, and types of materials used are discussed along with particular features of DISSCO, the original software employed. A non-linear narrative is detected and the implications of an work open to multiple interpretations are examined together with existing clues about the author's belief system. Finally, the world view embedded in the composition is analyzed and the merits of comprehensive or "black box" software are identified as essential to the production of composition classes or *manifold compositions* such as *figer*.

1. Introduction

In the words of Arthur Schopenhauer, "The world is my representation"[1]. If that is true for all of us, artists go one step further when creating original works. They imagine parallel realities that either mirror their representation of the world (realism), fulfill perceived expectations (usually for material gain), propose an alternative model (politically motivated), represent a gamesome construction (abstract art) or combine a number of such goals. Some of these creations are cleverer than other, some are more complex, some more attractive and some more subtle but all divulge the artist's system of beliefs. The work under scrutiny here, *figer*, is not different: its architecture, syntax and purported scenario denote a particular view of the world.

Having established that, two questions could be asked: are the traditional roles of the composer and of the audience transformed in the context of what Umberto Eco's defines as *open works* [2] ? and can a narrative be identified in an "abstract" composition ?

2. Form and Structure

2.1 Composition Software

figer is a computer-assisted composition for computer-generated sounds (fixed media) that can be presented in stereo or eight channel versions. It is also a *manifold composition* [3] or a *class of compositions* whose multiple variants are realized by a computer. In the case of *manifold compositions*, the computer runs a program containing elements of indeterminacy and reads the same data for each run, the only variable being the random number generator's seed. The work was realized with DISSCO, software that unifies composition and sound synthesis into a seamless process [4] for the purpose of realizing such *manifold compositions*.

In DISSCO, written in C++, objects representing the formal units of a composition are arranged in a Directed Graph (DG) tree structure and inherit from an Event class. There are: a unique Top Event corresponding to the entire piece; High Events - main sections; Medium and Low Events - corresponding to more detailed divisions; and Bottom Events in charge of generating synthesized sounds or notes in a score. Each level can spawn any number of Children Events and the same operations are available at all levels of the hierarchy. The user is offered an array of tools that can be used to choose values for assorted parameters and nested link lists that increase considerably the scope and sophistication of such decisions. Applying similar procedures to different time scales insures the coherence of the whole.

DISSCO offers three ways in which Children Events can be created: *Continuum*, *Sweep*, and *Discrete*. *Continuum* distributes values randomly within a designated space and, in **figer**, most attacks and durations are determined this way. *Sweep* creates sequence of attacks and insures that no event starts before the end of the preceding one plus a certain interval (which can be 0). It is used to place such events in succession. *Discrete* assigns attacks and durations for multiple streams of events. It relies on a three dimensional matrix built with the help of two sieves [5].

Deterministic options are available but the software displays a bias toward methods based on probabilities. From choices regarding the macro structure of the piece to those related to minute details in a sound's makeup, the user can introduce elements of randomness that, in turn, support the making of *manifolds*. Depending on the extent to which probabilities were used, each computer run will produce a different distribution of sounds, new sonorities or even multiple formal designs.

Tools that introduce indeterminate aspects in a composition range from flat distributions within a specified range, to functions that control average values, to a triplet of envelopes (functions of time) two representing the lower and the upper dynamic limits of the range, respectively, and the third the probability distribution defined between these limits. Such envelopes are stored in a library and could be drawn by the user who can either select points on a line and drag them to the desired position or specify precise (x, y) coordinates. They can also be constructed through the *Make Envelope* method which allows the composer to define a range of values for each x and y point thus introducing another element of indeterminacy in the process. In this case, the same envelope may take a different shape every time it is used.

2.2 Time Proportions

The Top Event in **figer** has eight children or High Events: four main sections, three interludes and a coda. The main sections have the durations of 5, 2, 3, and 1 minutes, the interludes last for 1/3, 1/5 and 1/2 minutes

while the coda has a duration of 1/3 minutes.

The High Events or main sections contain between four and nine streams represented by Medium or Low Events. The two minute main section contains four such streams, the three and the five minute sections consist of five streams each and the one minute High Event presents nine streams. Reminiscent of Cage's square root method or rather of his way of organizing the music based on time intervals and not on pitch, the beginnings and endings of these streams divide the main sections into segments whose lengths are defined by Fibonacci numbers or Golden Sections and reflect the divisions of the Top Event.

2.3 Types of Materials

Only three primary types of materials are present in **figer**: points, lines, and chords/textures or simultaneous aggregates. Points are disjoined, isolated, unique occurrences: most of them are loud percussive sounds usually lasting a fraction of a second but some are longer "shrieks" with a more complex internal content.

