# SonicJumper composer

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## ABSTRACT

This document describes the implementation of the *SonicJumper* gestural controller bodysuit in a compositional context. It is a tool for generating musical materials, which are then used to compose a piece of music. The emphasis is on integration of gestural controllers at the earliest stage of the compositional process, rather than at the end. That is to say, the following discussion centers on controllers as a tool for creating musical material, and not as instruments for a performance. An effective compositional tool provides the composer with a manner of producing materials that have an inherent musical quality lending themselves to the formation of musical messages, which are then organized into a meaningful compositional whole. The author regularly incorporates the *SonicJumper* into his compositional process, generating materials for mixed works—compositions for ensemble and electronics.

## Keywords

composition, process, materials, gesture, controller, cross-modal interaction

## 1. INTRODUCTION

There has been a strong push to extend musicians' potential for musical expression, via gestural controller technology. Amazingly, this propulsion has lead to a wealth of new research linking musical expression to such things as: new instrument design and control; redefining performance practice; gesture analysis and classification; gestural acquisition; music cognition and other branches of psychology. At the same time, the ultimate question still remains unanswered: Can gestural controllers be successfully woven into a musical fabric, such that the technological aspect is far less significant than the overall musical experience? Moreover, might the inclusion of gestural controller technology into a musical domain lead us to a new Art form? These questions highlight the author's principal focus. He postulates that the answers lie in our ability to create a musical whole. That is to say, electroacoustic elements and human expression are integrated—creating a musical whole—if they are perceived as inextricable. A successful composition, including work in other Art forms, is one in which the artist unifies materials. Materials are all aspects of a work that are cognitively perceptible. In particular, the manner in which materials are created, must be directly linked to their final presentation. This is obvious to a great extent in the visual Arts. Most music is also generated with clear evidence concerning its impetus—often drawn from codified stencils dictating formal design and pitch logic. The inclusion of technology into a musical work, however, creates a number of dilemmas surrounding the initial generation of materials. The immediacy at which technology so readily gives us an 'output' does not often encourage an exploration into where the output comes from or how it is generated. This potentially drives a wedge between the materials of the work and the composition's final form: its presentation in the context of a public performance. If a 'whole' musical experience is to be created, the technological aspect must be a part of work's initial development. It is the objective of this document to identify how the *SonicJumper* generates material in the earliest stage of composing, unifying the piece right from the get-go.



## 2. MALLEABLE GESTURAL CONTROLLER

### 2.1 Components

Four accelerometers (± 2 G.), five potentiometers (measuring bend from 0° to 130°), one infrared proximity sensor (80 cm.) and an orientation sensor (360°) sense body movement. Voltage values from these sensors are converted to MIDI. Max/MSP interprets and maps sensor data, controlling digital signal processing. The sensors are held in place using various types of sport braces—stretchable bands of fabric that comfortably fit around the body and do not limit movement. The voltage to MIDI convertor rests in a belt pouch along with its portable power supply. One long MIDI cable connects the convertor to a computer. Sensor placement is somewhat different for each project. It is for this reason that the jumper is considered a malleable controller—it shapes itself according to the movement requirements of each project. [1]

### 2.2 Synthesis Engine

Data from sensors are sent to Max/MSP, for digital signal processing. The sensors are not transmitting "one-off" triggers; rather, they are sending variable signals in real-time. The Max patch is based on *granularized*, by les & zoax, in which a signal "scrubs" through a buffer~ object at a user-defined rate. [2] Common effects associated with granular synthesis are achieved (i.e. time and pitch scaling). In addition, the Max patch is expanded to include various filtering objects, which are used to balance signal output—as opposed to creating effects such as chorus and delay. The engine is not necessarily meant to produce a specific style of composition. It is not meant to generate, say, 12-tone music or formulaic commercial music. The aim is to tap into the composer's expressiveness in a manner that is impossible with more traditional compositional tools (i.e. piano), and to offer users a sound palette that is representative of the wide-open sound world of electronics—both mimetic and abstract.

