

## **Digital Lutherie and Digital Sound Sculptures**

### **In the Context of Sound Plasticity**

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#### **Abstract**

At the beginnings of the 20th Century, Luigi Russolo, with his “Intonarumories,” gave one of the rather early definitions of the Sound Sculptures, and strengthened it by The Art of Noises—one of the first and most durable manifesti of the field. In parallel with this, there happened a cognitive revolution by the “Ready Mades” by Duchamp, a workfield opening up huge possibilities for new dimensions in plastic arts. In addition to this, dadaist works, including those of Duchamp, such as “Sculpture Musicale,” “With Hidden Noise,” have been inspiring in the rise of the concepts “sound sculpture” and “sound object.” In accordance with the requirements of the time and the developing technologies, the boundaries of music and works of sound have been expanded, and the concept of sound object has brought in new dimensions to the field upon Pierre Schaeffer’s ‘Musique Concrète.’ The 4’33” breakthrough of John Cage and the revolutionary works of Edgard Varèse, especially their early exemplars of electronic music have resulted in the scrutinizes of the very concept of sound. The contemporary artists have concentrated more on sound and this resulted in the emergence of “Sound Art” after 1960 as a pure, independent art form, and particularly the studies on sound regarding the technological developments from the 80’s to the day have brought new dimensions to that conception. As to the lutherie, a profession which is constantly developing in relation to sound art, a respective process is in question—the object of design becomes moreover digitalized, similar to the other plastic art forms. Within the slope of the 21st century, the enhanced works of sound art, and sound sculptures as well, get their self-share from this drastic change, and find their places in several digital media. At the same time, the paths of sound sculpture and lutherie are crossing over, and it is becoming harder to define the boundaries of those two. The music—or better: the audial design—of the age, and the creative tools and methods used by/for it; its crossings and interferences with other digital arts/platforms and media organs

make it even more difficult. Within the context of the plasticity of sound, on the other hand, the sound—overshadowed by visual and plastics arts for a long time—has now begun to be represented with the elements of digital design to a far broader scene. In this study, digital lutherie and the representative examples of sound sculpture; the relationship between design elements and plasticity of sound will be scrutinized.

## Introduction

While sound progresses with relation to music and other art forms, it has been shaped in accordance with the experiences of human beings and the aesthetic values of the era it belongs to. The human being who has sought to imitate the sounds of nature and discover new sounds has designed the songs, dances, and the instruments in favor of protection and spiritual practices. The human being, who is a designer, has developed the definition and plastic values of sound and music in accordance with their desires and needs throughout history. And by continuing their musical discoveries, has never given up seeking new sounds. While music has been shaped in parallel with the aesthetic values of the era, the instruments have also undergone transformations in accordance with this change. Whilst several musical genres have emerged through new instruments, the human being, who chases different sounds and timbre with the new instruments, has intensified their relationship with sound.

The technologies and studies on sound, which were rather slowly progressing until the 19th century, have hastened within (19th) century. Through the studies whose foci are sound, acoustics and psychoacoustics, in cognitive and conceptual contexts there have been considerable developments. The most important advancement in the (19th century) is a recording dated by Edouard Leon Scott de Martinville as April 9, 1860, a French folk song called “Au Clair de la Lune” [1]. This recording which is distinctive as being the first recording of the time is a messenger of the revolution that is about to take place in the following century. Hence, the sound becoming recordable and replayable would essentially alter the conception of sound and music. In conjunction with this, while (the habits (and novelties) introduced by the mechanization of the 19th century to the daily life), crowded urban life and its unusual sounds and the concept of “noise” was pushing people towards a chaotic lifestyle, people were also pushed to rethink about sound.

