

# The Composition-Instrument: musical emergence and interaction

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**Abstract.** As a musician and sound artist, I have always understood the process of composition as the conception and organization of musical ideas, and an instrument as something that provides the necessary apparatus to realize such a work. However, my recent work with computer games and digital media has led me become increasingly curious to blur the lines between these terms and consider a coalescence of “composition” and “instrument.” In digital games and other environments of telematic interaction, a composed musical work can both stand-alone and provide a point of individual musical departure. Heard on its own the piece creates an experience of sound. But when altered by one or several users in the course of an interaction, it serves as an agent for further musical expression, exploration, and improvisation. The composition-instrument is a work that can play and be played simultaneously. This paper, building on a research project conducted in the summer of 2006, examines the synergies found in the experimental music of Earle Brown and Terry Riley, Free Improvisation, the game pieces of John Zorn, generative music, the interactive works of Toshio Iwai, contemporary music practice based on file sharing, electronic instrument construction, and computer game design. Across these disparate genres there is a confluence of technical and aesthetic sensibilities—a point at which the idea of a “composition-instrument” can be explored. Examples and previous research by the author are used to focus the discussion, including a work based on swarm intelligence and telematic interaction.

## 1 Introduction

In the conventional practice of music, the process of *composition* can be understood as the conception and organization of musical ideas, whereas an *instrument* provides the equipment necessary to realize such a work. In contemporary interactive media such as multimedia web sites, computer games, and other interactive applications involving the personal computer and mobile devices, this distinction remains largely the same. The composition of the music heard in these environments consists of musical statements to be heard and instructions to be executed in the course of an interaction. Often these structures call for a great deal of random sequencing and repetition following a linear structure. [1][2] The instrument can be simulated in software and manipulated using the inputs of an interactive system. It is usually represented as a database of recordings or samples. Composition and instrument are treated as distinct in the structure underlying the media product and function in their traditionally separate roles.

This separation, while not wholly damaging to the experience of the media, should not be immune from scrutiny. Music that operates in a binary, linear mode does little to recognize the emergence, or *becoming*, that one experiences in the course of an interactive exchange. A traditional, narrative compositional approach leaves no room for the potential of a *becoming* of music. There is need for a critique of music in contemporary interactive media. The emergent, non-linear experience of interactivity is incongruous with the overly repetitive, linear music that is often heard in this field. It is time to ask: *What kinds of compositional techniques can be used to create a music that recognizes the emergence and the potential of becoming found in a digitally-based or telematic interaction with art and media?*

### 1.1 Composition-instrument

Blurring the traditionally distinct roles of composition and instrument provides one possible answer to this question. This approach allows a piece of music to play, or undergo a performance like a traditional composition. When it plays it allows listeners or users to have a musical experience of sound. But it can also be played like a conventional instrument. This treatment allows the musical output of the work to be modified by users in the course of an

interaction. This “instrumentalization” transforms the work into an agent for further musical expression and exploration. Thus, a composition-instrument is a work that can *play* and *be played* simultaneously.

A composition-instrument is not a specific piece of music or interactive work in itself but a means of approaching any work where music can be created and transformed. Composition-instrument is a conceptual framework that helps facilitate the creation of musical systems for interactive media, art, and telematic environments. This paper will discuss the historical context of this compositional approach and show how it is beginning to emerge in the current field of interactive media. The example of an original work aspires to demonstrate how a composition-instrument approach to music exhibits a congruity with the emergent nature of the medium. And finally, discussion of a contemporary computer game project exposes the potential of this musical concept in the world of games, digital art, and telematic media.

## 2 History

Though the idea of a composition-instrument hybrid is situated in the praxis of computer games, telematic media and digital art, the historical precursors to this kind of compositional approach lie in an entirely different field and stem from three different musical traditions: Experimental, Improvisatory, and Generative. Each of these traditions has established aesthetic approaches, creative processes, and musical style. A historical perspective helps to reveal how these attributes can be woven into the fabric of a compositional approach for music that operates in art and media environments with telematic and digitally based interaction.