Lines are either drones persisting for up to two and half minutes or long continuous glissandi between well defined points that may evolve for more than three minutes. Such glissandi are actually single, prolonged sounds produced by applying an envelope to the initial frequency. Frequencies of the pitches forming this uninterrupted "melody" are carefully computed as points where there is a change in envelope's direction and angle.

Chords are pitch aggregates whose components share the same start time. They can form familiar sonorities (such as traditional diatonic or chromatic chords), clusters or complex sound mass textures whose constituent units are indistinguishable. As in the case of points and lines, their particular frequencies could be arbitrary stops either on a continuum, or on equal tempered scales or on just intonation scales (as in the case of the coda section).

The three categories of primary materials could be combined in order to create

intermediary shades. Isolated points form sound mass textures when the density increases beyond a certain level. Lines become sometimes tangled in a complex counterpoint to the point of forming an opaque conglomerate. What might be recognized as "siren sounds" are extended points on the verge of becoming lines and changes of register might dramatically alter the appearance of any primary type. High pitched drones of constant frequency but circulating around the room blur the difference between static drones and dynamic lines. Finally, white noise, used sparingly, is treated as one point but is it actually a drone (line) or a sound mass texture, an agglomeration of random frequencies ?

Simple, straight forward and basic types of materials could become ambiguous when appearing in different circumstances and *figer* takes advantage of such vagueness.

2.4 Sound Synthesis

DISSCO generates sounds using LASS, a Library for Additive Sound Synthesis. In an electro-acoustic music environment dominated by *musique concrète* techniques, additive synthesis stands out and it is easily recognizable. When composing *figer* a challenge has been to create sounds that are not quickly identified as such while taking advantage of the main aspect of additive synthesis: strict control over details. As a result, some sonorities recall your typical "additive" sound – especially the lines in the 5 min. section – while others are more difficult to identify.

In the definition of timbre the most important element is the sound's spectral (overtone) content: the number, relative strength, and behavior in time of partials. Sounds in LASS can have an arbitrary number of partials, their amplitude evolution and scaling determined by user defined envelopes. A variety of timbres was produced in *figer* by modifying the harmonic spectra in which partial frequencies are integer multiples of the fundamental. Adding or subtracting a percentage of up to half of the original frequency of each partial (an integer multiple of the fundamental) creates a

distortion of the original spectrum. Since the operation is based on a user specified probability, the result is different for sounds that have the same number of partials and same envelopes even if they were identically scaled originally.

Another precision tool provided by LASS and used in *figer* allows the user to specify the perceived loudness, a subjective sensation distinct from amplitude, and to maintain it constant over the entire frequency domain. Unique in its category, the loudness device rends obsolete the post-production stage during which amplitude overflow is usually managed and makes possible the creation of *manifolds*.

Modifiers are another way through which typical additive synthesis sonorities are transformed. They include vibrato (FM), tremolo (AM), glissandi, and transients. All are controlled by the user stipulating the following: a probability of occurrence, the magnitude of the modulation factor (Index in FM synthesis), and its rate. If a six to eight Hertz vibrato or tremolo might be construed as "normal", asking for much higher rates (50-200 Hz or even more) would create an effect not unlike that produced through the FM synthesis technique even when the carrier remains at a frequency well within the 20 to 4000 Hz. range In the case of transients - spikes in the frequency or in the amplitude of a sound - the user can also control their width or the number of samples affected. While for acoustic instruments transients occur only in a few fractions of a second at the onset or the end of a sound, in DISSCO they can be placed during the entire duration and are controlled by envelopes.

Spatialization creates two categories of *manifold* versions of *figer*: one for stereo and another for an eight channel array. In both cases, an effort has been made to coordinate the suggested spatial location of sounds with their loudness and the amount of reverberation involved in order to obtain a more "credible" effect.

For the eight channel versions two methods available in DISSCO, *Multipan* and *Polar*, were used. The first enables the composer to assign specific percentages of the sound to each

speaker. *Polar* assumes that the speakers are arranged in a circle. Specifying the angle (θ) and the radius (r) places the sound in the room. In the 5 minute section, a spatialization "canon" is created by having the lines follow each other.

3. Narrative and Continuity

3.1 The Surface

When first approached, **figer** presents itself as a dramatic, even emotional narrative. There are a number of sound categories that could be associated with realistic imagery: one can recognize a heart beat, sirens warning of an impending adversity, "marching chords" moving in from all directions like soldiers threatening to take over the audience. Then there are these assailing shrieks (or maybe they are desperate ?) and a bombardment of small particles in huge numbers creating anxiety or at least a uncomfortable feeling. Melodic lines become tangled in a disconcerting way but long drones and sustained, somewhat familiar chords bring an element of stability and misleading reassurance. At the same time, the long, very high, piercing sound of the ½ minute interlude only increases the level of uneasiness.