By the 20th century, Luigi Russolo, one of the pioneers of futurists in plastic arts, who especially focus on speed, sound, and movement, has given one of the most important propositions of the era. With his musical instruments (Intonarumori) and by giving one of the preliminary definitions of Sound Art and Sound Sculpture, Russolo has consolidated this with “The Art of Noise” which is considered to be one of the founding works in the field [2]. In line with this, Marcel Duchamp’s Dadaist works “With Hidden Noise”, “Sculpture Musicale”, in between 1912 and 1916, are distinctive in being the first works where the concept of Sound Object is used in. These works are inspiring in terms of early sound and music definitions before concepts such as Sound Art and Sound Sculpture. Through the needs of the era and the developing technologies, the boundaries of music and artistic sound studies have been widened,

and with the “Musique Concrete” of Pierre Schaeffer, beyond sound and place, the concept of Ready Made has widened the boundaries of perception of sound. Furthermore, John Cage’s 4’33” and Edgard Varèse’s early exemplars of electronic music have brought new dimensions to the concept of sound.

It is a well-known fact that the more and more accelerating life structure of the 20th century, which is much more dense and gapless when compared to the previous centuries, has brought about changes worth a-five-centuries-period. Again, the artistic works and manifesti of the futurists, and the kinetic art movement, arising in parallel of these at the beginning of this century, provided new dimensions to the plastic arts. And an art form that is focused on sound and movement has begun to give its preliminary exemplars.

In this study digital lutherie and digital sound sculpture will be under investigation, which are the subbranches of sound art and lutherie, shaped by the multidisciplinary understanding of the 20th and 21st centuries. The concept of sound sculpture has started to grow mature in the last century and has been spreading over a wide area. And it is sometimes difficult to determine with its boundaries with experimental musical instruments, in fact, has a half-century history with this name. When the old technologies are concerned, it is very difficult to distinguish those two closely related fields, which have gained different dimensions due to the technological developments of the last centuries (especially after the invention of electricity.) However, it is not possible to disregard the fact that the foundations of sound art are formed by the fields of sound sculpture and musical instruments. Those interdependent fields are being digitalized as the time goes by, and at the last stage of music and sound studies, concepts such as digital sculpture and digital lutherie, which provide their early works, can be encountered frequently. It is not always possible to make a distinction between the method and appearance of sound production being used, and especially the experimental musical instruments and sound sculptures of the previous centuries. In this sense, the luthier, whose material is the sound and aim is a sound design, is important in providing early sound propositions, and in being inspirational for the early developments of sound art. Though the term luthier, the builder, and designer of musical instruments, is applied only to the producer of stringed and bowed instruments due to a conceptual confusion, the term, in fact, encompasses all instrument production, including experimental instrument production. However, experimental instruments within the scope of this field are examined under a different group in order not to create confusion.

While the plasticity of sound and music is concerned in relation to time and place, the transformation of the concept of plasticity to a raw material of sound design manipulates our perception in audiovisual terms. The fact that the sound art, which is in a constant relation with the plastic arts, has a wide perspective and has remained untouched in comparison to other art forms, attracted the attention of other art forms within today’s multidisciplinary understanding of art, and this area has been used frequently because of its richness in expression and the background it creates. (Nevertheless, the sound is still an unknown to us since the studies done in this field

grounded the unreachable character of the sound in terms of what is visual.) The sound is a marvel that human beings have been trying to make sense for thousands of years, in obscurity and fear. Sometimes along thunder, sometimes along the rustle of leaves, the flow of a waterfall or river, waves crashing into the rocks, or the eruption of volcanoes and many other natural phenomena, the sound has been a wonder-inducing mystery for human beings. (At first, the human being who had begun to experience the sounds of nature, began to imitate sounds and animals in nature, and in parallel, the sound has begun to be used as a means of communication.) (Sound has remained as a sacred mystery during the long period where it could not be defined, it has stood for what is sacred and invisible.) The human being who has discovered rhythm and melody used sound to reach a state of trance and strengthen their spiritual rites. Beginning with more routine rhythms and effective sounds without a specific understanding of tone and harmony, this process, which started with rituals of magic and worship, has evolved into an artistic dimension over the centuries. The sound, which gained different meanings in different periods, is now one of the basic materials of design. And undoubtedly, the most artificial material that has gained much more importance than the sound itself is silence. Sound and silence, during the undulating process between the two, create an aura, and this aura with its density, whether we are aware of it or not, manipulates our affections and by doing so makes us a vibrating part of it. The effect of sound on our affections and thoughts is a well-known fact, and this effect of sound has been noticed, experienced, and used for various purposes. And the most well-known design of sound is music. As Ahmet Say states [3];

