WHAT NMSAT SAYS ABOUT SONIFICATION

JÉRÔME JOY
PhD student in audio art and experimental music, Laval University, Québec
Locus Sonus – audio in art, Sonic Research Lab
http://locusonus.org/
National School of Arts Bourges, School of Arts Aix en Provence, France
jerome.joy.1@ulaval.ca , joy@thing.net , support@locusonus.org

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Introduction

NMSAT "Networked Music & SoundArt Timeline" is simultaneously a historical documentary database and a monitor of the evolution of networked music and sound art. Jerome Joy initiated the project in 2008 as part of Locus Sonus' research program. The aim is to provide an overview of practices and techniques in the realm of networked music and sonic performance, from ancient history to the present day, through a collection of references to theoretical and critical texts, thereby offering a valuable resource available to artists and researchers.
A future version of NMSAT will be publicly accessible online, open to contributions and collectively moderated by an international college of more than sixty artists and researchers. It will also become an editorial platform for analytical studies and other projects related to sound transmission and distance listening.

Abstract

This article presents a sample of references issuing directly from the existing NMSAT database. The method employed – that of systematically probing the database - reveals forms of sonification but also hypothetical premises of sonification, covering the period from ancient times to the beginning of the twentieth century. The following are some of the categories of sonification that have emerged as a result of this search: Natural phenomenon & meteorology to sound (autophones); Image to sound; Text & communication to sound; Human & machine activities to sound (auditing); Localisation to sound (sonar); Architecture & geometry & abstract proportions to sound (scalization, transcription, & spatialization); Energy to sound; Human body to sound; Distance to sound (distance listening); Movement to sound (holophony, kynophony); Interpreted observations to sound (naturalist music, transpositions & analogies, paraphrasing).
The search also uncovered other principals and practices in the vicinity of sonification including: audification, auditing, auscultation, auralization, soniculation, transduction, mapping, earcons, auditory icons, sympathy, echometry, etc.

It has been decided to summarise the results of « What NMSAT Has To Say About Sonification » in this special issue of AI&Society, access to the unabridged version of article is available here : http://locusonus.org/sonification/ .

Keywords : sonification history, distance listening, networks, audio art, networked music, timeline, database

1. ENTRIES

- **ca - 3500 BC __ Ancient Systems of Accounting**

- *Comment :* The presence of auditing ("hearing of accounts" from the Latin "auditus") has been inferred from records of Mesopotamian civilizations going back as early as 3500 BCE. To ensure that the Pharaoh was not being cheated, auditors compared the "soundness" of strictly independently scribed accounts of commodities moving in, out and remaining in warehouses (Boyd 1905). In the alternating intoning of such lists, differences can be easily identified aurally. A faster and more secure method that eliminates any "copy-cat" syndrome in such alternation, is to have the scribes read the records simultaneously a type of modulation differencing technique. While we have no evidence that these techniques were practiced in ancient times, such a suggestion does not seem unreasonable, and would represent possibly the earliest form of data sonification. *(David Worrall - published with the author's agreement)* — [Ed. : This reference is an inference of Boyd's account by Worrall.]
- *Attached references :* E. Boyd. (1905). *History of auditing* (1326) ; Mathieu-François-Régis Buisson (1776-1804), *Auscultation* (1802) ; René-Théophile-Marie-Hyacinthe Laënnec (1781-1826), *On Mediate Auscultation* (1819) ; Dr. Benjamin Ward Richardson (1828-1896), *Sphygmophone* (1879) ; Dxing (1920) ; Car mechanics, *Listen to the engine, Mechanic's stethoscope* (?) ; Listen to the code, *Code Smell* ; Codesounding (?).
- *Sources :* E. Boyd. (1905). *Ancient Systems of Accounting.* In 'A History of Accounting and Accountants', edited by Richard Brown. Chapter II. Edinburgh: T.L & E.C. Jack and Augustus M. Kelley Publishers; and also : General Books LLC publication, 2009, pp. 13-17 ; R.W. Rogers. (1901). *A History of Babylonia and Assyria.* Vol. 1. New York : Eaton & Mains ; D. Worrall. (2009). *Sonification and Information - Concepts, Instruments and Techniques.* PhD thesis, University of Canberra, p. 2-1.

- **ca - 540 BC __ Musica universalis**

- *Pythagoras of Samos (Pythagore) (Πυθαγόρας, Pythagóras) (ca 580-497 BC)*
- *Translated excerpt :* « [985b] [...] At the same time, however, and even earlier the so-called Pythagoreans applied themselves to mathematics, and were the first to develop this science; and through studying it they came to believe that its principles are the principles of everything. And since numbers are by nature first among these principles, and they fancied that they could detect in numbers, to a greater extent than in fire and earth and water, many analogues of what is and comes into being—such and such a property of number being justice, and such and such soul or mind, another opportunity, and similarly, more or less, with all the rest—and since they saw further that the properties and ratios of the musical scales are based on numbers, and since it seemed clear that all other things have their whole nature modelled upon numbers, and that numbers are the ultimate things in the whole physical universe, [986a] they assumed the elements of numbers to be the elements of everything, and the whole universe to be a proportion or number. Whatever analogues to the processes and parts of the heavens and to the whole order of the universe they could exhibit in numbers and proportions, these they collected and correlated ; and if there was any deficiency anywhere, they made haste to supply it, in order to make their system a connected whole. [...] » *(Aristotle, Metaphysics, Metaphysica A 5. 985 b, 986a, Translated by Hugh Tredennick)*
- *Attached references :* Philolaus (Φιλόλαος Philólaos) (ca 470-385 BC), *Bacchae, On Nature* ; Plato (Πλάτων / Plátôn) (ca.428-427 BC - ca. 347-346 BC), *Timaeus* (ca 360 BC) ; Claudius Ptolemaeus (Κλαύδιος Πτολεμαῖος Klaúdios Ptolemaîos) (Ptolemy) (ca. AD 90 – ca. 168), *Harmonics* ; Anicius Manlius Severinus Boëthius (Boethius) (ca 480–524), *De Institutione Musica (Fundamentals of Music)* ; Guido of Arezzo (Guido Aretinus ; Guido da Arezzo ; Guido Monaco) (991/992 – ca 1033), *Micrologus* (1025) ; Anonymous, *Naturalis concordia vocum cum planetis* (ca 1100) ; Johannes de Muris (Jean de Murs; Johannis de Muris; Jean de Muris; Jehan des Muris) (ca 1290-1350), *De sonis musicis* (1319), *Ars novæ musica* (1319), *Musica speculativa secundum Boethium* (1323) ; Adrian Willaert (ca 1490-1562), *Salmi Spezzati* (1550) ; Gioseffo Zarlino (1517-1590), *Le Istitutioni Harmoniche* (1558) ; Adrian Willaert (ca 1490-1562), Giovanni Gabrieli (ca 1554/1557–1612), *Cori Spezzati* (ca 1590) ; Johannes Kepler (1571-1630), *Harmonices Mundi* (1619) ; Michael Praetorius (1571-1621), *Syntagma musicum* (1619) ; Orazio Benevoli (1605-1672), *Te Deum (Missa Salisburgensis)* (1628).
- *Source :* Aristotle. (-350 B.C.). *Metaphysics.* In 'Aristotle in 23 Volumes'. Vols.17, 18. Translated by Hugh Tredennick. Cambridge, MA, Harvard University Press; London, William Heinemann Ltd. 1933, 1989.