### 2.1 Experimental Music

The roots of a composition-instrument approach can be found in Experimental music. American composer Earle Brown was looking for ways to open musical form and incorporate elements of improvisation into his music during the 1950's. He found a great deal of inspiration in the mobiles of sculptor Alexander Calder. Brown described them to improvising guitarist and author Derek Bailey as, “...transforming works of art, I mean they have indigenous transformational factors in their construction, and this

seemed to me to be just beautiful. As you walk into a museum and you look at a mobile you see a configuration that's moving very subtly. You walk in the same building the next day and it's a different configuration yet it's the same piece, the same work by Calder." [3]

Brown's thoughts on musical structure are also noted by Michael Nyman in "Experimental Music: Cage and Beyond." Brown emphasizes that one importance of composition is to be both a means of sonic identification and musical point-of-departure. "There must be a fixed (even if flexible) sound-content, to establish the *character* of the work, in order to be called 'open' or 'available' *form*. We recognize people regardless of what they are doing or saying or how they are dressed if their basic *identity* has been established as a constant but flexible function of being alive." [4] Brown was interested in approaching music with an openness that allowed every performance to render a unique musical output that retains the essential character of the work. These compositional ideas, however, were not exclusive to Brown and his music.

Terry Riley's *In C*, composed in 1964, is a seminal work in both the Experimental and Minimalist music traditions that shares in the compositional approach discussed by Brown. The piece consists of 53 melodic phrases (or patterns) and can be performed by any number of players. The piece is notated, but was conceived with an improvisatory spirit that demands careful listening by all involved in the performance. Players are asked to perform each of the 53 phrases in order, but may advance at their own pace, repeating a phrase or resting between phrases as they see fit. Performers are asked to try to stay within two or three phrases of each other and should not fall too far behind or rush ahead of the rest of the group. An eighth note pulse played on the high C's of a piano or mallet instrument helps regulate the tempo, as it is essential to play each phrase in strict rhythm. [5][6]

The musical outcome of *In C* is a seething texture of melodic patterns in which phrases emerge, transform, and dissolve in a continuous organic process. Though the 53 patterns are prescribed, the choices made by individual musicians will inevitably vary, leading to an inimitable version of the piece every time it is performed. Riley's composition reflects the imperative of self-identification expressed by Brown, but it also illustrates some of John Cage's thoughts on Experimental music, when he writes that the "experiment" is essentially a composition where "the outcome of which is unknown." [7] In performance, *In C* has indefinite outcomes and yet is always recognizable as *In C* due to the "personality" of the composition—the patterns and performance directions that comprise the work.

## 2.2 Free Improvisation

There are links between Experimental music practice and improvisatory music. Free Improvisation is a good example of this. The genre took root in Europe in the early 1960s, with London, England serving as a major hub in its development. [3] This genre, in spite of labels and stereotypes, still involved elements of composition. One instance of this can be found in the coalescence of performing groups. In his essay "Les Instants Composés," Dan Warburton notes that "The majority of professional improvisers are choosy about who they play with...and tend to restrict themselves to their own personal repertoire of techniques." [8]

David Borgo, in a recent publication on music improvisation and complex systems [9], acknowledges that this characteristic in free improvisation praxis comprises an important aspect of the musical organization and composition in these performances.

Free improvised music depends upon some amount of organization, even if it is minimal. In musical situations where there is no preparation or discussion of musical intentions, an established rapport or relationship between performers serves as a kind of composition. This provides organization through familiarity and shared sensibilities. Borgo describes an improvising ensemble as an "open system" that emerges from bottom-up processes driven by players' relationships and interactions, their training, and environmental factors. Listening is also a huge factor because it regulates the dynamics of the performance. Players are constantly aware of their contributions as well as the contributions of others, and make split-second decisions based on the overall musical output of the group.

Composition in this genre can be more formalized as well. Saxophonist Steve Lacy talks very openly about how he uses composition as a means of mobilizing a performance and creating a musically fertile situation that can nurture an improvisational performance. He stated, "I'm attracted to improvisation because of something I value. That is a freshness, a certain quality, which can only be obtained through improvisation, something you cannot possibly get from writing. It is something to do with 'edge'. Always being on the brink of the unknown and being prepared for the leap. And when you go on out there you have all your years of preparation and all your sensibilities and your prepared means but it is a leap into the unknown. If through that leap you find something then it has a value which I don't think can be found in any other way. I place a higher value on that than on what you can prepare. But I am also hooked on what you can prepare, especially in the way that it can take you to the edge. What I write is to take you to the edge safely so that you can go on out there and find this other stuff." [3]