*“The human being, who is considered to have a history of two hundred million years, is born into a sound universe, is intertwined with the universe of sound and interacts constantly with the sounds it perceives. The human being, who is a bio-psychic, cultural and social organism, has been analyzing and evaluating the sounds he has perceived since ages and transforming the sounds into a form of narration. This narrative art with sounds is called music.”*

In this context, we can interpret music as a pattern of organized sound formation within a period of time whose material is sound and silence. Furthermore, from a cultural and social aspect, we can conceive music as a means of cultural communication which forms a strong bond between humans. However, the sound is more than these; it is also an instrument of design. The effect of deliberately chosen and organized sounds in a musical piece is due to the sound mass that the composer discovered and inspired in. Each and every sound that is discovered means a new narration and emotional richness, and it is an obligation to not limit sound with music but to treat it with a broader perspective.

Generally, the sound has been overshadowed when its relationship with the art forms other than music is concerned. Especially, while in plastic arts other design elements have continued to develop for centuries, the sound has remained as a representative of the skies, nature, spiritual and divine, its development had been

much slower than that of the visual arts. Perceptually, the sound has transferred its effects to the other art forms where it had crossed with them and has been perceived as a plastic factor. On this account, it has been overshadowed by the visual arts. Nevertheless, where our life is built upon what is visual is in the foreground of the structure of life, this fact is not a very surprising one. The effort of humanity to depict what is invisible has been realized by what is visual, what one had experienced more than sound, and to depict what is abstract by likening it to what is concrete has been limited, shaped with the boundaries of language and visual perception. For this reason, sound and music have been plasticized consciously or unconsciously from the beginning, and are characterized by plastic elements.

Sound sculptures on the idea of a predetermined sound proposition or sound often create a plasticized element in the audiovisual relationship.

The sound is a complementary element in the shadow of plastic arts. At the beginning of the 21st century, where every aspect of life is becoming digitalized as time goes by, in order to reflect their age art and design update their language and material. Although the artistic sound works emerge as sound art especially after the 1960s, since then the borders of sound art and other branches of art cannot be clearly determined.

With the development of digital audio technologies and becoming an indispensable element of the new sensory media, sound, that was used to plasticize ideas (as a side element), has become an indispensable element in determining the design, not only a complementary element. And conversely, digital resources have become a determining element of sound.

If we both look at digital lutherie and the development of digital sound sculptures, the movement of "piezo music" plays a crucial role in the development of these areas. Nicolas Collins, in his *"Handmade Electronic Music: The Art of Hardware Hacking"*, defines Davies as the first pioneers of "piezo music" [5]:

*"In the aftermath of Cage's 'Cartridge Music,' many sound artists sought affordable techniques for amplifying mechanical vibration and microscopic sounds. Since the mid-1970s the Proliferation of 'Piezo Disk' in beeping appliances has effectively put contact mikes within Reach of anyone with a soldering iron... The disks have insinuated themselves into surprisingly diverse corners of our recorded soundscape, and have given rise to a genre of 'Piezo Music' Hugh Davis (1943-2004) (UK) and Richard Lerman (USA) were two of the earliest innovators. Davies began inventing piezo-amplified instruments in the 1970s."*

Piezo first emerged in 1880 by Pierre Curie and Jacques Curie. The effect of piezo-electric is a reversible one, on the one hand, when force is applied to a material that is piezo-electric it is able to produce currency, on the other hand when the same

material is electrified there happens a mechanical motion in the material. Further, piezoceramic, which can be used for the same purposes as the piezo crystal, was developed in the 1940s and it has become widespread. After piezo became common in electronic, it was not only used with those experimental instruments, but also used with the standardized instruments such as guitar and bass guitar, and is still being used.