From this perspective, the work seems to present an aggressive, disturbing, "apocalyptic" picture full of surrealist aural images. Similar to paintings born from that aesthetics, it includes recognizable, somewhat familiar elements placed in an incongruent context. The coda, a quote from the traditional repertoire, only enforces this perception.

Things become less clear if one is trying to discern a "story" in this music. It will be difficult to find casual links between various components, a thread that leads in one direction toward a necessary conclusion. Unlike the music of a few centuries ago, there are no themes-characters participating in a logical "plot" supported by a consecrated form (eg. Fugue, Sonata) or by a literary program. Instead, there is an offering of various sound objects that re-occur in a non-linear, ostensibly random succession - the elements of this piece

do not seem to be arranged in a logical, deterministic order. Each new appearance of a previously encountered object is distinct in different degrees although they all can be quickly identified as being diverse incarnations of the three primary types of materials: points, lines, and aggregates.

The continuity of the piece is broken by interludes that introduce new materials disconnected from their surroundings. They fulfill at least two functions: to generate surprise and to encourage the disengagement of the audience from the preceding scene. Inserting not only a totally different type of material but also a contrasting way in which it is presented (static or monotonous-repetitive as opposed to the fast paced, dynamic main sections), the interludes are unexpected and disruptive. They also prevent listeners to become immersed in the musical discourse and invites them to switch from a passive mode of reception to an active one, to adopt a critical attitude - a practice found frequently in Bertolt Brecht's plays.

3.2 The Substance

Encountering a new work, the listener's expectations based on previous experiences are measured against the reality of the yet unexplored object. Innovative features are related to familiar ones in order to construct a new paradigm. Sometimes references to extra-musical practices are necessary in order to accomplish the task.

Certain aspects of **figer** present similarities not only with some musical compositions but also with literary or cinematic oeuvres. In the novels of Alain Robbe-Grillet the description of the same incident occurs repeatedly during the work, each time with changed details (see, for example, "La maison de rendez-vous" [6]). In the famous "statue scene" from the movie "L'Année dernière à Marienbad", directed by Alain Resnais from a screenplay by Alain Robbe-Grillet [7], we hear five possible explanations of the attitudes displayed by the sculpted couple and their dog. The events in this movie align themselves in an ambiguous

time line open to multiple interpretations and, by the end, it is unclear if a crime has been committed or not.

In a similar way, the main sections of *figer* present the same primary events under different guises, same objects viewed from a number of different perspectives. A change of register, a modified duration, a higher or lower rate of vibrato or the placement in a new context does not affect the essence of such objects. Open to multiple interpretation, the piece does not offer a unique solution or a unique timeline, it does not follow a pre-existent formal pattern, and its complexity adds to the equivocation of the whole. The extensive use of probability, from the higher structural levels down to the finest details in the makeup of each sound, add another layer of incertitude and defeat the attempts to congeal and reduce this piece to a fixed manifestation: *figer* is a *manifold composition* comprising a unlimited number of variants.

There are some obvious similarities between concepts animating *figer* and aleatory music approaches in particular the "Momentform" of Stockhausen [8]. They are regarded here as part of that group of past experiences against which a new artifact is measured.

Music has the advantage over other art forms of being abstract which makes it easier for the composer to invite the listeners to construct their own interpretation. This piece could also be seen as a riddle whose answer lays with the coda and the title. Each individual will forge a distinct representation of the realm proposed by the composer, aware of being a co-author.

Ultimately, *figer* has its own narrative represented by its internal coherence, by the juxtaposition of various materials in an organic conglomerate. Facing this "found object", the listener is encouraged to take an active role and contribute to the creation of an imaginary world, a parallel reality.

4. World View

Music is not created in a cultural vacuum and most pieces reflect to some extent the "Zeitgeist", the spirit of their time. Longer periods also share a dominant way of looking at and understanding reality, a shared world view that influences an individual's representation mentioned by Schopenhauer. This world view is echoed, in the architecture of a work, in the materials used and mostly, in the musical language employed. Tonality, for example, started in the seventeenth century as an orderly hierarchical system governed by causality, in perfect concordance with the rationalism of the Enlightenment, only to dissolve a few centuries later in a mass of ambiguities and delayed resolutions mirroring more complex scientific and less stable social environments.