- **ca -500 BC __ Æolian harp**

- *Comment :* « The harp was suspended above David's bed (Lam. R. 2:22), facing the windows (Jer.Ber. 1:1)". The open window above his bed faced north. The north wind would come through this window and pluck at the

harp strings [similar to wind chimes] so that the harp played by itself (Shocher Tov 22). When David heard that sound, he would awaken and study Torah (Lam. R. 2:22). Then all his disciples would occupy themselves in Torah diligently, warding off sleep until dawn. » *(In "Middrash Rabbah", Michael Miller, Midrash Ha-Mevo'ar Institute (Eds), Stiftung Irene Bolleg-Herzheimer, Basel, Feldheim Publishers, 2002 ; and also some references in : Bible, Ancient Testament, Books of Samuel)* — « St. Dunstan's harp upon the wall Fast by a pin did hang a, Without man's help, with lie and all, And by itself did twang. » *(not identified, quoted in John Foxe, (1583), "The acts and monuments of John Foxe", Vol. II, p. 103, Edited By Stephen Reed Catley. London : R.B. Seeley and W. Burnside, sold by L. & G. Seeley, 1837)* — « Winter — Jan. 28, 1852 — No music from the telegraph harp on the causeway, where the wind is strong, but in the Cut this cold day I hear memorable strains. What must the birds and beasts think where it passes through the woods, who heard only the squeaking of the trees before ? I should think that these strains would get into their music at last. Will not the mockingbird be heard one day inserting this strain in his medley ! It intoxicates me. Orpheus is still alive. All poetry and mythology revive. The spirits of all bards sweep the strings. I hear the clearest silver, lyre-like tones, Tyrtœan tones. I think of Menander and the rest. It is the most glorious music I ever heard. All those bards revive and flourish again in that five minutes in the Deep Cut. The breeeze came through an oak still wearing its dry leaves. The very fine clear tones seemed to come from the very core and pith of this telegraph-pole. I know not but it is my own chords that tremble so divinely. There are barytones and high sharp tones, etc. Some come sweepingly from further along the wire. The latent music of the earth had found here a vent. Music Æolian. There were two strings, in fact, on each side. I do not know but this will make me read the Greek poets. Thus, as ever, the finest uses of things are accidental. Mr. Morse did not invent this music. [...] There are some whose ears help so that my things have a rare significance when I read to them. It is almost too good a hearing, so that for the time I regard my own writing from too favorable a point of view. [...] » *(Henry David Thoreau, 1852)*

- *Attached references :* Hermes (Mercury), *Homeric Hymn* (ca -522 BC) ; St. Dunstan (909-988), *quoted in John Foxe, (1583) ;* Shishi Odoshi (ししおどし, 鹿威し) (deer scarer) - Fuurin (風鈴 - ふうりん - huurin) (wind bell) - Sōzu (そうず, 添水) (water fountain) (ca 1300) ; King David's harp, In *Midrash* ; John Foxe (1517-1587), *Dunstan 's harp (909-988)* (1583) ; Giambattista Della Porta (1535-1615), *Magiae Naturalis* (1558) ; Suikinkutsu (水琴窟) (Water koto cave) (ca 1600) ; Ji Cheng (1582- ca 1642), *Shakkei (*借景*) & ikedori (Borrowed scenery)* (1634) ; Athanasius Kircher (1601-1680) , *Musurgia Universalis* (1650), *Phonurgia Nova* (1673) ; Carillons (1652) ; Samuel Taylor Coleridge (1772-1834), *The Æolian Harp* (1796) ; Percy Bysshe Shelley (1792-1822), *Ode to the West Wind* (1819) ; Hector Berlioz (1803-1869), *The Æolian Harp (Lélio ou le retour à la vie - H 55, op. 14b)* (1832) ; Frédéric Chopin (1810-1849), *Etude in A flat major* for piano (1836) ; Rodolphe Radau (1835-1911), *L'Acoustique ou les Phénomènes du Son* (1867) ; Sergei Mikhailovich Lyapunov (1859-1924), *12 Transcendental Etudes* Op.11 No.9 (1905) ; Lord Rayleigh (1842-1919), *Æolian Tones* (1915) ; Henry Cowell (1897-1965), *Æolian Harp* for piano (1923) ; La Monte Young (1935-), *The Second Dream of the High-Tension Line Stepdown Transformer (The Four Dreams of China)* (1962) ; Jan Garbarek (1947-), *Dis* (1976) ; Alan Lamb (1944-), *Primal Image* (1995) ; Douglas Kahn (?-), *Aelectrosonic* (2009).
- *Sources :* H. D. Thoreau (1852). *Journal*. Vol. 3, pp. 219-220, New York : Houghton Mifflin; cited by Allen S. Weiss, In "Varieties of Audio Mimesis : Musical Evocation of Landscape", coll. « Audio Issues » Vol. 3, New York / Berlin : Errant Bodies Press, 2008 ; P. Szendy. (1996). *De la Harpe Éolienne à la "toile" : fragments d'une généalogie portative*. In 'Lire' l'Ircam (n° spécial des Cahiers de l'Ircam),1996, pp. 40-72; also In 'Tr@verses' n° 1, juillet 1996 ; S. Bonner. (1968). *The History and Organology of the Aeolian Harp*. Cambridge, Duxford : Bois de Boulogne ; J. Mansfield. (1970). *The Design and Construction of an Aeolian Harp*. Cambridge, Duxford : Bois de Boulogne ; J.E. Harrison. (1927). *Myths of Greece and Rome*. p. 50, London : Ernest Benn, 1927 ; T. L. Hankins & R. J. Silverman. (1995). *The Æolian Harp and the Romantic Quest of Nature*. In 'Instruments and the Imagination'. pp. 86-112. Second printing 1999. Princeton (NJ) : Princeton University Press, 1995.

- **ca - 400 BC __ On Mathematics**

- *Archytas of Tarentum (Ἀρχύτας / Arkhytas) (ca.428-350 BC)*
- *Translated excerpt :* « [...] Well then, first they [the Mathematicians] reflected that it is not possible that there be sound, if an impact of some things against one another does not occur ; they said that an impact occurred whenever things in motion came upon and collided with one another. Some moving in opposing directions, when they meet, make a sound as each slows the other down, but others moving in the same direction but not with equal speed, being overtaken by the ones rushing upon them and being struck, make a sound. Indeed many of these sounds cannot be recognized because of our nature, some because of the weakness of the blow, others because of the distance of separation from us and some because of the excess of the magnitude. For the great sounds do not steal into our hearing, just as nothing is poured into narrow-mouthed vessels, whenever someone pours out a lot. [...] » *(Archytas the Pythagorean, "On Mathematics")*
- *Attached references :* Aristotle (- 384-322 BC), *Problemata* (ca -350 BC) ; Aeneas Tacticus (?), *How to Survive under Siege* (ca -350 BC) ; Vitruvius (Marcus Vitruvius Pollio) (ca 80/70-15 BC), *« De Architectura, Libri Decem »* (- 25 BC) ; Hero (or Heron) of