This important invention and the midi technologies, which later gained importance in the process from analog to digital, have hastened the developments in musical equipment technologies. The increase in computer usage has brought about the midi technologies, and by laptops falling into the hands of the younger generation music has become codable and programmable. A new era started with the development of various coding languages and interfaces. A new era started with the development of various coding languages and interfaces.

## Digital Lutherie

Digital lutherie and digital instrument design is an extensive subject, including the technologies such as electronic, sensor technology, sound synthesis, data processing, programming, and the humane disciplines such as psychology, physiology, ergonomics and the like.

Digital lutherie, which has emerged with the development of sound technologies and the facilitation of novel possibilities to music, has started to hasten with the recent technology. At first, digital lutherie has evolved as an experimental field under the heading of music technologies, and later with the development of electronic music and its growth as a major industry, digital lutherie has become a discipline in itself as a branch of instrument technologies. Huguette Davies (1943-2005) and Sergi Jordà (1961-) greatly contributed to the definition of the field.

As Mooney points out, Davies has been the pioneer of this field and the younger generation, with "do it yourself" and "lo-fi approach" trends and works on his laptop. His instrument-building practice can be defined as an intersecting point in the boundaries of avant-garde music, improvisation, lutherie, and sound sculpture. Davies improvised his experimental work with a laptop (by coding) and opened the doors to an entirely new world. Davies performed this innovative music practice by presenting the live screen performance of the computer screen by projecting the computer screen to the audience with video projection. Thus, the viewer was able to monitor the influence of a written code of music.

Sergi Jordà, in his thesis, supports the use of the laptop as a musical instrument with the following excerpt;

*"When asked what musical instrument they play, few computer musicians respond spontaneously with I play the computer. Why not?" [6].*

Musical instruments are more than a machine, they are energy transformation devices which have a meaningful end. Designers of the new musical instruments can only partially be responsible for the development of music. When designing new instruments, they cannot limit their designs with sonic abilities and algorithms. Furthermore, they must consider the conceptual aspects of those instruments and how they are imposing or suggesting new ideas to the performers. The designers must also consider new ways to establish relationships and interaction, new ways to organize time and textures [7].

In his thesis “Digital Lutherie Crafting musical computers for new musics’ performance and improvisation”, some of the 25-point recommendations he made for the Digital Lottery were as follows;

- *New musics tend to be the result of new techniques, which can be both compositional or instrumental.*
- *New instruments will be able to survive and succeed in the measure they are truly innovative; i.e. they have something new to bring to music, and not merely because they are based on novel, previously unavailable technologies.*
- *Learning from the past does not merely mean emulating it. It also means to try avoiding or improving upon passed errors and limitations (the past was not perfect).*
- *One of the aspects that should be clearly improved is that of efficiency. Traditional instruments take years to master, whereas, given the speed at which technology and fashion shift in our current 21st century, new instruments have to hook from the first minute. We cannot rely anymore on persistent parents that insist on bringing their children to the conservatory, or on patient students to whom we promise the light after ten years of sacrifice.*
- *These new ‘traditionally-modeled’ instruments with increased efficiency may appeal to non-musicians and to dilettante, which is good. However, it will be much harder for them to appeal to advanced musicians as well. Advanced musicians will preferably look for new-fangled possibilities.*
- *By running processes at different temporal and formal scales and different levels of complexity, new instruments naturally surpass the one-action to one-event model inescapable in all traditional instruments. New instruments are not only sound producers, they become music producers too.*
- *Performing with such powerful instruments should not mean leaving all the musical decisions to the instrument, though. Just like the traditional composer is responsible for the music played by the performers, so should the new performer be responsible of the music performed together with the instrument. Playing*

