

The Experience of Teaching and Collaborating with a Young Composer in the Creation of an Electro-acoustic Piece

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Abstract

This paper describes the aesthetic and technical characteristics as well as the process of creating the interactive piece *Gestures*. This piece was written for two trumpets, two violas, two trombones, double bass, and six electronic devices called "Shapers." The Shapers were designed to be played by children with or without musical training. *Gestures*, which was performed as part of the *Toy Symphony* concerts in April and May of 2003, is the result of a close collaboration between Natasha Sinha, a 12-year-old nationally recognized composer and the co-author.

First the *Toy Symphony* project (including its technical challenges and pedagogic features) is described. The characteristics of *Gestures* are then described; finally, the compositional process and the experience of working in collaboration with Natasha Sinha are discussed.

1 Toy Symphony

Toy Symphony, a project directed and developed by Tod Machover and the Opera of the Future Group at the MIT Media Laboratory, is an educational project that employs new technologies as a vehicle to teach music to children of different ages and different levels of musical skill. As of September 2003, Toy Symphony has toured in Berlin, Dublin, Glasgow, Boston, and New York. In each city, the first stage of the project consists of workshops and open-house sessions where children and audience members are able to try out a variety of *Music Toys*-specially designed hardware and software, such as Shapers, used by children to perform and compose music. This week-long series of intensive workshops is followed by a final orchestra concert where children involved in the workshops perform with professional musicians using the Music Toys.

2 Shapers

Shapers (Weinberg, Orth, and Russo 2000) are MIDI devices developed at the Opera of the Future Group mainly by Roberto Aimi, Margaret Orth and Gil Weinberg. They are soft, spherical musical instruments made of a squeezable material, five inches in diameter, covered with bright fabric, and decorated with attractive embroidery. By squeezing the instrument with both hands, children can alter sounds in a way that allows them to access high-level musical parameters such as contour, timbre, density, and structure. The Shapers have a plastic "nucleus" in the center that contains a small

speaker (not utilized in *Gestures*) and a PIC microcontroller chip. This chip is used to make the analog to digital conversion of the pressure applied to the Shaper. The outer shell of the nucleus has four separate plates of copper film that is covered by a layer of foam, giving the instrument a spongy consistency. Around the foam, directly underneath the fabric cover, is a strip of copper, uniformly distributed around the "equator" of the sphere. Each of the inner copper plates is connected to one pin of the microcontroller. The instrument sends four MIDI pitch bend values according to how much each area is being pressed. The microcontroller is programmed to measure the time constant of the capacitance of each plate, determined by how near or far the outer copper strip is to each inner plate. The value of the discharge time is converted into a digital value and codified as a MIDI pitch bend value. The mapping of these values to musical ideas such as contour, timbre, density, and structure is produced by MAX/MSP (Zicarelli 1998) software running on a Macintosh.



Figure 1, Shaper

The Shapers have been used in different roles in two pieces. In *Nature Suite* by Jean-Pascal Beintus, the Shapers are employed to play different sound effects corresponding to different seasons of the year.

The Shapers are versatile instruments that can be programmed to control a diverse spectrum of musical elements. In *Gestures* the idea was to use the instrument in a context that better exploited its malleable and gestural nature.

3 Characteristics of the piece

Gestures is intended to be a piece where children could collaborate without been worried about technical issues with professional musicians in a performance setting. Children would not only learn and realize the importance of listening carefully to other players during a performance but also become conscious of how their own decisions could influence the general evolution of the musical material. The piece was inspired in this way, at least in its conception, by Luigi Nono's *La Lontanaza nostalgica utopica futura* for violin and eight audio channels. From Nono's work originated the idea to compose a work where musical thoughts were only suggested and where volume and sound density were never going to exceed the threshold of the semi-darkness and distance.

Gestures is a five-minute piece composed by Natasha Sinha, a 13-year-old composer, and the co-author. It was originally conceived for six shapers, two trumpets, two violas, trombone, bassoon, and double bass. However, due to acoustic and logistical reasons, the bassoon was replaced by a second trombone. Since the six Shapers were supposed to be played by children without musical training, we didn't want to create a score that specified when or what they had to play. We wanted to create an acoustic experience where children were free to play whatever and whenever they wanted without any constraints during the entire piece. However there were some options and rules all the performers, children included, had to respect in order to allow the piece to flow smoothly and maintain a coherent structure even with the freedom of the Shaper parts. After the initial trials with children, we realized that total freedom for children so young (6-7 years old) was unrealistic for the amount rehearsal time we would have for the piece. In addition the score was more complex to coordinate than expected. For these reasons we decided to create a score where Shaper parts were described as opposed to completely undirected. Furthermore we decided to use a conductor to coordinate the acoustic and Shaper players.