Alexandria (10-70 AD), *Pneumatika (Hydraulis)* (62 AD), *Automaton Theater — ΠΕΡΙ ΤΩΝ ΣΤΑΤΩΝ ΑΥΤΟΜΑΤΩΝ* (ca 100 AD) ; Plutarch of Delphi (ca 46-120 AD), *« Peri tou akouein — De recta ratione audiendi »* (ca 100 AD), « Symposia » (ca 100 AD) ; Augustine of Hippo (Aurelius Augustinus Hipponensis) (St. Augustine or St. Austin) (354-430), *De musica* (ca 400 AD) ; Muristus (or Murtas, or Murtus, or Ameristos), *Hydraulic organ* (ca 800-900) ; Banū Mūsā Brothers (ca 800-873), *Kilāb al-hiyal (The Book of Ingenious Devices) (Al-ālāt allatī tuzammiru bi-nafsihā)* (ca 850) ; Leo the Mathematician (866-912), *Automatons* (ca 900) ; Pirro Ligorio (?) & Orazio Olivieri (?), *Fontana dell'Organo - Villa d'Este (Tivoli)* (1549/1575) ; Santino Solari (1576-1646), *Garden of Hellbrunn* (1615) ; Salomon de Caus (1576-1626), *Les Raisons des forces mouvantes* (1615) ; Ernst Florens Friedrich Chladni (1756-1827), *Entdeckungen über die Theorie des Klanges* (1787), *Die Akustik* (1802) ; Thomas Young (1773-1829), *Vibrograph* (1807) ; Charles Wheatstone (1802-1875), *Kaleidophone* (1827) ; Jean-Marie Constant Duhamel (1797-1872), *Vibroscope* (1843) ; Joshua C. Stoddard (1814-1902), *Calliope* (1855) ; Edwin Scott Votey (1856-1931), *Pianola* (1895) ; El Lissitzky (1890–1941), *Elektro-mechanischen Schau* (1920) ; Frederick Law Olmsted Jr. (1870-1957), *Bok Tower Gardens* (1929).

- *Sources :* C. A. Huffman. (2005). *Archytas of Tarentum: Pythagorean, philosopher, and mathematician king*. Cambridge University Press ; F. Baskevitch. (2008). *Les représentations de la propagation du son, d'Aristote à l'Encyclopédie*. Thèse de Doctorat, Université de Nantes, U.F.R. Lettres et Langages, Ecole doctorale : « Connaissance, Langages, Cultures ».

- **1326 __ History of auditing**

- *Comment :* « [...] The origin of auditing goes back to times scarcely less remote than that of accounting. [...] The thirteenth century supplies us with references to auditors and auditing both in Italy and in England. Early in the century we find an auditor employed to revise (or audit) the account books of the commune of Pisa. [...] A thirteenth century teatrise on estate-management in French [...] recommends that the lord of the manor ought to command that the accounts be heard every year at each manor. The auditors ought to be faithful and prudent, knowing their business. The seneschal ought to be joined with the auditors, but subordinate as having to answer to the auditors on the account for his doings, just as another. "It is not necessary so to speak to the auditors ["acunturs"] about making audit because of their office, for they ought to be so prudent, and so faithful, and so knowing in their business, that they have no need of other teaching about things connected with the account" (from a thirteenth century teatrise). [...] » *(Edward Boyd, Chapter 4 — History of auditing, 1905)*
- *Sources :* E. Boyd. (1905). *History of auditing*. In 'A History of Accounting and Accountants', edited by Richard Brown, Chapter III & IV. Edinburgh: T.L & E.C. Jack and Augustus M. Kelley Publishers; and also : General Books LLC publication, 2009, pp. 31-37 and pp. 55-67.

- **1436 __ Nuper Rosarum Flores** (Recently Flowers of Roses / The Rose Blossoms Recently)

- *Guillaume Dufay (1397-1474)*
- *Comment :* "Nuper Rosarum Flores" or Flowers of Roses/The Rose Blossoms, is an isorhythmic motet composed in 1436 by Guillaume Dufay, to be performed at the consecration of the new Florence cathedral on the occasion of the completion of the dome designed by Filippo Brunelleschi. The motet is striking for its synthesis of both the older isorhythmic style and the new contrapuntal style which would be developed in the coming decades by Dufay himself as well as his successors (such as Ockeghem and Josquin des Prez). The title of the piece stems from the actual cathedral itself, which was named Santa Maria del Fiore, or St. Mary of the Flower. The musicologist Charles Warren claimed that the proportional structure of the motet mimicked the proportions of the building itself (Warren 1973). David Fallows (1987, 283 n46), Charles Turner (1991, 99–102) [Ed. : This was later refuted by Craig Wright (Wright 1994, 401, 404–407)] *(Comment under Creative Commons CC-BY-SA license, In Wikipedia: The Free Encyclopedia. Wikimedia Foundation. Retrieved October 31, 2010)*
- *Sources :* M. Trachtenberg. (2001). *Architecture and Music Reunited: A New Reading of Dufay's "Nuper Rosarum Flores" and the Cathedral of Florence*. In 'Renaissance Quarterly' 54 (2001), pp. 740-775 ; C. Warren. 1973. *Brunelleschi's Dome and Dufay's Motet*. In 'The Musical Quarterly' 59:92–105 ; D. Fallows. 1987. *Dufay*. Revised edition. The Master Musicians Series. London and Melbourne: J. M. Dent & Sons Ltd ; C. Turner. 1991. *Proportion and Form in the Continental Isorhythmic Motet c. 1385–1450*. In "Music Analysis' 10, no. 1/2 (March–July): 89–124 ; C. Wright. 1994. *Dufay's Nuper rosarum flores, King Solomon's Temple, and the Veneration of the Virgin*. In 'Journal of the American Musicological Society' 47, no. 3 (Fall): 395–441.

- **1483 __ Underwater acoustics**

- *Leonardo da Vinci (1452-1519)*

- *Comment :* "If you let your ship stop and dip the end of a long blowpipe in the water and hold the other end to your ear, then you can hear ships which are very [far] distant from you" *(Leonardo da Vinci, 1483 ; quoted in "Fundamentals of noise and vibration", 1998, edited by Frank Fahy & John Gerard Walker, Taylor & Francis, p. 375)*
- *Attached references :* Jean-Daniel Colladon (1802-1893), *measure of the sound velocity in the waters of Lake Geneva* (1826) ; Lazzaro Spallanzani (1729-1799), *theory of echolocation* (1794) ; Pierre Curie (1859-1906) & Jacques Curie (1856-1941), *piezoelectric effect* (1880) ; Alexander Belm (?), *underwater echo-sounding device* (1912) ; Lewis Fry Richardson (1881-1953), *underwater echo ranging sonar* (1912) ; Reginald Fessenden (1866-1932), *sonar* (1914) ; Paul Langevin (1872-1946) & Constantin Chilowski (?), *Hydrophone - high frequency ultrasonic echo-sounding device w/ piezoelectric transducer* (1917) ; Sir Edward Victor Appleton (1892-1965), *use of radio echoes to determine the ionosphere's height* (1924) ; Sir Robert Alexander Watson-Watt (1892-1973), *RADAR system* (1935).
- *Source :* K.F. Graff. (1981). *A History of Ultrasonics*. In 'Physical Acoustics', Vol. 15. Mason & Thurston (Eds). Academic Press.

