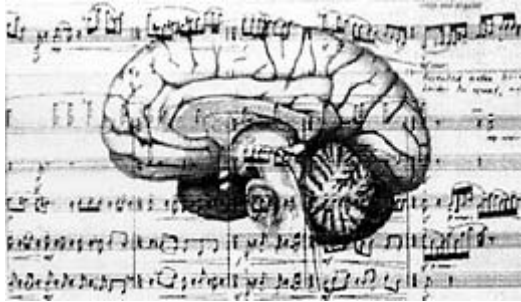# The Brain Opera and Active Music
# Tod Machover/MIT Media Lab





Brain Opera, Melody



Brain Opera, Harmony 3

Photos: MIT Media Lab

Thirty years ago, the great pianist and essayist Glenn Gould published an article on the future of music recording [*High Fidelity*, April 1966] in which he said: "In the best of all possible worlds, art would be unnecessary. Its offer of restorative, placative therapy would go begging a patient. The professional specialization involved in its making would be presumption …The audience would be the artist and their life would be art."

As someone with many of the usual "professional" music credentials, I was surprised on rediscovering Gould's article recently that my own work in music and technology has evolved in exactly this direction. In fact, I now believe that the highest priority for the coming decade or two is to create musical experiences and environments that open doors of expression and creation to anyone, anywhere, anytime. To accomplish this without producing numbing background music — but music that enhances the senses and stimulates the mind — is the real trick! I believe that such "active music" could be one of our most powerful tools for discovering the unity and coherence that underlies the chaos and complexity of everyday life.

My view of technology has always been that it should respond to human intentions, rather than simulate or replace them, and I started developing hyperinstruments at the MIT Media

Lab in 1985 towards this end. The first generation of hyperinstruments was designed for virtuosic professional musicians, such as Yo-Yo Ma. These hyperinstruments measured many nuances of performance expression, using this information to enhance and expand the instruments' capabilities. Starting in 1991, we began building hyperinstruments for non-professional music lovers. Our Joystick Music system allows a piece of music to be steered, modified, and shaped by manipulating two videogame joysticks. A Sensor Chair, designed for magicians Penn & Teller, uses an invisible electric field to detect body motion and turn it into sound. Such instruments are easy to learn but difficult to master, with enough depth to make them worth practising and exploring.

For the past two years we have been working on one of our largest projects yet, the *Brain Opera*, in which the audience — live and via the Internet — is involved in contributing to, performing, and helping to create the piece itself. A maze of specially designed hyperinstruments lets people play with different aspects of music [*Rhythm Tree, Harmonic Driving, Gesture Wall, Melody Easel*, etc.], before attending a performance where a complete version of the piece will incorporate the sounds and music they have just created.

The interactive experiences in the *Brain Opera* lobby are:

* 12 *Speaking Trees*: talk to Marvin Minsky; record voice with thoughts, memories, reactions to text and images about the music, mind, emotion and memory. These speaking samples are immediately incorporated into performances.

* 3 *SingingTrees*: Sing a simple note into a microphone; music is generated to create an "aura" around your voice; "purity" & "calm" of voice is measured to influence result. Singing voices of audience are recorded, and experience is expanded in Performance.

* *Rhythm Tree* [320 pads, 10-50 players]: Multiple pads. Percussion plus voice samples, making rhythms and words. Collective behavior is measured.

* *Melody Easel* [3]: Draw melodies with finger. Timbre, articulation, and embellishment changed with slightest movement. Data collected; melodies are core melodic fragments from composed *Brain Opera*.

* *Harmonic Driving* [3]: Like video driving game, except that core composition is changed depending on how you "drive" through it. Harmony, structure, articulation [as well as visuals] all controlled by steering and tilting.

* *Gesture Wall* [6 players]: Quite improvisatory; control musical timbre and "word painting" with core words taken from Minsky texts.

In these experiences, as well as in various parts of the *Brain Opera* website, the goal is not just to have audience members contribute musical sounds or spoken text, thoughts, memories, or favorite songs, but to prompt a reflection on the significance and deeper meaning of each. In this integration of diverse sonic sources, the attempt is to present an exploration of how our minds turn fragmented experience into coherent views of the world.