For the performance, Shaper players are located on stage in a single row with the double bass in the middle. The rest of the acoustic instruments are arranged in the audience space in a pre-established configuration. As the performance of the piece progresses, the musicians move around following fixed routes defined in the score. The hall must be dimmed enough to leave the off-stage musicians in semi-darkness, and the stage must be illuminated but not too bright to the point of breaking the atmosphere of the hall.

Although double bass was not conceived as a solo instrument, it is naturally highlighted due to its fixed onstage presence. The sounds produced by the Shapers are electronic variations of acoustic instruments used in the piece. These variations, realized in the studio, are traditional processes such as reverb, delay, flange, granular synthesis, pitch-shifting, time stretching, etc. Two Shapers produce electronic variations of trumpet sounds, two others produce viola sounds, and the last two produce trombone sounds. During the performance these sounds are morphed in real time according to how there are squeezed by the children. Amplitude, density, and quality of the texture (more or less dense) are some of the parameters children may manipulate with the Shapers.

Collaborating with a young composer

Natasha Sinha was invited to collaborate in the Toy Symphony project in November 2002. Natasha was a 12-year-old composer who started playing the piano at age 5 and composing at age 7. She has won prestigious awards such as the Warner Brothers/MTNA National Award, ASCAP Foundation Morton Gould Young Composers National Award for three years, etc. and now has a considerable creative output that includes solo pieces and music for small and large ensembles, all of them written in traditional forms using established techniques; it is important to note that none of her pieces prior to the collaboration employed electronics.

The main task of this pedagogical project was to teach Natasha new perspectives and techniques-both acoustic and electronic-without dampening the freshness of her perspective. During the first meetings the author realized that although Natasha had had many years of musical training and guidance, she had not been exposed to electronic contemporary music.

The first sessions and initial exercises

We spent a few sessions listening and commenting on pieces composed by interesting contemporary composers that had some bearing on the project. The listening sessions were always done with the score in hand because notation was an important issue we had to deal with. Of particular interest were Berio's *Secuencias* for trombone, viola, and voice and Luigi Nono's *Lontanaza nostalgica utopica futura*. Berio's piece presented an extraordinary exploration of extended instrumental techniques and methods of notating them. Nono's piece offered an original solution to the interaction of acoustics and electronics. We also examined other composers because of their historic relevance or because they had works related to our exploration; Ligeti, Stockhausen, Subotnick, Nancarrow, Xenakis were some of the composers studied.

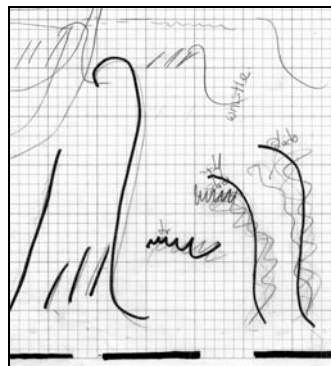


Figure 2: sketch of an "audio gesture"

The listening sessions were complemented with different kinds of sound explorations, most of them vocal experiments. Exercises of "vocal imitation" were induced by questions such as: "Please recreate with your voice the sounds that are in your room just before you go to bed" or "What is the soundscape of your kitchen at breakfast time?" Natasha would first recreate the various sounds in the environment described. The author would then ask her to focus attention on one particular sound, for example: "Can you reproduce with more detail the sounds of the

blender?” or “Can you layer this blender sound? How does it change when you speed it up? What does the movement of the blades sound like? What do the tomatoes sounds like while being chopped? How does the sound change as they liquefy?” We did additional experiments where we were not worried about the precision of the exact reproduction but used the question as a pretext for generating and developing abstract sounds. These “acoustic fantasies” were induced by questions such as “Sing the sound of the red color, then change it to blue gradually” or “What’s the sound of a sunflower?”