- **1619 __ Harmonices Mundi** (The Harmony of the World)
- *Johannes Kepler (1571-1630)*
- *Translated excerpt :* « Book IV of the Harmony of the World by Johannes Kepler — On the harmonic configurations of the stellar rays on the earth, and their effects on events in the sky and other natural phenomena — On the use of mathematics in Natural Philosophy and Politics which most of all concern the Harmonic part of it on radiations. It furnishes everything that is important for the contemplation of nature, declaring the most splendid order of the ratios, according to which the whole of this universe has been constructed, and the analogy of the proportions, which connects together everything in the world, as Timaeus says somewhere, and which restores friendship between things which are in conflict, and relations and mutual affection between those which are widely separated. [...] It remains for us to apply the harmonies, which we have hitherto described, to the cosmos, in three other books, of which the first would attribute the harmonies to God the Creator of the heavens, the second to Nature the director of different motions, and the third to Man the controller of his voice, which originates from motion. However, the requirements of stating the arguments have persuaded us not only to reverse the order, starting from human song, passing from that to the works of Nature, and thus finally to the work of Creation, which was the first and most perfect of all, but also to combine the end of abstract speculation with the beginning of actual harmonies in melody, in the same third book. Therefore, after starting this application to the cosmos in the preceding book, and transferring the harmonies to human melody, which others usually embrace in the general term Art, there now follows the fourth book, which in this reverse order attributes to Nature the second part in actual harmony. [...] — Book V of the Harmony of the World by Johannes Kepler — [...] Chapter VI - That in the Extremes of the Planetary Motions Have Been Expressed, in a Fashion, the Musical Modes or Tones — Yet by the designation of two notes in a common system, and the shaping of the skeleton of the octave, by spanning a definite melodic interval, there is a certain first step towards distinguishing tones or modes : therefore the musical modes have been distributed among the planets. To be sure I know that for the shaping and defining of distinct modes many things are needed , which are proper to human melody, that is to say when it has intervals ; and so I have used the voice in a fashion. Now it will be open to a musician to draw his own conclusion as to which mode each planet more nearly expresses, now that the extremes have here been assigned for him. [...] » *(Transl. by E.J. Aiton, A.M. Duncan, J.V. Field)*
- *Sources :* J. Kepler. (1619 [1997]). *The Harmony of the World.* Tr.: E.J. Aiton, A.M. Duncan, J.V. Field. The American Philosophical Society (Eds), 1997 ; J. Kepler. (1619 [1952]). *The Harmony of the World.* Tr. Charles Glenn Wallis. Chicago: Great Books of the Western World. Pub. by Encyclopedia Britannica, Inc., 1952.

- **1627 __ Sylva Sylvarum : Or a Natural History in Ten Centuries - Experiments in consort touching Music**
- *Francis Bacon (1561-1626)*
- *Original excerpt :* « — CENTURY III — [...] 281 — The experiment of sympathy may be transferred, perhaps, from instruments of strings to other instruments of sound. As to try, if there were in one steeple two bells of unison, whether the striking of the one would move the other, more than if it were another accord; and so in pipes, if they be of equal bore and sound, whether a little straw or feather would move in the one pipe, when the other is blown at an unison. — It seemeth, both in ear and eye, the instrument of sense hath a sympathy or similitude with that which giveth the reflection, as hath been touched before; for as the sight of the eye is like a crystal, or glass, or water; so is the ear a sinuous cave, with a hard bone to stop and reverberate the sound; which is like to the places that report echos. [...] — 285 — [...] There be these differences in general, by which sounds are divi-

ded : 1) Musical, immusical, 2) Treble, base, 3) Flat, sharp, 4) Soft, loud, 5) Exterior, interior, 6) Clean, harsh, or purling, 7) Articulate, inarticulate. We have laboured, as may appear, in this inquisition of sounds diligently; both because sound is one of the mist hidden portions of nature, as we said in the beginning, and because it is a virtue which may be called incorporeal and immateriate; where of there be in nature but few. Besides, we were willing, now in these our first centuries, to make a pattern or precedent of an exact inquisition; and we shall do the like hereafter in some other subjects which require it. For we desire that men should learn and perceive, how severe a thing the true inquisition or nature is; and should accustom themselves by the light of particulars to enlarge their minds to the amplitude of the world, and not reduce the world to the narrowness of their minds. [...] » *(Francis Bacon, 1627)*

- *Source :* F. Bacon (1627). *Sylva sylvarum.* In 'The Works of Francis Bacon — Philosophical works : Of the proficience and advancement of learning, divine and moral. Sylva sylvarum; or a natural history in ten centuries (century I - VIII)'. Printed for C. and J. Rivington, etc., London (1826). New edition in ten volumes, vol. 1, pp. 286-316, pp. 318-341, and pp. 474-475.

- **1634 __ Shakkei (借景) & ikedori** (Borrowed scenery)

- *Ji Cheng (计成) (1582- ca 1642)*
- *Comment :* In Japanese tradition, this art refers to the subtle practice of gardening considered as a technique of perception,called 'mitate' ("see like"). [...] The 'shakkei' allows us to become aware of the successive plans integrated in a perspective (such as an outlook, for instance). It offers a mode of conscious decision helping to place an item (for the gardener: a plant) in a relationship between the foreground and a remote background. The plant in front of you placed in a composed layout: the bed nearby, organized, and a mountain far away for example. [...] *(Jérôme Joy, "Extended Music - Out in the Open", In 'Around' Festival catalog, edited by Yang yeung and soundpocket, Hong Kong, 2010)*
- *Sources :* Cheng, Ji. (1634). *Yuanye (園冶).* Ed. Wang Changmei, Golden Maple Publishing House ; and also : collection 'Jardins et paysages', 1997. Paris : Éditions de l'Imprimeur ; Cheng, Ji. (1634). *Craft of Gardens.* Translated by Alison Hardie, 1988. Yale University Press ; S. Inagalien. (1983). *La réinterprétation de la perspective linéaire au Japon (1740-1830) et son retour en France (1860-1910).* In Actes de la Recherche en Sciences Sociales, 1983, n° 49, pp. 29-45.