## 2.3 Game Pieces

A similar aesthetic is evident in John Zorn's compositional approach to his game pieces, which he considered as a later-day version of Riley's *In C*, "... something that is fun to play, relatively easy, written on one sheet of paper. Game pieces came about through improvising with other people, seeing that things I wanted to have happen weren't happening. [10] Zorn discusses the compositional direction he followed, "The game pieces worked because I was collaborating with improvisers who had developed very personal languages, and I could harness those languages in ways that made the players feel they were creating and participating. In these pieces, they were not being told what to *do*. You don't tell a great improviser what to *do*—they're going to get bored right away." [10]

In an interview with Christopher Cox, Zorn explains his rationale behind this position. He emphasizes how the individuality of the players he selected to perform the game pieces was an essential part of the compositional process, "I wanted to find something to harness the personal languages that the improvisers had developed on their own, languages that were so idiosyncratic as to be almost un-notate-able (to write it down would be to ruin it). The answer for me was to deal with *form* not with *content*, with *relationships* not with *sound*." [11] Zorn understood the musicians in his ensemble and knew what they were and were not interested in playing. He was able to situate their personal musical vocabularies in a larger structure that allowed for freedom and individual expression while also satisfying his own musical objectives.

## 2.4 Generative Music

Experimental music composition, and techniques or processes of composition found in various forms of improvised music are

similar to the work involved in modeling an emergent, self-organizing system. Generally, all involve a bottom-up structural approach that generates emergent dynamics through a lack of centralized control. The same can be said of generative music. Musician, composer, and visual artist Brian Eno has been working with a variety of generative structures throughout his career. He looks at works like *In C*, or anything where the composer makes no top-down directions, as precursors to generative music. In these works detailed directions are not provided. Instead there is “a set of conditions by which something will come into existence.” [12]

Eno’s influential Ambient recording *Music for Airports* was created using generative techniques [13]. Rather than deal directly with notes and form, generative composers create systems with musical potential. Eno refers to this as “...making seeds rather than forests,” and “...letting the forests grow themselves,” drawing on useful metaphors from arboriculture. An important aspect of this approach, however, is in setting constraints so that the generative system is able to produce what its creator (and hopefully others) will find to be interesting. In a recent conversation with Will Wright, the designer of *The Sims* and *SimCity*, Eno explains the reasoning behind this, “You have to care about your inputs and your systems a lot more since you aren’t designing the whole thing (you are not specifying in detail the whole thing) you’re making something that by definition is going to generate itself in a different way at different times.” [13]

These techniques—experimental, improvisatory, and generative—exhibit in their emergence a becoming. With each, the simple rules or relationships that form a composition act together and lead to unexpected, unpredictable, or novel results. Musical gestures show a ripple of promise, take ephemeral form, and then dissipate. Often this process requires a great investment of attention and time on the part of the listener. Time is especially important in Generative music, where the intentions are not to produce an immediate effect or shock of perception, but a gradual transformation as sounds are heard in the ebb and flow of the generative process. This quality of becoming can be similar to the emergence of a telematic environment or an experience with interactive art or media.

### 3 Contemporary related works

While a true blurring of composition and instrument has not been fully realized in contemporary practice there are a number of works that show the potential embedded in this approach. All examples discussed here demonstrate the latent quality of “composition-instrument” in the current art and media landscape. All of these works share three characteristics: asynchrony, emergence, and generative-ness. Asynchrony is a key factor in the processes of interaction. An input will have an affect on the output of the system, but it may not be immediately or fully apparent at the moment of interaction. While at first this approach may seem misleading or unresponsive, it is essential in shaping the music and the listening experience it creates. Whereas an immediate response would cause users to focus on functionality and “what it (the software/music) can do,” a delay—however slight—helps keep them focused on listening and allows for a more gradual and introspective process of discovery. Additionally, it retains the potential for musical surprise. Listeners know that the music is changing but they are unlikely to be able to anticipate the nature of its transformation.

Change occurs by way of interaction but also through various means of generation. All of the works discussed here contain, in

some way, generative processes that affect the sound as well as the visuals and overall experience of the piece. These processes occur in a variety of ways including telematic exchange, random ordering and selection, and computer algorithms. Depending upon the nature of the work, several generative processes may be used, each in a different way, leading to a unique experience for the end-user or listener.