The co-author also wanted Natasha to seriously question the paradigm of music notation. The co-author’s opinion is that traditional music notation-despite its long history and evolution-is just a low-resolution guide that requires a trained person not only to perform what’s written in the score but to provide an interpretation for what’s omitted. However, the exploration of new musical notation systems is not a new field and it is possible for individual composers to come up with their own solutions. However, in working with Natasha, the co-author didn’t want to suggest solutions that twentieth-century composers had developed as part of the general evolution of standard notation. The author wanted her think through the problem and come up with her own ideas through personal experimentation.

In one of our “vocal imitation” exercises the co-author asked Natasha to write down what she had previously sung. It was the imitation of a bunch of keys; her vocal performance was interesting and filled with delicate details. She took out some staff paper, drew the clef and the bar lines, and started to write down quarter notes and eighth notes. Her inability to use a different kind of notation system, more appropriate to the sounds she was producing, was not result of inaptitude, but rather the way she conceived the musical process and the way music has been taught to her.

In addition, Natasha was asked to notate pieces written by other composer which either had no score (were purely electronic) or had a nontraditional score (e.g. music by Jonty Harrison, Subotnick, and Berio). Once Natasha realized the difficulty of employing traditional notation, she discovered many interesting, personal, diverse, and original methods of notation. Sometimes she used colors, sometimes lines and curves; sometimes she used the x-axis for temporal evolution and sometimes she avoided this convention. She distinguished between layers, phrases, and directions, and all these elements were in one way or another represented in the drawings.

Form and instrumentation

It’s important to note that one main interest Natasha and the co-author had when writing the piece was the exploration of spatialized sound. The intention of exploring “surround” sound was the main factor in defining the form, structure, and instrumentation of the piece. For technical reasons spatialization was not implemented for the Shapers-this effect is created only by the acoustic instruments. The excellent sound projection, ample dynamic range, and easy portability (i.e. it’s possible to walk while) made brass instruments the best candidates for spatialization. Mobility was the reason for choosing two trumpets and two trombones. Later we decided to complement the ensemble with instruments that would enrich the sound palette. In spite of the difference in dynamic range we decided to use two violas and one double bass. The

double bass would be the only instrument on stage and would play a distinguish role during the piece not only because of its fixed location but also because of its low pitch range.

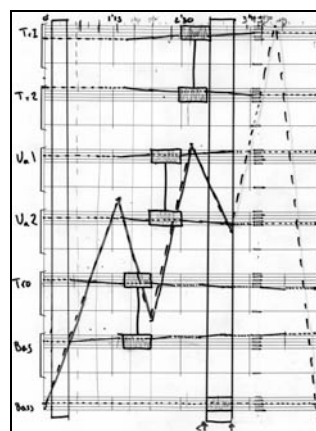


Figure 3, sketch of form and musicians’s displacement.

Seven acoustic instruments and six shapers seemed to be a manageable and balanced ensemble to work with. We started to work on the main shape of the piece. We wanted musicians to walk around the hall in a way similar to the displacement of musicians used in Xenakis’ *Persephassa*. We sketched routes that were interesting, surprising, and balanced. On these “maps” we defined moments where musicians should stand at fixed points reading the score and also moments where musicians should be walking while they improvised within some constrains such as: “While walking to point B, improvise based on the sounds that the other acoustic instruments are playing.” The flow of when and which musicians were walking and improvising carefully defined the structure of the piece.

Writing the main graphic score

The next step was the formalization of a notation system that would allow us to preserve the freedom of the earlier experimental attempts while also to be able to understand the evolution and form of the piece. We reduced our variables for sound manipulation to the following categories: general pitch range, dynamic intensity, density of orchestration, and speed of event changes. We decided to graph these parameters using a well known system. On a long roll of paper where the x-axis was time and the y-axis the value of the parameter, we drew one color-coded line for each parameter. Based on our map of the instrumentalists’ physical movements, we created regions and transitions for each parameter. These values-only one for the entire acoustic ensemble-represented the combination or sum of the individual values for each instrument.

Several discussion sessions were necessary in order to complete this graph, from which the individual instrumental parts would later be derived. Shapers were not included in the graph because of the free-form improvisatory nature of their parts. The intent was for the children to respond to what they were hearing in the score in an unscripted way.