- **1641 __ Mercury, or The Secret and Swift Messenger : shewing, how a man may with privacy and speed communicate his thoughts to a friend at any distance**

- *Bishop John Wilkins (1614-1672)*
- *Original excerpt :* « [...] Suppose a Friend were persidiously clapped up in some close Dungeon, and that we did not know exactly where, but could only guess at the place, within the latitude of half a mile or somewhat more ; a man might very distinctly, by these other inventions, discourse unto him. Or suppose a City were straitly besieged, and there were either within it or without it, such a Confederate, with whom we should necessary confer about some design; we may by these means safely dicover to him our intentions. by which you may guess, that the Messenger which is here imployed, is of so strange a nature, as not to be barred out with walls, or deterred by enemies. To the performance of this, it is requisite that there be two Bells of different notes, or some such other audible and loud sounds, which we may command at pleasure, as Muskets, Cannons, Horns, Drums, etc. By the various founding of these (according to the former Table) a man may easily express any letter, and so consequentely any sense. These Tables I shall again repeat in this place : That of two letters may be contrived thus : A (aaaaa), B (aaaab), C (aaaba), D (aaabb), E (aabaa), F (aabab), G (aabba), H (aabbb), I (abaaa), K (abaab), L (ababa), M (ababb), N (abbaa), O (abbab), P (abbba), Q (abbbb), R (baaaa), S (baaab), T (baaba), V (=U) (baabb), W (babaa), X (babab), Y (babba), Z (babbb). [...] If the musical instrument that is used to this purpose, be able to express the ordinary notes, not only according to their different tones, but their times also, then may each letter of the alphabet be rendered by a single sound. Whence it will follow, that a man may frame a language, consisting only of tunes and such inarticulate sounds, as no letters can express. [...] By this you may easily discern how two musicians may discourse with one another, by playing upon their instruments of music, as well as by talking with their instruments of speech. (And which is a singular curiosity) how the words of a song may be contrived in the tune of it. [...] The utterance of these Musical tunes may serve for the universal Language, and the writing of them for the universal Character. As all Nations do agree in the same conceit of things, so likewise in the same conceit of Harmonies. » (*Bishop John Wilkins, Chapter XVII and XVIII)*

- *Attached references :* Jean-François Sudre (1787-1862), *Téléphonie* (1827), *Solresol* (1838) ; Samuel (Finley Breese) Morse (1791–1872), *Recording telegraph - Morse code* (1843), *The Sounder* (1846) ; David Henry Keller (1880-1966), *The Lost Language* (1934) ; Clarence Barlow (1945-), *Çoğluotobüsişletmesi* (1975-79), *Synthrumentation* (1998).
- *Source :* J. Wilkins. (1641). *Mercury, or The Secret and Swift Messenger.* In 'The Mathematical and Philosophical Works of the Right Rev. John Wilkins', Vol. II, London : printed by C. Whittingham for Vernor and Hood, Poultry, and Martin, Middle-Row, Holborn; and also : J. Walker, Paternoster-Row, 1802, pp. 69-75.

- **1725 __ The Ocular Harpsichord** (Le clavecin pour les yeux)
- *Louis-Bertrand Castel (1688-1757)*
- *Comment :* "As the harmony and discord of sounds proceeded from the properties of the aerial vibrations, so may the harmony of certain colours, as of golden and blue, and the discord of others, as of red and blue, proceed from the properties of the aetherial. And possibly color may be distinguished into its principal degrees, Red, Orange, Green, Blew, Indigo and deep Violet on the same ground, that sound within an eighth is graduated into tones." *(Isaac Newton, "Letter to the Royal Society, 1675", In 'The Correspondence of Isaac Newton', ed. H.W. Turnbull et al., Vol. 1, p. 376, Cambridge : Cambridge University Press, 1959-1977)*
- *Translated excerpt :* « All of which leads me to say : 1) That the more color-music is refined, artificial, scientific even, that is, nonhabitual, the more beautiful and agreeable it will be, not at first, but "col balsamo di costume" ; and thus 2) I must attempt to make it know to the taste, to the mind, to the reason, to the internal sense in order to make it felt by the external sense, the eye. [..] Everyone is a bit of a physicist to the extent that he has an attentive mind capable of natural reasoning [...] not on arbitrary hypothesis or particular and personal experience, but uniquely on history and on the general observation of nature and art. [...] My philosophy [...] considers only facts, but facts are natural, daily occurring, constant, and a thousand times repeated, habitual facts rather than facts of the moment, facts of humanity rather than facts of one man. A unique fact is a monstruous fact. » *(Louis-Bertrand Castel, "L'Optique des Couleurs", p. 375 &. 403, Paris : Briasson, 1740)* — « [...] Now it is analogy that renders these poetic flashes fecund in discoveries. Because what one calls among the poets and orators "metaphor, similitude, allegory, figure" ; a philosopher, a geometer will call "analogy, proportion, ratio". All our discoveries, all our scientific truths, are only truths of ratio. And from there often the figurative sense degenerates into the proper sense and the figure into reality. » *(Louis-Bertrand Castel, "Suite et seconde partie des nouvelles expériences d'optique et d'acoustique adressées à M. le Président de Montesquieu", In 'Journal de Trévoux', August 1735, p. 1625)*
- *Attached references :* G. Comanini. (1591[2001]). *The Figino, or On the purpose of painting : art theory in the late Renaissance.* Ann Doyle-Anderson et Giancarlo Maiorino (Eds and Trans.). Toronto: University of Toronto Press, 2001 ; N. Malebranche (1674). *De la Recherche de la Vérité.* Strasbourg : Chez George André d'Olhoff ; Karl von Eckartshausen (1752-1803), *Color Organ* (1788) ; Bainbridge Bishop (?), *The Color-Organ* (1876) ; Alexander Wallace Rimington (1854-1918), *Colour Organ* (1915) ; Vladimir Baranoff Rossiné (1888-1944), *Optophonic Piano* (1916) ; Thomas Wilfred (Richard Edgar Løvstrom) (1889-1968), *Clavilux - Lumia* (1920) ; Arthur C. Vinageras (?), *Chromopiano* (1921) ; Alexander Laszlo (1895-1970), *Farblichtmusik* (1925).
- *Sources :* L.B. Castel. (1725). *Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pièces de musique, Lettre écrite de Paris le 20 février 1725 par le R.P. Castel, Jésuite, à M. Decourt, à Amiens.* (Ed: transl. Ocular Harpsichord). Mercure de France, pp. 2552-2577 ; M. Franssen. (1991). *The ocular harpsichord of Louis-Bertrand Castel: The science and aesthetics of an eighteenth-century cause célèbre.* In 'Tractrix (3) : Yearbook for the History of Science, Medicine, Technology and Mathematics', pp. 15-77 ; T. L. Hankins and R.J. Silverman,. (1995). *Instruments and the Imagination.* Princeton University Press (1999), pp. 72-85, and p. 247.

- **1750 __ Die Kunst der Fuge BWV 1080** (The Art of Fugue)
- *Johann Sebastian Bach (1685-1750)*
- *Comment :* « Über dieser Fuge, wo der name B A C H im Contrasubject angebracht worden, ist der Verfasser gestorben » (At the point where the composer introduces the name BACH [Ed. : for which the English notation would be Bb-A-C-B] in the countersubject to this fugue, the composer died). [Ed. : This note in the handwriting of Bach's son Carl Philipp Emmanuel Bach is written on the Contrapunctus XIV autograph. The use of motif or musical cryptogram (or "gematria", number-word symbolism) or musical signature or ciphered versions of names in musicians' compositions corresponds to a cryptogrammatic sequence of musical notes referred to an extra-musical text and logical system (between numbers, note names, and letters : syllables to solmization names, letters to note names, etc.). Composers have dabbled in musical cryptograms for centuries : Josquin des Prez ; Adrian Willaert ; Costanzo Festa ; Johannes Brahms ; Franz Liszt ; Robert Schumann ; Nikolai Rimsky-Korsakov ; Max Reger ; Ferruccio Busoni ; Charles Koechlin ; Camille Saint-Saëns ; Gabriel Fauré ; Arnold Schoenberg ; Anton Webern ; Maurice Ravel ; Florent Schmitt ; Charles Ives ; Francis Poulenc ; Albert Roussel ; Ar-

thur Honegger ; Darius Milhaud ; Hans Eisler ; Olivier Messiaen ; Dmitri Shostakovich ; Edward Elgar ; Elliot Carter ; etc.]