As discussed earlier, emergence is an important quality heard in Experimental, free-improvised, and generative music. It is also a fundamental aspect of contemporary digital art works, and can arise from a variety of sources, “ordering itself from a multiplicity of chaotic interactions.” [14] The pieces discussed here are no exception. Whether through the layering of sonic and visual patterns, navigation of a data space, evolutionary algorithms, or telematic exchange, one cannot ignore the emergent properties that characterize these works.

#### 3.1 *Electroplankton*

*Electroplankton*, created for the Nintendo DS game system by Toshio Iwai, was released in Japan in 2005, and later in Europe and North America in 2006. Iwai writes that the idea draws on his fascination with different objects across the course of his life—a microscope, a tape recorder, a synthesizer, and the Nintendo Entertainment System (NES). [15] Some consider it a game; others a musical toy. Either way, *Electroplankton* captivates player and audience alike with its engaging use of sound and animation controlled via the touch-sensitive screen of the Nintendo DS device. Using a stylus, players are able to draw, twirl, tap, and sweep an array of animated plankton characters on the screen. There are ten different plankton “species;” each with its own sounds and sound-producing characteristics. Plankton and their behavior are linked to a pitched sound or a short recording made by the player using the device’s built-in microphone. Manipulating an individual plankton (or its environment) initiates a change in the sound(s) associated with it—a different pitch, timbre, rhythm, phrase length, and so on. As multiple plankton are manipulated, a shift in the overall sonic output of the system is apparent, causing the music of *Electroplankton* to produce textural patterns and foreground/background modulations similar to those of *In C* (as described earlier).

Interactions with the plankton turn the Nintendo DS into an instrument that can be played purposely through the manipulation of the onscreen animations. Simultaneously, the software programming that links sounds to the plankton and their environment represents a musical ordering, or composition that is implicit in *Electroplankton*. The coupling of these attributes perfectly illustrates how the combination or blurring of *composition* and *instrument* can lead to an interactive work with profound musical potential.

#### 3.2 Additional Examples

The musical qualities embedded in *Electroplankton* provide a clear—but not a sole—example of ways in which a composition-instrument approach is latent in contemporary games and digital art works. Following are several short descriptions of additional projects that share a similar musical sensibility. To retain the focus of this paper, lengthy discussions have been avoided. However, readers are encouraged to pursue further investigation into these projects beginning with the web sites provided here.

##### 3.2.1 *Rez*

*Rez*, designed by Tetsuya Mizuguchi for Sega Dreamcast and Sony Playstation 2, is described as a musical shooter game.

Players enter the cyber world of a sleeping computer network to destroy viruses and awaken the system. [16] Each successful shot leads to the performance of sounds and musical phrases that perform/compose the soundtrack for *Rez* in real-time as a direct result of the game play. Both the visual and audio experience leads players to feel an immersive, trance-like state that makes the game incredibly captivating. More information on *Rez* can be found at [www.sonicteam.com/rez](http://www.sonicteam.com/rez). Readers may also be interested to see other musically focused games that require physical or “twitch” skills such as *Amplitude*, *Band Brothers* (a.k.a. *Jam With the Band* or *Dai Gassou! Band Brothers*), *Dance Dance Revolution* (a.k.a. *Dancing Stage*), and *Guitar Hero*.

### 3.2.2 Eden

*Eden*, by Jon McCormack, is described as an “interactive, self-generating, artificial ecosystem.” [17] In more general terms, it is a generative installation artwork of sound, light and animation, driven by Artificial Life systems and environmental sensors. [18] *Eden* situates visitors in a room, standing outside the virtual ecosystem that is represented by a projected, cellular lattice in the room’s center. A visitor’s presence in the room can impact the ecosystem favorably. Someone standing in a particular location makes the adjacent space more fertile for the creatures, or “sonic agents,” that inhabit *Eden*. The lives of these creatures involve eating, mating, fighting, moving about the environment, and central to the musical character of the piece—singing. One way or another, all of these activities lead to both the visual and aural aspects that comprise the work. More information about *Eden* and McCormack’s publications can be found at [www.csse.monash.edu.au/~jonmc/projects/eden/eden.html](http://www.csse.monash.edu.au/~jonmc/projects/eden/eden.html).