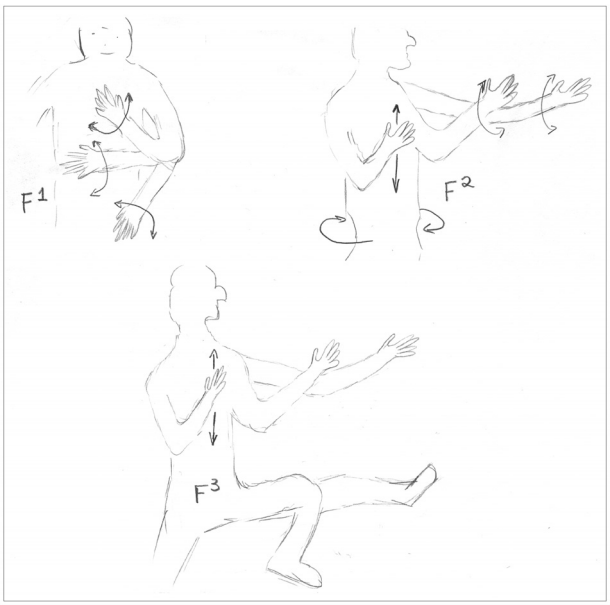


**Figure 1. The first three feints.**

## 2.3 Mapping the Movement Repertoire

Sparring rationale is used to develop the movement repertoire and sensor to signal processing mapping. In this way, the *SonicJumper* is a symbolic immersive controller. [3] There are five movement categories representing the tools of combat: feinting; drawing; leading; infighting; parrying. Figure 1 shows the first three feints. Each category contains a collection of precise coordinated head, arm, hand, torso, etc., movements —organized according to the expanse of the gesture (see Table 1). In total, there are 18 distinct movements. Mapping is derived to suit the movement repertoire. That is to say, instead of tailoring the repertoire to a fixed, rigid association to sensor data, mappings vary for each movement. For instance, the subtle action of the first feint (F1) only entails mapping the scrub start and end position (within buffer~) to left hand rotation and left elbow bend, respectively. On the other hand, the second feint (F2) entails a more complex mapping: start position to right elbow bend; end position to left elbow bend; lower limit of pitch-scaling to left hand rotation; upper limit of pitch-scaling to proximity of hand(s) to chest. For the most part, mapping is one to one, with a few examples of divergent mapping. For instance, the first parry (P1) involves a subtle rotation of the head. In this case, data from the orientation sensor is mapped to almost all granularization parameters.

# 3. SONIC-JUMPING

## 3.1 Cyclic Relationship

The core concept behind sonic-jumping is cross-modal interaction. The composer is spurred on—in particular, by aural and proprioceptive stimuli—to digest and produce sound in a cyclic manner. One can conceptualize the 'path of sound' as: out of an electronic system - into the human physiological system - returning to the electronic system. For example, an electronic sound is produced by a computer. Then, the ears receive the sound. A meaningful message is perceived (through cross-modal sensory data). Next, a movement impulse is manifested. The computer interprets user movement (via a gestural controller bodysuit). Movement data generates an electronic sound. For the most part, a composer's manipulation, or directing, of sound in this fashion, is unconscious. They do not naturally analyze the gestures they make in relation to aural stimuli.

## 3.2 Sound Movement Combinations

A work of Art conveys a message that is more or less clear, based on the way the message's meaning is distilled, generally speaking. Messages are anything that have either abstract or literal meaning for the onlooker. The aspiration of any artist is to provide clarity so that an audience can extract and refine messages. Providing clarity in a piece of music can be particularly difficult, because musical sounds are ephemeral. That is to say, music is a time-based Art form, with sounds only occupying enough time for them to be heard. A sound does not rest in one place, as a painting hangs on the wall for the duration of its exposition. The *SonicJumper* approach to creating clarity involves attaching a gestural component to each sound, or a sound to each gesture (refer to Cyclic Relationship, above). For the composer, the invention of a movement element gives new meaning to the sound / movement combination. The composer gradually establishes a somatic relationship between the two. This is followed by the formation of musical messages as the composer organizes somatic meaning. The suggestion here is that by infusing musical

**Table 1. Five movement categories showing minute movements to expanded movement from top to bottom.**

Expanse

minute

↕

expanded

| Feint | Draw | Lead | Infighting | Parry |
|---|---|---|---|---|
| F1 - subtle | D1 - subtle | | | P1 - subconscious, self-preserving |
| F2 - false start, stunted | D2 - deceptive, with purpose | | | |
| F3 - deceptive, with purpose | D3 - luring, enticing | | I1 - reactive | |
| F4 - reactive | D4 - expressive, engaging | L1 - expressive, engaging | I2 - expressive, engaging | P2 - evasive, escaping, disengaging |
| | D5 - impressive, refined | L2 - assertive, direct | | P3 - impressive, refined |
| | D6 - demonstrative, exaggerated | L3 - demonstrative, exaggerated | | |