*music is a 'serious' activity, different from 'playing with music' (also very important but not studied here).*

- *The performer must thus be able to affect all these dimensions: both the metacontrol of ongoing processes and the microcontrol of final parameters should be permitted. All of them with the maximum simplicity, flexibility and speed.*
- *To allow this type of control, new instruments have to be 'wider' rather than 'deeper'. 'Wide' instruments permit a better direct access to all of their complexity.*
- *The potential of computer graphics for representing and monitoring complex processes, is not easily surmounted. This is probably the reason why many of the more interesting recent instruments, are screen based. While, the mouse is a very limited controller that we should definitely try to avoid.*
- *For including real-time interactive visualizations and, at the same time, overcoming mouse limitations without adding indirections, interfaces should be able to reflect their own states and behaviors. They should integrate, like the abacus, both representation and control.[8].*

As seen above, Jordà clarifies some of the characteristics of the instruments which can be improved by current technology in 25 steps. It is constantly emphasized that these instruments should be simple and plain.

*"There is the desire on the part of some computer music researchers to create new instruments that should "know" what to do and require very little skill to play. Though this might allow beginners and amateurs to enter into music making quickly and enjoyably, this trend might ultimately limit a person's understanding of music. The question is whether these instruments will stimulate due to their immediate accessibility, or suffocate due to a kind of atrophy of learned musicality [9]."*

A qualified music instrument must have a balanced action and reaction and certain qualities such as making the musician satisfied. Simple devices or instruments cannot provide a rich experience. Complex devices, on the other hand, alienate the musicians. A proper instrument, indubitably, must be easily learned and played, while it must also be ergonomic.

The important question, at this point, is how the new digital instruments should be in the sense of ease of use. Is it necessary for new instruments to be difficult as the violin or the piano? This question is crucial whereas it is beyond the boundaries of the current article.



## Digital Sound Sculpture

*Sound Sculpture*; It can be defined as sculpture, object or structures that can produce sound when it is driven by its own internal mechanism or by environmental elements such as wind, water, sunlight (not always musical).

The most important common point of certain types of sound art is their visuality and plastic quality, and they practically always use “space” as dominant value or material.

Interdisciplinary production is considered to be a domain where what is perceptual overlaps with what is visual and plastic. And according to some definitions, it is where performance and media art overlap, interacts. The most dominant subtype of it is the products of sound sculpture. Sound sculpture can be defined in various ways. This includes variables such as an object producing melodic or rhythmic motives, either by itself or by means of sound or sensual data triggered by the audience or an object with sensual reference [10].

If the scope of current technology is taken into account, sound sculpture can be defined as sculpture whose design material is sound.

Design environment or material of sound sculptures in the 21st century's art environment are digital and they are influenced by the chaotic art environment of this century. Moreover, it builds up a more complicated area for itself because of the fact that it combines new digital media means with its ambiguous area which is mingled with plastic arts. Sound sculpture, with its uncertain boundaries and experimentality, is in an integrated structure with digital musical instruments and new digital media arts.

The crucial point is that the ambiguity of sound tools, musical instruments, sound objects and sculptures that have been improving in the sense of communication for centuries is due to the fact that they are being re-used within the digital media in this century. It is because each experimental instrument has similar characteristics with sound sculptures with regards to creativity and schematic and functional qualities.

Examples of digital sound sculptures created by the new digital media can be given as; “*Augmented Sound Sculpture, 2018*” with Lucia Ruggiero [11], Gabrielle Petrillo and Massimiliano Annibali's “*Sphere 2.0 Digital Sound Sculpture, 2017 (a work which is similar to digital lutherie)*” [12]. And Andy Thomas's “*Whip Bird Sound Sculpture, 2016*” [13].

## Sound Plasticity Within The Boundaries of Digital Lutherie & Sound Sculpture

Whether it is a digital music instrument, a digital sound sculpture or a musical group of sound, volumetric activity of sound can be plasticized in a visual-audial platform because of the gesticulation and plastic items.