### 3.2.3 Intelligent Street

*Intelligent Street* was a telematic sound installation where users could compose their sound environment through SMS messages sent via mobile phone. [19] The piece was developed in 2003 by Henrik Lörstad, Mark d’Inverno, and John Eacott, with help from the Ambigence Group. *Intelligent Street* was situated simultaneously at the University of Westminster, London and the Interactive Institute, Piteå, Sweden via live video connection. Users at either end of the connection were able to see and hear the results of their interactions. Using freely associated, non-musical terms such as “air” or “mellow,” participants sent an SMS message to *Intelligent Street*, and were able to hear how their contribution impacted the overall composition. [19] Simultaneously, all received messages were superimposed over the video feed to create a graphic representation of the audible sounds at any given time. *Intelligent Street* showed how music could be used to set the mood of a physical space through processes of cooperation and composition across groups of people in distributed environments. [20] Further information about *Intelligent Street* is available at John Eacott’s web site ([www.informal.org](http://www.informal.org)), Henrik Lörstad’s web site ([www.lorstad.se/Lorstad/musik.html](http://www.lorstad.se/Lorstad/musik.html)), and the Interactive Institute of Sweden ([www.tii.se/sonic.backup/intelligentstreet](http://www.tii.se/sonic.backup/intelligentstreet)).

### 3.2.4 PANSE

*PANSE*, or *Public Access Network Sound Engine*, is an open platform for the development of audio-visual netArt created by Palle Thayer. The project exists online as a streaming audio application, and consists of a synthesizer, two step sequencers, and an effects generator. [21] *PANSE* creates an opportunity for artists and musicians to create interfaces that control, or animations that are controlled by, the *PANSE* audio stream. Information about *PANSE* including technical specifics for connecting to the stream and interface authoring is online at <http://130.208.220.190/panse>.

## 4 The Composition-Instrument in Contemporary Projects

As stated earlier, a composition-instrument approach is latent in contemporary practice. There are many excellent projects where the seeds of this approach are visible but no single work has yet realized the full potential bound within the idea. Following is a discussion of projects that either seek to—or have great potential to—embody the composition-instrument approach.

### 4.1 Perturb as a Model of Interaction

*Perturb* is a project developed by the author in tandem with the research that helped inform this paper. It was created with the intent to provide a very basic and clear illustration of the composition-instrument idea. *Perturb* shows how music can be composed and performed in real-time via generative systems and user interaction.

The title was conceived by considering the nature of musical interaction in these works. Composition-instrument was initially defined as a work that can “play and be played,” and serves as a conceptual framework for music in interactive media and digital art. The concept strives to find a balance; neither the ability to “play” nor “be played” should dominate a user’s experience. If interactions are too direct (“be played” is too apparent), the piece becomes too much like an instrument and the significance of other aspects of the artwork can be diminished. Similarly, if an unresponsive musical environment obscures interactions and “play” dominates the experience, the work loses its novelty in being tied to the course of a user’s interaction. The composition-instrument approach permits equilibrium between these two and as a result, acknowledges user interactions as *perturbations* in the overall musical system. In this context a perturbation is understood as a ripple sent through the musical system due to an interaction. It does not take on the clear cause-effect nature of a musical instrument (press a key to hear a note, for example). Instead it allows interactions to manifest as sound, gradually following the course of the composition’s generative process. Perturbations introduce new sounds into the composition’s aural palette and can subtly reshape the musical character of the work.

As a basic illustration of the composition-instrument approach, *Perturb* consists solely of an interface for introducing perturbations into the musical system. It offers nine separate modules that can hold sound samples. Running alongside the nine modules is a generative musical system based on the Particle Swarm Optimization algorithm developed by Kennedy and Eberhart [22][23]. The swarm has nine agents that correspond to each of the nine sound modules of the interface. As the system runs, the dynamics of individual agents within the swarm send cue messages that tell a module to play one of its attached sound samples. Users have the ability to attach an array of preset sounds. Or they can attach sounds on an individual basis. Either way, when an agent sends a cue message to its sound module, a randomly selected sound from the module is heard. As all agents act together, the music of *Perturb* begins. Users can improvise within this structure (or perturb it) in several ways. They can use as many or few of the nine modules as they like, which results in thinning or thickening the musical texture. Users are also able to choose which sound(s) are attached to each module. They can draw from a preset database of sounds or use sound files they have created themselves. Any of these interactions—adding/removing sounds or modulating the sonic texture—allows the work to *be played*. Simultaneously, while following the generative structure directed by the swarm, the work is allowed to *play* on its own accord. The tension between interactive control and generative autonomy define the

nature of an interaction as a perturbation. User choices are recognized within a system, but are subject to the dynamics of that system before they can become manifest.