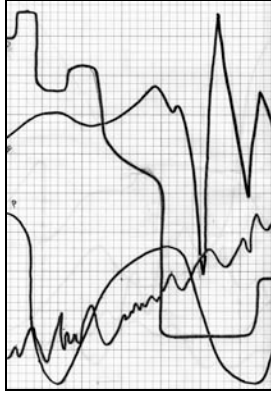


Figure 4: Fragment of the graphical score showing the four parameters.

Creating the individual scores

Once we had finished the graphical score, we had to find a way to derive the individual parts. We approached this problem by improvising with our voices based on the score. Using a multi-track recorder, we created an audio rendition of the piece; we first started with a vocal imitation of the bass part, then layered the other parts on top of it. We recorded them in pairs: trombones first, trumpets next, and violas last. The technique of recording pairs of similar instruments together—each improviser on a different channel—was particularly interesting because it allowed us to create contrapuntal and imitative interactions between the instrumental lines.

Listening, muting, redoing and rerecording material was an extremely natural and intuitive method for modeling and shaping the piece. During the improvisation we didn't worry about intonation or pitch registers because we only wanted to indicate the gestures, motivic relationships, and motivic evolution.

When we finished the improvisation it was necessary to transcribe this vocal version into individual scores for each instrument. We decided to employ proportional notation where the length of a line that extends from a note indicates its duration. The slope of a line would mean a gradual change in pitch (glissando). The frequency resolution employed for all the instruments was a quartertone and the dynamic range was *pppp* to *ffff*.

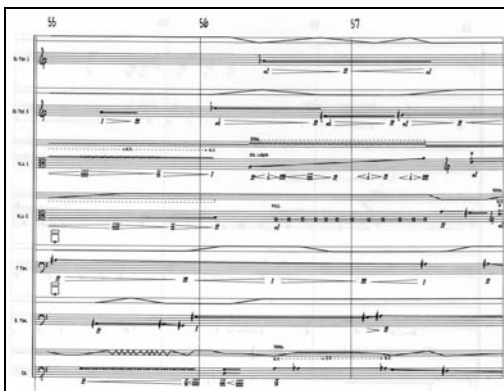


Figure 5, fragment of score

During the transcription process, the ranges and physical possibilities of each instrument were studied in order to decide the final pitches. However the intentions and gestures of the vocal version were preserved as much as possible. The process of listening to the vocal recording carefully, adjusting and deciding the pitches and timbral effects (e.g. muting, string techniques, amount of vibrato, etc.) took several sessions. Nevertheless we ended up with a score that preserved much of the original intentions and acoustic ideas.

The Shapers

The realization of the electronic parts of the piece was done in parallel to the development of the acoustic sections. At first we weren't sure how to relate the acoustic instruments with the Shapers. After analyzing different possibilities we decided to implement electronic variations of the sounds produced by the acoustic instruments. We individually recorded members of the MIT Symphony Orchestra and asked them to play an extensive range of sounds. In addition to recording normal notes and scales at different pitches and intensities, we asked the musicians to make an exploration of instrumental techniques such as flutter tonguing, glissandos, harmonics, multiphonics, noise, etc. The trombone player, for example, suggested putting water in his instrument; the double bass player created interesting glissando improvisations; the trumpet player developed surprising rhythmic patterns. All of this material would be the basis from which electronic textures would be derived.

When the recording sessions were finished, we started the procedure of manipulating and processing the sounds. Natasha didn't know anything about digital audio processing, therefore this task was realized slowly, requiring the co-author to explain basic concepts and techniques. The different techniques employed included time stretching and reversing, pitch shifting; convolving and mixing sounds, adding reverb, flangers, and delays; special emphasis was placed on granular synthesis.

Once we had the source material for the Shapers, we needed to develop some interesting strategy for how the children would use them. We developed a system with MAX/MSP where the children could manipulate the sounds in a free-form, intuitive manner without altering the structure of the piece. The process of implementing the MAX patch was also slow because Natasha didn't know the basics of the programming language.

In an initial version, the system allowed the children to modify an extended set of parameters with a wide range of variation—intensity, pitch, and reverberation among others. However during one workshop at the Boston Children's Museum, we realized that in order to clarify the interactions and procedures we had to limit and reduce these ranges and parameters. We also observed that our initial intention of giving children total freedom in playing whenever and whatever they wanted was hard to accomplish in a few rehearsals. We decided to create another version with a more rigid structure and fewer Shaper parameters (limited to pitch and intensity). In this version the sounds produced by the Shapers depend on the current section in the piece. In order to facilitate this, a very simple score indicating sections to was added. The changes of sound were

performed by a person sitting at the computer and following the score. These modifications gave the piece a more stable structure without completely eliminating the free style of the first version. Although the Shaper parts were simple, a conductor was still required to guide the children. The addition of the conductor was extremely helpful because he also helped to synchronize the musicians.