- *Sources :* J.G. Walther. (1732). *Musicalisches Lexicon*. Leipzig: W. Deer ; E. Sams. (1980). *Cryptography, musical*. In Sadie Stanley (Ed.), 'The New Grove Dictionary of music and musicians'. Vol. 5. p. 80. Macmillan.

- **1761 __ Inventum novum ex percussione thoracis humani ut signo abstrusos interni pectoris morbos detegendi** (A New Discovery that Enables the Physician from the Percussion of the Human Thorax to Detect the Diseases Hidden Within the Chest)

- *Joseph Leopold Auenbrugger (von Auenbrugg) (1722-1809)*
- *Original excerpt :* « Observatio I — De sono humani thoracis naturali, et quomodo is in diversis locis deprehendatur. [...] — 2) Sonus quem thorax edit (1.), talis observatur, qualis in tympanis esse solet, dum panno vel alio tegmine, ex lana crassiori facto, obtecta sunt. » *(quoted in Jean-Nicolas Corvisart, In "Essai sur les maladies et les lésions organiques du cœur et des gros vaisseaux", pp. 189-347) —*
- *Attached references :* Mathieu-François-Régis Buisson (1776-1804), *Auscultation* (1802) ; E. Boyd. (1905). *Ancient Systems of Accounting* (ca - 3500 BC) ; René-Théophile-Marie-Hyacinthe Laënnec (1781-1826), *On Mediate Auscultation* (1819) ; Dr. Benjamin Ward Richardson (1828-1896), *Sphygmophone* (1879) ; Dxing (1920) ; Hans Berger (1873-1941), *Sonification of brainwaves* (1934) ; Alvin Lucier (1931-), *Music for a Solo Performer* (1965) ; Pierre Henry (1927-) & Roger Lafosse (?), *Corticalart* (1971) ; David Rosenboom (1947-), *Brainwave Music* (1975), *Piano Etude I (Alpha)* (1971). Car mechanics, *Listen to the engine*, *Mechanic's stethoscope* (?) ; Listen to the code, *Code Smell* ; Codesounding (?).
- *Sources :* J. L. Auenbrugger (1761). *Inventum novum ex percussionne thoracis humanis, &c*. Vienna ; J. L. Auenbrugger (1761). *Nouvelle méthode pour connaître les maladies de la poitrine par la percussion de cette cavité*. Transl. into French by Roziere de la Chassagne. Montpellier, 1763 ; Vienna ; J. L. Auenbrugger (1761). *Nouvelle méthode pour connaître les maladies de la poitrine par la percussion de cette cavité*. Transl. into French by J.N. Corvisart. Paris, 1808 ; Vienna ; J. B. P. Barth & H. Roger. (1866). A Manual of Auscultation and Percussion. Philadelphia : Lindsay & Blakiston ; M. K. Davies & A. Hollman. (1997). *Joseph Leopold Auenbrugger (1722–1809)*. In 'Heart' 1997;78:102.

- **1787 __ Musikalisches Würfelspiel, K 516f** (Musical dice game)

- *Wolfgang Amadeus Mozart (1756-1791)*
- *Original excerpt :* « Anleitung: Walzer oder Schleifer mit zwei Würfeln zu componieren, ohne Musikalisch zu seyn, noch von der Composition etwas zu verstehen. » [Instruction: To compose a waltz or a schleifer / landler with two dice, without being musically gifted, nor knowing anything about composition.] *(W.A. Mozart, KV 294 d ; quoted in 'Zeitschrift für Musikwissenschaft', Volume 16, Breitkopf und Härtel, 1934)*
- *Attached references :* [Ed. : Other famous examples : Johann Philipp Kirnberger's *Der allezeit fertige Menuetten- une Polonoisen Komponist (Würfel-Menuet) (The Ever Ready Composer of Polonaises and Minuets)* (1757 1st edition; revised 2nd 1783) ; Carl Philipp Emanuel Bach's *Idea of composing a six-bar double counterpoint at the octave without knowing the rules* (c. 1757) ; Joseph Haydn's *Gioco Filarmonico (Philharmonic Joke or the Art of Composing an Infinite Number of Minuets Without the Least Knowledge of Counterpoint)* (1790) ; Maximilian Stadler (*Tables according to which one can toss off minuets and trios*) ; de la Chevardiere (*The Harmonic Top — A Tabular System whereby any person without the least knowledge of music may compose ten thousand different minuets in the most pleasing and correct manner*) ; Christian Ernst Graf ; Max Fiedler ; Johann Caspar Ferdinand Fischer ; Antonio Calegari (*L'Art de composer de la musique sans en connaitre les elements*, 1802)] ; See : Dodecaphonism, Serialism, Algorithmic & Stochastic music, etc.
- *Sources :* W.A. Mozart. (ca 1787). *Ms. 253* (K. Anh. 294d/516f). Bibliothèque Nationale, Paris (Collection Malherbe) ; W.A. Mozart. (ca 1787). *Musikalisches Wurfelspiel*. Edited by Karl Heinz Taubert. Mainz : B. Schott's Söhne , 1956 ; S.C. Hedges. (1978). *Dice Music in the Eighteenth Century*. In 'Music and Letters' (1978) Vol. 59 (2): 180-187. Oxford University Press ; J. Hearon. (2005). *Lexicon Musikautomaten: Die Welt der selbstspielenden Musikinstrumente (review)*. In 'Computer Music Journal', Volume 29, Number 1, Spring 2005, pp. 100-101. Published by the MIT Press.

- **1802 __ Auscultation**

- *Mathieu-François-Régis Buisson (1776-1804)*
- *Comment :* « Buisson distinguishes two sorts of hearing, the passive or "audition", the active or "auscultation", a division based on equally exact observations, and on which is based the difference between the words, "to hear" and "to listen" » *(Laënnec on Buisson (1802), in 'Journal de Médecine Brumaire' ; quoted in Duffin, "To see with a better eye", p. 43 ; cited by Jonathan Sterne, In "The Audible Past", p. 100)* — AUSCULTATE : "to listen" (especially with a stethoscope), 1833 (in auscultator), from L. auscultat-, pp. stem of auscultare "to listen to," from aus-,

from auris "ear" ; "the rest is doubtful" [Oxford English Dictionary OED]. Auscultation "act of listening" is from 1634; medical sense is from 1833.

- *Source :* J. Sterne. (2003). *The Audible Past - Cultural Origins of Sound Reproduction.* Durham & London : Duke University Press.