*Perturb* was created to demonstrate the musical and technical characteristics of a composition-instrument approach. The strength of the piece is in its musical expressiveness and flexibility, but it does not fully address the connection between music conceived in the composition-instrument approach and an interactive system or artwork. There are however other contemporary projects where the foundations of a substantial connection between music and interaction seem to be in the process of formation.

#### 4.2 *Spore*—The Potential of Becoming

*Spore*, the current project of game designer Will Wright, is a project where a composition-instrument approach could be fruitfully employed. *Spore* is slated for commercial release in the second-half of 2007 [24], which means that much of the argument offered here is speculative. Few details concerning *Spore*'s gameplay and features have been officially confirmed. However, there have been enough published articles, screen captures, and interviews with Wright to leave one with a good impression of the overall flavor of *Spore*.

In the game, players have the ability to design their own characters. These creatures can look like lizards, horses, trolls, or cutesy cartoons—whatever a player decides to create. One potential difficulty with this feature then becomes animating such an unpredictable variety of creatures. How can the game accurately simulate the motion of creatures that walk with tentacles, or creatures that have legs like waterfowl, or other exotic means of locomotion? This challenge presents one of the most promising aspects of *Spore*—the use of “procedurally generated content.” [24] [25] GameSpot news describes this as “content that’s created on the fly by the game in response to a few key decisions that players make, such as how they make their creatures look, walk, eat, and fight.” [24] The technology behind this aspect of *Spore* has not been revealed, but Wright describes it using an analogy: “think of it as sharing the DNA template of a creature while the game, like a womb, builds the ‘phenotypes’ of the animal, which represent a few megabytes of texturing, animation, etc.” [25] *Spore* also uses “content pollination” to complete the make-up of one player’s world using the assets of another player. [26] The basic sharing of resources is simple enough to grasp, but to be able to distribute these resources realistically and allow them to engage in believable interactions with another environment must involve a complex Artificial Life (or A-Life-like) system. If the world of *Spore* is to be a fluid ecosystem as promised, there will have to be some sort of self-organizing system or generative, non-linear dynamics that underlie the entire game and allow it to unfold in a natural, organic fashion.

The generative aspects of *Spore* (whether documented in an article or speculated here) show that it has, as a central component of its functionality, the ability to *become*. Wright has commented that at one point the game was titled “Sim Everything.” [26] [26] Most likely this is due to the ability of the game to become any kind of world the player/designer intends. This focus on customization of experience, growth, and becoming are what make *Spore* such an ideal environment for music. In addition to exploring (to name a few) the physical, dietary, and architectural possibilities of culture in this game environment, it would also be interesting to explore musical possibilities. What sounds resonate with a

particular species? What devices do they use to make music, and what is the sound of that music?

In a game of becoming like *Spore*, a composition-instrument approach would be very advantageous. Composition-instrument monitors interactions carefully and sees each as perturbation that will have a gradual consequence within the system where it is sensed. In the way that procedural content generation leads to a natural mode of locomotion for a creature, perturbations to the musical system lead to a natural development of sounds that define that creature and its culture. As creature and culture develop and evolve, the sounds and music that are part of their identity take on new forms and tonalities. The generative nature of *Spore* can help to sustain this development. The game maintains its own internal sense of progress and evolution as it grows new creatures, new landscapes, generates climates, and pollinates one world with the contents of another. This continuous process of generation provides the exact dynamics that enable a composition-instrument piece to play while a gamer’s interactions in the *Spore* world play music with it.

#### 5 Conclusion

A composition-instrument approach embodies qualities of music formally understood as “composed” and “improvised.” Works that use this idea are like generative music compositions in that they have their own internal order or organization. They are also like instruments in that they can be played, or performed-upon, and in the course of that performance, make an impact that modifies the character or course of the music outputted by the generative system. This “instrumentalization” allows for perturbations in the generative system and leads to an emergent becoming of music. When coupled with an interactive game system, the composition-instrument piece becomes a soundtrack that is both responsive to the game state and autonomous in its ability to adapt and develop relative to that state. This approach to music for games, or any sort of interactive digital system, hopes to open new opportunities for music in digital art and media, and to break down the linear models that have stifled creative progress in this area.

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