

The Making of a Multimedia Rhapsody for Helmholtz

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Introduction

This paper documents the collaborative composition between the authors, that derives from an analysis of Hermann Helmholtz's work, in which instrumental, esthetical, theoretical, physical, and physiological information was extracted, in order to compose a musical piece and exhibition dedicated to his bicentennial. Helmholtz's main music-related book "On the Sensations of Tone" [1], is the prime source of a multimedia rhapsody, still under construction, that combines instruments and devices employed by Helmholtz to elucidate the various phenomena, such as consonance, dissonance, beats, combinational tones, the structure of natural and cultural scales and temperaments, sound illusions, synthesis of vowels, investigation of timbre, among others.

The background entails a historical panorama on the music theory in Europe – from the medieval Guido d'Arezzo and Franco of Cologne to the contemporaries of Helmholtz, Guido Adler, and Carl Stumpf [2]. With the help of the biographical data available [3], we try to gather and extrapolate the sounding and musical universe of Helmholtz, in addition to relevant facts of his personal and academic life, comprising important moments of the musical, cultural and political world. A complete framework of theoretical and practical elements are being gathered, serving as inspirational material for the Multimedia Rhapsody for Helmholtz, and also for the education and debate on Helmholtz's legacy in music and science.

Inspiration

In spite of Helmholtz's immense contribution to the theory of music, to music acoustics and to music perception, and the development of a close friendship with great composers and soloists, there is not a single musical or artistic work dedicated to him. The event of Helmholtz Bicentennial is another major reason for this homage.

Helmholtz grew up in an artistic and intellectual environment. His broad interests in geometry, physics, music, and philosophy, bring many rich elements for this multimedia creation.

His book *On the Sensations of Tone* can be regarded as a "patchwork" of different and complementary outlooks to the matters of music, being one of the first modern books with a transdisciplinary approach in history. The term 'rhapsody' means, in Greek, the stitching of several poems, making a full recital. This justifies the title of our composition.

One of Helmholtz's favorite masterpieces was the *Coriolan Overture* by Beethoven [4]. This piece has been chosen with its intervals, melodies, and motifs, to underline the whole Rhapsody. It can be regarded both as tragic and triumphant. Therefore, the rhapsody is meant to be performed as a prelude or an introduction to Beethoven's piece, ideally

being performed by an orchestra. The authors also conceived a reduced instrumental version of the *Coriolan Overture* for a woodwind quintet, a string quintet (with double bass) and a pair of timpani.



Figure 1: The cavity resonator, a tool developed, studied and abundantly employed by Helmholtz in his lab. There are several instruments that are based on the resonator, together with others that are being created by the authors and collaborators. They will be used in the Rhapsody, with conventional instruments.

In our conception for the performance, the conductor for the *Coriolan Overture* is also the percussionist, who will combine his conducting gestures with the playing of the two timpani. More than a musician, this artist will also embody the tragic character of *Coriolan* himself.

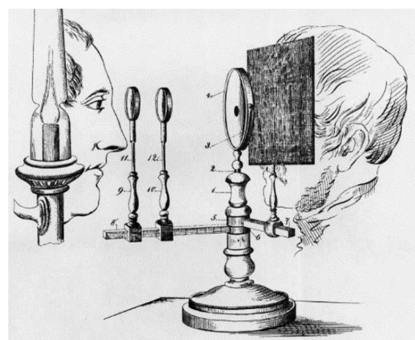


Figure 2: The ophthalmoscope, a device that permits the examination of the retina and structures of the eye, was invented by the young Helmholtz in 1851. We intend to explore the visual possibilities brought by the ophthalmoscope, including the real-time inspection of some artists' eyes during the performance.

This masterpiece, that has a duration of between five and nine minutes, depending on the tempo adopted by the conductor, was composed in 1807 by Beethoven to be performed in the tragedy written in 1804 by Heinrich Joseph von Collin. The play is about the semi-legendary character who was a military Roman hero, turned into a betrayer of the Empire. The music is related to the moment when Coriolan is at the brink of attacking Rome with his soldiers, but is stopped by his family, that supplicates him not to take forward his plans. Eventually, he will give in his mother and wife's plead, however committing suicide. This short piece offers a rich spectrum of musical and human emotions, tempi and dynamic levels. Also, the succession of chords and musical solos from the string and wind instruments, provide a very convenient opportunity for exploring contrastant intervals (consonant and dissonant ones) and temperaments.