- **1819 __ Stethoscope — On Mediate Auscultation**
- *René-Théophile-Marie-Hyacinthe Laënnec (1781-1826)*
- *Comment :* Auscultation - act of listening. Buisson has used it synonymously with "listening". Laënnec introduced "auscultation" to appreciate the different sounds, which can be heard in the chest, and in the diagnosis of diseases of the heart, lungs, etc. This may be done by the aid of an instrument called a "stethoscope", one extremity of which is applied to the ear, the other to the chest of the patient. This mode of examination is called "Mediate Auscultation", (F) Auscultation médiate - the application of the ear to the chest being "immediate auscultation". The act of exploring the chest is called "Stethoscopia", and "Thoracoscopia" ; of the abdomen, "Abdominoscopia". *(Robley Dunglison, p. 83, 1845)*
- *Translated excerpt :* « I recalled a well known acoustic phenomenon : if you place your ear against one end of a wood beam the scratch of a pin at the other end is distinctly audible. It occurred to me that this physical property might serve a useful purpose in the case I was dealing with. I then tightly rolled a sheet of paper, one end of which I placed over the precordium (chest) and my ear to the other. I was surprised and elated to be able to hear the beating of her heart with far greater clearness than I ever had with direct application of my ear. I immediately saw that this might become an indispensable method for studying, not only the beating of the heart, but all movements able of producing sound in the chest cavity. » *(Translated from French by John Forbes, 1834, In Jay V. "The legacy of Laënnec". Arch Pathol Lab Med 2000;124:1420–1421 ; and also : Davies MK, Hollman A. Rene Theophile-Hyacinthe Laënnec (1781–1826) Heart 1996;76:196 ; Welsby PD, Parry G, Smith D. The stethoscope: some preliminary investigations. Postgrad Med J 2003;79:695–698)*
- *Sources :* R. Dunglison. (1845). *Medical lexicon: a dictionary of medical science : containing a concise account of the various subjects and terms, with the French and other synonymes, notices of climate, and of celebrated mineral waters, formulae for various officinal and empirical preparations, etc,.* Fifth edition. Philadelphia : Lea and Blanchard ; R.-T.-M.-H. Laënnec. (1819). *Traité de l'auscultation médiate, ou Traité du diagnostic des maladies des poumons et du cœur, fondé principalement ur ce nouveau mode d'exploration*. Paris : Chez J.A. Brosson & J.S. Chaudé, 1837.

- **1825 __ Electrical Disturbances on Telegraph Lines**
- *Comment :* It finds confirmation also in the fact, generally admitted by the inhabitants of the northern regions, that, when the auroræ appear low, a crackling is heard similar to that of the electric spark. [..] M. Ramm, Inspector of Forests in Norway, wrote to M. Hansteen, in 1825, that he had heard the noise, which always coincided with the appearance of the luminous jets, when, being only ten years old, he was crossing a meadow covered with snow and hoar-frost, near which no forests were in existence. [...] Dr. Gisler adds, that he has frequently hear the noise of the aurora, and that it resembles that of a strong wind, or the hissing that certain chemical substances produce in the act of decomposition. *(George B. Prescott, 1860)* — Professor Pierce has observed the most curious sounds produced from a telephone in connexion with a telegraph wire during the Aurora Borealis, and I have just heard of a curious phenomenon lately observed by Dr. Channing. In the city of Providence, Rhode Island, there is an overhouse wire about one mile in extent with a telephone at either end. On one occasion the sounds of music and singing was faintly audible in one of the telephones. It seemed as if some one was practicing vocal music with a pianoforte accompaniment. The natural suppositions was that experiments were being made with the telephone at the other end of the circuit, but upon inquiry this proved not to have been the case. Attention having thus been directed to the phenomenon, a watch was kept upon the instruments, and upon a subsequent occasion the same fact was observed at both ends of the line by Dr. Channing and his friends. It was prove that the sounds continued for about two hours, and usually commenced about the same time. A searching examination of the line disclosed nothing abnormal in its condition, and I am unable to give you any explanation of this curious phenomenon. Dr. Channing has, however, addressed a letter upon the subject to the editor of one of the Providence papers, giving the names of such songs as were recognized, with full details of the observations, in the hope that publicity may lead to the discovery of the performer, and thus afford a solution of the mystery. *(George B. Prescott, 1884)*
- *Attached references :* Carlo Matteuci (1811-1868), *observations* (1848) ; Thomas A. Watson (1854-1934), *Static currents* (1876).
- *Sources :* G. B. Prescott. (1884). *Bell's electric speaking telephone : its invention, construction, application, modification, and history.* In 'HISTORY, THEORY, AND PRACTICE OF THE ELECTRIC TELEGRAPH'. pp. 79-80. D. Appleton. Reprinted by Arno Press 1972 ; G. B. Prescott. (1860). *Electrical Disturbances on Telegraph Lines.* In 'HISTORY,

THEORY, AND PRACTICE OF THE ELECTRIC TELEGRAPH'. pp. 317-332. Boston: Ticknor and Fields, University Press, Cambridge ; Alfred Angot. (1897). *The Aurora Borealis*. International Scientific Series, Vol. LXXVII. pp. 46-51. New York : D. Appleton & Co ; J.R. Capron. (1879). *Auroræ : their characters and spectra*. E. & F.N. Spon.

- **ca 1830 __ Metal detector**
  - *R.W. Fox (?)*
  - *Comment :* "[...] Mr. Fox's beautiful discovery of electric currents in veins, being confined to the veins alone, for neither in his experiments (yet published) nor my own, have we ever detected electric currents in the rocks or in the earthy contents of the veins, the experiments shewing nothing but the existence of electricity or the present contents of veins, in their present places. [...]" *(In W.J. Henwood, "A Lecture on the phenomena of metalliferous veins, delivered at the Penzance Institution, on Tuesday the 10th of November 1836", In 'The Edinburgh New Philosophical Journal', Vol. XXII, N° XLIII, January 1837, pp. 168-169)*
  - *Attached references :* Joseph Henry (1797-1878) & Michael Faraday (1791-1867), *theory of electromagnetism* (1831) ; Heinrich Wilhem Dove (1803-1879), *earliest form of induction balance* (1841) ; Alexander Graham Bell (1847-1922), *experiments in induction balance with the telephone* (1877) ; Prof. David E. Hughes (1831-1900) & William Groves (?), *Induction Balance (I.B.) as a metal locator* (1879) ; George Hopkins (?), *Hopkins electric ore finder* (1881) ; Dr. John Girner (?), *experimentation with locating metallic masses in the human body* (1887) ; Captain McEvoy (?), *electric submarine detector* (1883 & ca 1905) ; London Electric Ore Finding Company Ltd, *Bristish patent of a metal detector* (1902) ; Electric Metal Locating Company of Chicago (and Fred H. Brown (?)), *metal detection* (?) ; Daniel Chilson (?), *electromagnetic radio-detector* (1924) ; George Williams (?), *Radio-Locator* (ca 1925) ; Gerhard Fisher (?), *Metalloscope* (1929) ; Theodore Theodorsen (1897-1978), *instrument for detecting metallic bodies buried in the earth : N.A.C.A Bomb Detector* (1930) ; George Maher (?), *Alpha* (?) ; Engineering Research Corporation, *Terrasearch* (?) ; Goldak Inc., *Radioscope* (ca. 1939) ; J. Evan-Hart & D. Stuckey (?), *Detectorist* (2007).