If the interactive lobby experience is fragmented, marked by an individual journey through a dense barrage of seemingly unrelated impressions and experiences [whose similarity emerges with familiarity], then each Performance of the *Brain Opera* in the adjacent theater is an attempt to create a new kind of balance between the ordered complexity of Bach and the

exuberant chaos of Cage, with a touch of *The Beatles*' youthful energy [early Beatles, that is!] thrown into the mix. The audience will be right in the middle of this search, making the artistic experience more palpable and visceral to each active person, while underlining the collaborative, collective nature of the project as a whole.

The Performance itself, "mediated" by three trained performers playing specially designed hyperinstruments [Sensor Chair, Standing Chair, Digital Baton], is organized into three uninterrupted movements, as follows:

**Movement 1**

* Great deal of Performance freedom and difference from one "show" to the next;
* Sounds come mostly from "real life" with voice, and collected sounds and "favorite repertoire" music;
* This is the part that most incorporates sample material from live audience that has been collected;
* There is a general progression during this section from word-to-sound-to-music; from everyday life to transformed experience; from free association to more structured;
* There is a thread of Minsky text/voice that ties this section together;
* Concentration of samples from live audience, which is the focus;
* Some of the textures are precomposed; as is some music … but lots of room for modification and change due to actual sounds/samples received and chosen.

**Movement 2**

* Uses very few samples;
* Rather incorporates and coheres musical fragments heard and played within the lobby experiences;
* Music mostly composed ahead of time with different degrees of freedom for each section;
* One continuous arc of music, getting faster and faster;
* Lots of melodies, some with words, some without; text, when there is, from Minsky;
* Each section is connected with one of the lobby experiences;
* Great "interpretative" variety by three performers, but music itself does not vary much.

**Movement 3**

* Starts with "big bang" as Internet players control and improve by way they manipulate online instruments;
* Internet players are soloists here;
* Then Finale, where all elements are brought together: basic composition of mine; Internet performers shape texture; samples brought back; live audience movement on *Sensing Carpet* [with additional Doppler Radar] modifies;
* Surprising synthesis, and collaboration of forces.

These Final Performances are one of the unique aspects of the *Brain Opera*. Although I know of many experiments to incorporate audience response or contribution to musical environments [Gehlhaar, Rokeby, Dolby, Rundgren, and others], I don't really know of anything else so far that tries to be a real "piece", that is a coherent artistic experience that adds up to something more than the sum of its parts. I have tried to build a structure that lets people play with the individual elements of the music, get to know them, add to them, and then see the fragments fit together like a giant puzzle.

In fact, there is actually quite a lot of precomposed music in the *Brain Opera*. The music for the *Melody Easel* and *Harmonic Driving* is all composed, but modifiable by the audience. The *Gesture Wall, Rhythm Tree,* and *Singing Trees* are more like improvisation systems, where we set up the sounds and limits, and design the playability of the system, but do not determine the actual music that can be played. For the *Speaking Trees*, we send out precomposed stimuli; the responses which are recorded are completely up to the audience members.

In the Performance, Movement 1 is the most improvisational: my composition is like a piece of swiss cheese with lots of holes — some music and continuity there, but lots of room for new sounds, thoughts, texts, etc.

Movement 2 is completely composed, with lots of room for interpretation.

Movement 3 is a mix, where I have composed the basic elements, but have left room for all sorts of other ingredients to be added, modified, mixed, leading to wildly different versions of the piece. If I had to quantify, I'd say that 60% of the music is composed or carefully planned, while 40% is open to vast differences [in material or structure] from performance to performance.

The more important fact is that the way that precomposed and new material is combined varies from section to section, and there are actually at least twenty different models in the *Brain Opera* of how pre-existing music and audience/performer modification can be combined. We use these different models not just because we don't know which is best [although with a radical project on this large scale, we actually don't!], but because each has a different feel to it; a sense of continuity and progression is created through the variety of these models themselves. In fact, this methodology of formal construction has been an integral part of the way I compose for many years now [at least since my IRCAM days starting in 1978].

Central to the *Brain Opera* idea is the work of Marvin Minsky, a colleague of mine at the MIT Media Lab, and someone I have known since my student days at Juilliard in the mid 1970's. Although there are obvious similarities to be found on every level of the *Brain Opera* to Minsky's philosophy of mind — and indeed the "libretto" of the opera is taken from interviews I have done with him over the past two years — the connection to Minsky is deeper and more subtle than that. Marvin Minsky is the first person I ever met who dared to ask questions about music so basic that they seemed naive, yet so perceptive that no one has yet answered them. Why do we like music? Why do we spend so much time with an activity that has little or no practical benefit? Why does music make us feel? And think? And are feeling and thinking the same? Is music the activity that most deeply unifies our complex selves?