Even though the manipulative effect of sound makes plastic items meaningful and focuses them into the audial environment with the aid of digital sound technology, especially with regard to the use of music technology, sound environments renovate themselves with auxiliary means containing artificial items and interfaces.

This process begins with the “workbench”, especially with computer use, which currently has become the design media: Worldwide industry of music technology made an illusion that everybody can create something only with a computer, and they aimed to extend their market. A decade ago, the highly complex functions were put into use by the visual interfaces such as computer games, Lego or visual editing kit, that are thought to be much more advanced or busier than the audial perception. However, this kind has begun to dominate the visual fiction and the plastic sensory field in the work that are done on the screen.

The following examples show how photographic imagery (and the terms used in graphics softwares, i.e., Photoshop) immensely dominates the music design: “The grain” for the sound particles, “sample” for audio samples, “layer” for layers of sound, “blocks” for sound clusters, “snap-shot” for instant transfer on a sound item, or “preview” for test playback preview of a assigned value and so on.

While constructing music, the concepts used in video editing are referenced. As an example, a “monopoly MAX built on the IRCAM-MAX-Apple Macintosh triangle in recent years can be mentioned: Here, a particular mode of production is imposed or even is being fetishized by a software (MAX-MSP), a device (Apple Macintosh Computer System) and an organization (IRCAM71). This software, which is believed to give “serious and professional air” to the curriculum in most institutions that teach in music technology, is a long, laborious, complicated, sometimes magnificent, like counterpoint homework where the composition students are locked in the period when tonal music has a sacred value. However, it has helped to increase academic efforts that rarely go beyond a dry process. The main reason for this is that the music design environment consists of a small computer screen: Processes are defined on a visual platform by associating architectural modules. By looking at how impressive the reflections of the reflections on the visual plane, the complex processes used and the intricate structures obtained are fetishized, and the staggering of the sensory results of the fictions and processes in this environment are overlooked. The fact that the laptop is placed in every scene as the dominant instrument raises a major problem, despite all its imaginative charm: Almost all kinds of music production (with the exception of a few traditional music practices) are managed with eyes rather than ears. The results of such a deliberate positioning of sensory perception are naturally reflected in the music: “Plasticity”, as well as “artificially” meaningful place in music, when “the time” element was abused but “the massive structures increased”, in a music culture, visual elements prevented sensory qualities [14].

On this view, one might wonder whether watching a concert is more crucial or listening to it. Further, regarding the new instruments, where gesticulation is more dominant, it might as well be said that what is visual is more in the foreground. And

the visual and plastic aspects of digital sound sculptures may come to the fore more than the other aspects of them.

## **Conclusion**

Digital technologies are redefining the concept of sound sculpture or musical instrument, and these definitions renew themselves each day in line with technological utilities. It is a fact that the digital music of the new era is still in pursuit of new instruments, and it is clear that these new instruments will be more functional in contrast to the traditional instruments.

During the creation of new digital instruments, it is important to note that technology should be used without limiting the process of creation. A policy should be adopted, and this should not be a consumer based one, rather it should be a policy that will enable the idea of making music to

evolve to a more conceptual process. In the industry of music technologies unfruitful marketing strategies, which are based on the paradigm of "making one's own music", should be left behind.

These two dominant fields, which are still growing mature with the technologies of today, progress in close relation with each other, sometimes they become indistinguishable. If there arises a need to distinguish the two, this is only possible by determining their means of design, and categorization would be possible in terms of the functions they serve. However, the new musical instrument designs that suggest new notions as being experimental can bear the quality of being digital sound sculptures, hence they bear artistic value.

When the design of digital music instruments is concerned, the most important responsibility on behalf of the luthier is to suggest a design that will not manipulate and limit the creativity of the performer, a creative setting, which is free from plasticized elements that will be resulting in limiting gesticulations, should be provided.

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