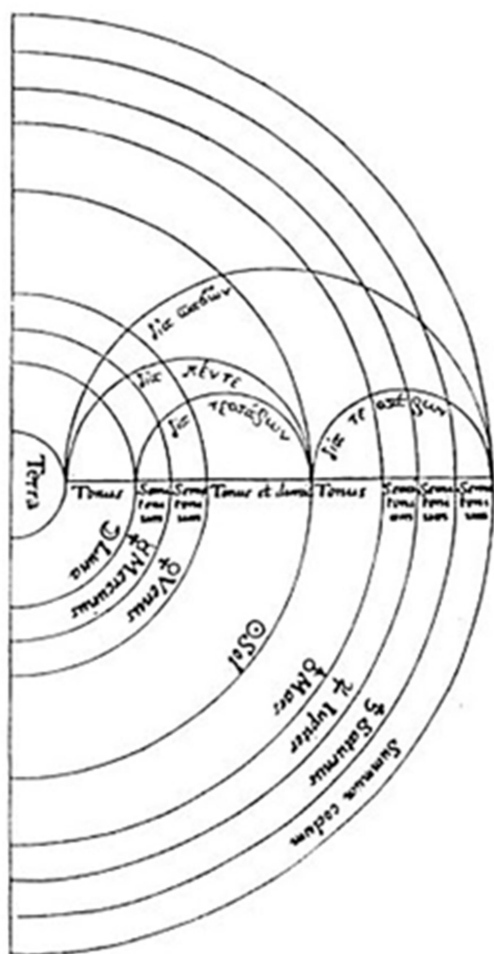


Figure 3: A diagram of the Music of the Spheres, as depicted by Stanley (1701) [5], attributed to Pythagoras and other Greek philosophers. The planets of the cosmological system are supposedly gravitating around the Earth, with a perfectly synchronized configuration, consisting of integer periods, and generating a universal sound (Musica Universalis). Helmholtz mentions this concept in his work, relating it to the harmonic series.



Figure 4: The first bars of the Coriolan Overture, by Beethoven. These dramatic and explosive chords, as other parts of the piece, will be explored in the Rhapsody, as thematic cells, with the use of temperaments belonging to different systems, such as pure intonation and equal-temperament.

Wagner wrote in 1952 a program note that starts with the following words about the Coriolan Overture [6]:

“This relatively little known work of the great tone poet is nonetheless one of his most significant creations, and no one intimately familiar with the object it represents will fail to come away from a good performance deeply moved. I therefore permit myself to describe here this object just as I hear it represented by the tone poet himself, so as to assist sympathetic listeners in enjoying the same sublime pleasure I do when hearing this piece. I may assume general knowledge of Coriolanus: a character of limitless power, incapable of cowardly hypocrisy. For that very reason he finds himself banished from his native city, and in league with its enemies in their attempt to destroy it, until he is moved by the pleas of mother, wife, and child to renounce this vengeance, only to be condemned to death for this betrayal of his erstwhile comrades.”

Helmholtz established a rather close relationship with Richard Wagner, who attended the recitals and events promoted by Anna Helmholtz in Berlin, deeply respected his scientific knowledge and was aware about the transdisciplinary work that he had developed in building bridges between music and science.

Interestingly, Helmholtz – who was regarded as one of the greatest German scientists in the 19th century – would be accused of being a betrayer himself, some decades after his death, during the Nazi regime, when some members, such as the infamous physicist Ludwig Glaser, connected to the National Socialist party, claimed that Helmholtz was one of the creators of the so-called “Jewish Physics”, something that obviously never really existed.

Max Planck, Helmholtz's most famous student, would suffer during his late years a fierce political persecution and the terrible loss of his beloved son Erwin, due to his political activities against the Third Reich. Erwin was accused of being part of a frustrated plot to kill Hitler. On the other hand, Planck was an accomplished musician, with high piano playing skills, having a very special sense of hearing, including absolute pitch. After the death of Helmholtz, Planck was the main organizer of musical sessions that would place together brilliant scientists and musicians.

Helmholtz was a friend of the great piano maker Theodore Steinweg. In several occasions, Helmholtz would provide acoustical consultancy to Steinweg, visiting his factory in

Berlin and offering some solutions for technical problems on the pianos.

This relationship among master and pupil, Hermann Helmholtz and Max Planck, and being music lovers, inspired the authors to write a movement called Max und Hermann, during which they have a verbal and musical conversation about life, music, acoustics and physics.

Movements

The **Rhasody for Helmholtz** consists of five movements, that can be described as follows:

1. Music of the Spheres - a kinetic installation with several flying resonators, in the shape of the planets, making a full orbital and sounding system. The Coriolan Overture by Beethoven begins to be presented, through subtle elements of its musical structure. (Duration ca. 2 minutes.)
2. The Idyll of Helmholtz - his happy childhood, with many sound-producing toys and other elaborated devices, such spinning tops, whistles, wheels, geometric solids, siren discs, and other ludic objects. The light theme, that refers in Coriolan Overture to the voice of the mother and wife of the Roman hero, is replicated and extended to symbolize this period from Helmholtz life (Duration ca. 2 minutes.)
3. Augenblick - the invention of the Ophthalmoscope, the large eyeball is brought to the scene and moves around the stage and over the audience conducted by a simple drone. The performer's eyes are observed by digital ophthalmoscopes and the images are projected on the screen. Laser beams and other light effects are directed to the eyes, creating patterns to appear on the screen, such as Lissajous curves and Chladni patterns. The music encompasses acoustical, electronic, and noise materials, from Coriolan elements (Duration ca. 2 minutes.)
4. Max und Hermann - a musical dialogue between master Helmholtz and his pupil Planck about music, absolute pitch, relativity, quantum physics, education, and their children, with their happy and tragic life stories. We employ several techniques such as Sprechgesang, serial music, and modal elements, based on the patterns of the Coriolan Overture. The whole conversation takes place around a Steinway piano, to which Helmholtz collaborated, that is occasionally played by both characters. (Duration ca. 4 minutes.)
5. Die Tonempfindungen - a sound performance with the Helmholtzian instruments and several others that were studied by him and mentioned in his book. Here the Coriolan Overture themes are clearly enunciated by the performers, however in a rather experimental and apparently random order. The finale brings the extinction of all sounds and approaches the beginning of Beethoven's masterpiece. (Duration ca. 3 minutes.)

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