With Minsky, such questions lead to a whirlwind of speculations about where music comes from and what it tells about us as human beings.

Perhaps music is one of our capacities acquired latest in evolution, and so is "messiest," having had to share its footprint with numerous mental agents already entrenched. Perhaps because of this, music has no brain center all its own, but rather touches a very large number of other mental functions ["gut" feeling, storytelling, mathematics, movement, speech processing, etc.] and somehow synthesizes them. Perhaps music allows us to experiment with thinking, in a liberated fashion because the results of such "musical thinking" have no repercussions in the "real world." Perhaps — as John Cage might have said — music is a way

of preparing our minds and our personalities — to finally throw away music altogether and experience the world directly.

We have designed our *Brain Opera* experiences to stimulate audiences to reflect on such questions, and on how the independent fragments and layers of music come together to form complex yet unified sonic images. And one of our deepest hopes for the *Brain Opera* is that it will encourage people to be excited by their own minds, and by the desire to "look inside and hear what is going on" [Minsky].

It is this kind of audience involvement — not the mere manipulation of our hyperinstruments — that makes the *Brain Opera* truly an "opera." Although the work does not have a linear narrative, which I have avoided at every step of the design process, it certainly has LOTS of voices — professional and amateur, singing and speaking, individual and communal — and the whole texture is actually very vocal, even "operatic." More significantly, the *Brain Opera* does have a significant dramatic progression, which is the voyage of each audience member through the maze of fragments, thoughts and memories, to collective and coherent experience. Just the process of understanding the scenario of each instrument — how it is played and what it means — and seeing how these turn into full musical structures in the performance, is a very rich and involving story in itself.

Although the *Brain Opera* is a natural progression from my work of the past five years, and even from earlier work such as VALIS, there are some particular preoccupations that have driven me to create this piece. First, I do think it is important at the present time to make a strong statement about the possibility of involving general, non-specialized audiences actively in artistic experiences, and that this need not be just a tentaive, flakey experiment, but can be a powerful, involving, and complete artistic work. Such models will lead to more knowledgeable, responsive and sensitive listeners, which will be good for everyone. Second, I have been obsessed for years with the theme of how unity and coherence emerge [or are seized by us] from the complexity and chaos of the world around us, and the *Brain Opera* treats this theme on a large scale. Third, I have long wanted to make a work which shows the world something about the new culture which the MIT Media Lab is trying to forge, where art/science/cognition/theory really are starting to blend into something different. This feeling will, I think, be tangible to anyone who walks into the *Brain Opera*.

And last, one of my strongest desires in this project has been to ask a lot of questions to which we don't have answers, in the hope that not only will the piece turn out to be something beyond what we can now imagine, but also that many new horizons will be opened for us.

It is hard to foresee what we will learn from watching audiences experience the *Brain Opera*, and what paths will seem best to pursue afterwards. But I predict that we will go even further towards the vision expressed by Glenn Gould in his 1966 article. I imagine musical instruments built into our environments — our furniture, clothing, walls, handheld objects — that will project our conscious and unconscious intentions onto our surroundings. A concert then would not be a special occasion but always around us, meaningful sound responding to our subtle commands, mirroring our attitudes, enhancing our actions at some moments, providing counterpoint or contradiction at others. Perhaps five or ten years down the line we will have developed a "Home Opera," designed to be experienced in the place where one is most comfortable, completely vivid and theatrical, yet personalized for and by each individual.

Gould went even further, predicting that "in the electronic age the art of music will become much more viably a part of our lives, much less an ornament to them, and that it will consequently change them much more profoundly." Our goal is to figure out how — in technological, musical, and human terms — to turn Gould's fabulous vision into reality.

In the meantime, I'll content myself with John Cage's statement: "You can think of a piece of music as a representation of a society in which you would be willing to live." Marvin Minsky's "Society of Mind" is such a model for future human society [and not just of the mind], and my hope is that the *Brain Opera* will give audiences at least a glimpse of this beautiful and stimulating possibility.