Composers have the responsibility to recognize such matters and to be aware of the consequences brought about by the artistic choices they make - it is in their power to become active participants in a contemporary reality or, even better, to design a desirable world. Those who deny being aware of such facts and avoid being accountable, are what Herbert Brün called "self appointed morons". In his definition: "the self-appointed moron, having some sort of intelligence, uses it to avoid thinking about knowledge" [9].

The world of *figer* does not avoid responsibility: it combines a structure based on a rhythmic template that is stable, even rigid in its outlines with surface occurrences that are fortuitous. The rational framework is grounded in simple proportions and is created through deterministic means such as sieves and basic logical (Boolean) operations. At the level of details, accidental happenings are governed by probability functions. However, such random occurrences may exist only within the confines of the larger structure which is driven by causality. Thus, *figer*, becomes a small model of the real world as described by contemporary science: ruled by indeterminacy at the particle level while large bodies obey the laws of classical mechanics. Another way to look at this would be to recognize that no chance events or human actions can contradict the laws of Nature; in the world of *figer* there is no room for miracles.

A relativistic view also characterizes the work. Its sections are presenting the same materials in

different arrangements but without developing them. Same entities are accessed from different angles, all equally valid, none of them privileged. The audience is free to adopt an advantage point of view but there is none implied in the makeup of the piece. In this world there is no one-and-only absolute Truth, a point of reference indicating the center - as in tonal music. In the case of *manifold compositions*, all variants are equal, none is "better" than the next and an exhaustive knowledge of the work - that absolute Truth - can be arrived at only by listening to all potential variants, an impossible task since their number is practically infinite.

DISSCO is a comprehensive or "black box" type of software. Meaning that after planing ahead, the composer feeds in all necessary data, runs the program without intervening in the process and accepts the result unless obvious blunders in the planning or in the preparation of the input are discovered. Since probability has a significant contribution in producing the work, the role of the composer shifts from the author of a unique piece to that of the creator of an entire universe. In order for a software to work on a large scale and in a multitude of heterogeneous situations, generating compelling aural realities, it has to be consistent within itself, to embody a system in which all variables are bound by interconnected constraints. Because DISSCO has this kind of internal coherence (minding the famous critique of Boulez at the address of Schoenberg's music), ***figer***'s world is plausible, a real life-like parallel world.

5. Conclusions

It turns out that an "abstract" work can still deliver a narrative albeit one that each member of the audience constructs independently especially if it belongs to the *open work* category. However, in spite of the variety of representations, the internal structure of the composition provides an abstract scenario, a template that unveils its own rich essence.

A *manifold composition*, ***figer*** betrays a world view in which structure and chance, destiny and free will, determinism and randomness coexist; it offers a vision of a

relativistic world without privileges in which one has the means to create new parallel realities. The question remaining is: are these multiverses, multiple worlds where variations on the same type of events happen in different guises as postulated by the Many Worlds interpretation of quantum physics or are they, like everything else, under the power of the Hindu Maya - illusions, subjective representations ?

6. References

[1] Arthur Schopenhauer, *The World as Will and Representation*, Dover, 1969.

[2] Umberto Eco, *Opera Aperta*, Bompiani, 1962.

[3] Sever Tipei, "Manifold Compositions: Formal Control, Intuition, and the Case for Comprehensive Software", in *Proc. Int'l Computer Music Conference* Copenhagen, 2007, vol. II, pp. 429-436.

[4] Hans G. Kaper and Sever Tipei, "DISSCO: A Unified Approach to Sound Synthesis and Composition", in *Proc. Int'l Computer Music Conference,* Barcelona, 2005, pp. 375-378.

[5] Hans G. Kaper and Sever Tipei, "DISSCO: An Object-oriented System for Music Composition and Sound Design", in *Proc. Int'l Computer Music Conference,* Berlin, 2000, pp. 340-343.

[6] Alain Robbe-Grillet, *La maison de rendez-vous,* Paris: Les Éditions de Minuit, 1965

[7] Alain Robbe-Grillet, *L'Année dernière à Marienbad: ciné-roman.* Paris: Les Éditions de Minuit, 1961

[8] Stockhausen, Karlheinz. 1963a. "Momentform: Neue Beziehungen zwischen Aufführungsdauer, Werkdauer und Moment" *Texte zur Musik*, vol. 1, pp. 189-210. Cologne: DuMont Schauberg.

[9] Herbert Brün, "The Premise is That There Be Music". keynote paper, in *Proc. Int'l Computer Music Conference,* Vacouver, *1985*, pp. 1-4.