The performances in Boston and New York

The piece was finished in April of 2003. The first performance was on April 26 at Kresge Auditorium at MIT, and the second performance was on May 17 at the Winter Garden/World Financial Center in New York. The musicians were members of the Boston Modern Orchestra Project (BMOP), an orchestra specializing in contemporary music, conducted by Gil Rose. The six children for the Boston performance were selected from workshops which took place at the Children's Museum, and the six children for the New York Performance were selected from public schools in Manhattan. Their ages in both cases were between 6 and 8.

The preparatory workshops for both concerts were similar. Four one-and-a-half hour sessions with children and mentors preceded the rehearsals with the orchestra musicians. Kevin Jennings (director of pedagogy for the Toy Symphony project) led the workshops; he taught the children how to use the Shapers, how to follow the conductor, and how to play the instruments in an expressive way. Emphasis was placed on how they needed to listen and respond to other players. Gil Rose conducted the final workshop in order to familiarize the children with his presence. There were two rehearsals without the children and finally one dress rehearsal. The performances of the piece ran smoothly and there were no technological difficulties.

Conclusion

The importance of this project, independent from the final acoustic result, was the learning process experienced by Natasha during the months we both worked together. Finding a balance between teaching her diverse techniques, tools and concepts and preserving her personal ideas and acoustic imagination was a delicate balance. The co-author tried to limit himself to being a guide for Natasha's own exploration. Suggesting, proposing, showing possibilities and options, discussing and arguing, comparing situations and giving examples, listening to previous works and teaching the principles that give substance to the digital technologies was the principles on which the piece was built. In this way, the principal goal of the project was reached successfully.

However we both felt that there were some elements that didn't work as well. The piece fails on the level of musical direction and discourse. The notation, which was intended to simplify the performance, became a difficulty for the ensemble, and there were problems with dynamic balance between brass, strings, and electronic instruments. Another problem was the lack of experience in creating music on the part of the young children. Some pedagogical elements were also not completely controlled or investigated.

The principal value of the project was the collaboration with Natasha. The author wonders if this experience is or is not the first time that a child has composed a piece for electronics and ensemble.

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Hugo Solís García (1976, México City) is a graduate student at the MIT Media Lab, in Tod Machover's Opera of the Future group. He studied piano, composition and music technology at the UNAM in Mexico City, with Alejandro Escuer, Mauricio Nader, Tere Frenk, Salvador Rodriguez, Eva del Carmen Medina, Andrés Acosta among others, and also studied computer music with Nick Didkovsky at NYU. While at university, Mr. Solís was a member of the Laboratory of Music Creation directed by Julio Estrada. He has played piano and electronics throughout Mexico and has collaborated in many interdisciplinary projects in conjunction with dancers, painters, filmmakers and radio-artists. Mr. Solís's interests in technology and improvisatory music inspired him to found the NICROM Trío, an interdisciplinary ensemble of electro-acoustic improvisatory music with action painting. He has received grants from the FONCA, the UNAM and TELMEX.

Natasha Sinha (1990, Boston) started playing piano at age 5 and composing at age 7. She has won several national awards for music and is also a four-time winner of the prestigious ASCAP Morton Gould Young Composers Award (including this year), and was the award's youngest recipient. She has been featured as "One of America's Most Amazing Kids" in *Rosie's magazine*, *Symphony magazine*, and several other national and International newspapers. Ms. Sinha's work has started to be performed in various East Coast, and Mid-West venues. In addition, in 1999 she founded the "Share the Music" program with a local hospital to increase the awareness of the important role music plays in health. Ms. Sinha is also interested in LEGO and robotics, and her invention—a collaborative project, "The Animal Feeder", was recently published by Addison Wesley's "Creative Projects with LEGO Mindstorms" by Ben Erwin. Seymour Papert, the founder of MIT has written a foreword for this book. Natasha Sinha is currently a 7th grade student at a private school in the Boston area.