materials with a somatic significance, at the earliest stage of composition, the composer creates repercussions for the presentation of the work, in front of an audience. They also create structural threads that are used to make the piece of music a unified whole. The notion of music combined with movement, or visa versa, is currently under investigation; and results are far from conclusive. In explaining the origins of somatic meaning, while sonic-jumping, this author favors one of the oldest investigations in experimental psychology concerning the nature of cross-modal sensory interactions—the degree to which information from one sensory channel influences our interpretation of information arising through other sensory channels. [4] Cross-domain mappings, enable us to perceive intensity, spatial location, tempo and rhythmic structure in an amodal manner. These abilities, moreover, appear to be innate or develop early and rapidly in human development (Lewkowicz, 2000). [5] There are other plausible explanations explaining our propensity to combine sound and movement. One could begin with a Darwinian perspective, which suggests that our internal sense of self-motion may have evolved in early hominids to deal with sounds in the environment. [6] We could also consider artistic emotion and expression. Davies (1994), suggested emotions are presented directly in the musical work through dynamic parallels to human movement, behavior, physiognomy, the human voice, gait and the like. [7] It is likely that all of the above viewpoints play a role in establishing meaning in sound / movement combinations. It is not the objective of this paper to establish which opinion is accurate; rather, the author wants to acknowledge the inextricable relationship between sound and movement, and state that this association is an intrinsic element of the *SonicJumper*.

## 3.3 Generating and Saving Musical Materials

Composers use different terminology to explain the earliest activity leading to an original work. Some may refer to a formulaic approach. Others might describe a rigorous pre-compositional process. Yet, other composers talk about the fruits of noodling on the piano, or improvising. What is happening, at this early stage, is the initial concretization of creative thought in the form of musical materials. The result is often a manuscript of some sort. Rigorous planning—much formulaic designing—goes into establishing the "voice" and "action" of the *SonicJumper*, before beginning to generate materials. Voice is akin to the controller's synthesis engine, while action is a result of mapping. Once voice and action are established, the user produces and digests sound in the manner described above, making decisions on-the-fly based on musical intelligence and intuition. The Max/MSP patch records both voice and action data, using a standard audio file format. In this way, the sounds of the voice are audio files, while action data more resembles a wavetable—one for each sensor output. One consequence of recording action data, is that the user is able to take "snapshots" of a particular movement. Then, the data can be used to duplicate signal processing (i.e. granular synthesis) on several different audio files, without the user having to set up the *SonicJumper* controller. This is comparable to transforming themes and harmonies via a 12-tone row table. The voice data—actual audio files—is transcribed into traditional musical notation either using the composer's ear or via computer-assisted compositional software (i.e. AudioSculpt by Niels Bogaards and others; OpenMusic by Gérard Assayag and Carlos Agon). It would be interesting to draw a comparison to other modes of composing. In some respects, *SonicJumper* composing is not far removed from traditional approaches, such as working out material while sitting at the piano.

# 4. CASE STUDY

In the fall of 2005, D. Andrew Stewart was commissioned to create a work for the Dutch ROSA Ensemble—tenor saxophone; electric guitar; bass guitar; piano; percussion; processed audio and live-audio streaming. Musical material for both pitch organization and processed audio was generated with the *SonicJumper*—based on sampled audio from early 1970s funk music. The composer set himself the task of 'entering' the SOUND WORLD of funk music, without necessarily evoking the funk idiom. It is important to point out that entering the funk sound took place at the earliest stage of composition (generating materials with the *SonicJumper*). The performances of the work remained in a similar sound world. The result, therefore, was a piece of music with a sense of whole, from it's inception to its realization.

# 5. CONCLUSION

There is no greater joy during the compositional process than to realize you have successfully captured what is in your head, in your ear or that which your creative spirit compels you to say. Indeed, composers make great effort over an entire lifetime—often unsuccessfully—to manifest their true musical thoughts in an aural form. The challenge is immense; many fail because there is no exact music to capture an artist's thought or feeling. On the other hand, we find ourselves in a unique position of being able to seize certain modes of communication, for the first time. Technology that can catch, examine and reproduce gesture brings us a few steps closer to tapping into learned and unconscious behaviour. If a composer is willing to use technology, there is a strong argument for the use of gestural acquisition for communicating creative thought; or at least, one is able to examine the relationship between gesture and creative impulse. In the early days of analog studio composition, Hugh LeCaine describes an interaction where the studio composer has intimate control of the musical outcome—the composer is closer to sound. [8] The *SonicJumper* reexamines the notion of proximity. Not only does the jumper bring its user nearer to a desired sonic result, it also allows for immediate realization of the creative impulse. If one could derive a maxim concerning gesture and creativity, the statement would go far in forwarding the idea that gestural controllers can be successfully woven into a musical fabric, such that the technological aspect is far less significant than the overall musical experience.

# 6. REFERENCES


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