- **1837 __ The Production of Galvanic Music**
  - *Charles Grafton Page (1812-1868)*
  - *Original excerpt :* « The Production of Galvanic Music — The following experience was communicated by Dr. C.G. Page of Salem, Mass., in a recent letter to the editor. From the well known action upon masses of matter, when one of those masses is a magnet, and the other some conducting substance, transmitting a galvanic current, it might have been safely inferred (a priori,) that if this action were prevented by having both bodies permanently fixed, a molecular derengement would occur, whenever such a reciprocal action should be established or destroyed. This condition is fully proved by the following singular experiment. A long copper wire covered with cotton was wound tightly into a flat spiral. After making forty turns, the whole was firmly fixed by a smearing of common cement, and mounted vertically between two upright supports. The ends of the wire were then brought down into mercury cups, which were connected by copper wires with the cups on the battery, which was a single pair of zinc and lead plates, excited by sulphate of copper. When one of the connecting wires was lifted from its cup a bright spark and loud snap were produced. When one or both poles of a large horse shoe magnet, are brought by the side or put astride the spiral, but not touching it, a distinct ringing is heard in the magnet, as often as the battery connexion with the spiral is made or broken by one of the wires. Thinking that the ringing sound might be produced by agitation or reverberation from the snap, I had the battery contact broken in a cup, at considerable distance from the field of experiment ; the effect was the same as before. The ringing is heard both when the contact is made and broken ; when the contact is made, the sound emitted is very feeble ; when broken it may be heard at two or three feet distance. The experiment will hardly succeed with small magnets. The first used in the experiment, consisted of three horse shoes, supporting ten pounds. The next one tried was composed of six magnets, supporting fifteen pounds by the armature. The third supported two pounds. In each of these trials the sounds produced differed from each other ; and were the notes or pitches peculiar to the several magnets. If a large magnet supported by the bend be struck with the knuckle, it gives a musical note ; if it be slightly tapped with the finger nail, it returns two sounds, one, its proper musical pitch, and another an octave above this, which last is the note given in the experiment. » *(C.G. Page, 1837)*
  - *Attached references :* Mr. Pétrina (?), *The Electric Harmonica* (1856) ; William Du Bois Duddell (1869-1942), *The Singing Arc* (1899) ; Thaddeus Cahill (1867-1934), *Telharmonium* (1897) ; *Second Telharmonium* (1906) ; Lee de Forest (1873-1961), *Audion Piano* (1915) ; Lev Sergueïevich Termen (Лев Сергеевич Термен) (Leon Theremin) (1896-1993), *Theremin* (1919), *Tersipchore* (1932) ; Maurice Martenot (1898-1980), *Ondes Martenot* (1928) ; Edouard Eloi Coupleux (?) & Joseph Armand Givelet (?), *Automatically Operating Musical Instrument of the Electric Oscillation Type* (1929) ; Adolf Trautwein (1888-1956), Oskar Sala (1910-2002), *Trautonium* (1930) ; Wolja Saraga (1908-1980), *Saraga-Generator* (1931) ; A. Lesti (?) & F. Sammis (?), *Radio Organ of a Trillion Tones* (1931) ; John Cage (1912-1992), *The Future of Music : Credo* (1937) ; Carlos Chávez (1899-1978), *Toward a New Music: Music and Electricity* (1937).

- *Source :* C.G. Page. (1837). *The Production of Galvanic Music.* In 'The American journal of science and arts'. Conducted by Benjamin Silliman. Volume 32, July 1837, pp. 306-307. New Haven : Hamlen.

- **1855 __ The Calliope**
- *Joshua C. Stoddard (1814-1902)*
- *Comment :* "Several years ago, Mr. Stoddard, a mechanic of Worcester, conceived the idea that the bells, by the vibration of whose thin edges the 'steam whistle', in music; and after experimenting for some time he succeeded in constructing a series of bells on which the seven notes of the octave could be played by steam. The desideratum was now to produce a valve sufficiently delicate to correspond with the touch of the performer on the keyboard of an organ. [...] " *(The Cincinnatus, 1856)*
- *Attached references :* William Hoyt of Dupont (?), *music produced by steamboats* (1851).
- *Source :* Anonymous. (1856). *The Calliope.* In 'The Cincinnatus'. Vol. 1, November 1856, pp 522-523. Edited by the Faculty of Farmer's College, Cincinnati.

- **1856 __ The Electric Harmonica**
- *Mr. Pétrina (?)*
- *Comment :* « In 1856, M. Pétrina, of Prague, invented an [...] arrangement, to which he gave the name of electric harmonica, although, strictly speaking, he had no thought of it as a musical instrument [...] : « The principle of this instrument is similar to that of Neef's Rheotome, in which the hammer is replaced by slender rods, whose vibrations produce a sound. Four of these rods are placed side by side, and when moved by keys, and arrested by levers, produce combined sounds of which the origin may be easily shown. » It is true that nothing is said in this passage of the capabilities possessed by these instruments of being played at a distance; but this idea was quite legitimate, and German peridicals assert that it was accomplished by Mr. Petrina even before 1856. It was the result of what I said at the outset : "that electro-magnetism may come to the aid of certain instruments, such as pianos, organs, etc. in order to enable them to be played at a distance.", and I also pointed out the expedients employed for the purpose, and even for setting them at work, under the influence of a small musical-box. I did not, however, ascribe importance to the matter, and it is only by way of historical illustration that I speak of these systems. » *(Theodore du Moncel, 1879)*
- *Source :* Th. du Moncel. (1879). *The Telephone, the Microphone, and the Phonograph.* p. 25. North Stratford : Ayer Publishing Co, 1974.

- **1876 __ Static currents**
- *Thomas A. Watson (1854-1934)*
- *Original excerpt :* « There were no trolley car or electric light systems to send their rattling current-noises into our wire and the only other electric circuits in constant use were the telegraph wires, the currents in which, being comparatively weak and easily recognised as the dots and dashes of the Morse code, did not trouble us. This early silence in a telephone circuit gave an opportunity for listening to stray electric currents that cannot be easily had today. I used to spend hours at night in the laboratory listening to the many strange noises in the telephone and speculating as to their cause. One of the most common sounds was a snap, followed by a grating sound that lasted two or three seconds before it faded into silence, and another was like the chirping of a bird. My theory at this time was that the currents causing these sounds came from explosions on the sun or that they were signals from another planet. They were mystic enough to suggest the latter explanation but I never detected any regularity in tem that might indicate they were intelligent signals. They were seldom loud enough to interfere with the use of the telephone on a short line. A few years later these delicate sounds could no longer be heard for they were completely drowned out when electric light and power dynamos began to operate. I don't believe any one has ever studied these noises on a grounded telephone line since that time, for they could not be so studied today unless a wire were run in some wilderness far from electric light or power station. These currents were probably from the same source as the static that afflicts the modern radio, and the difference in sound may have been due to the fact they were not amplified in the telephone as static is now in a radio receiver. I, perhaps may claim to be the first person who ever listened to static currents. » *(Thomas A. Watson)*
- *Attached references :* Heraclitus of Ephesus (ca - 544-541 BC - ca - 480 BC), *Oracle, Sybil, Pythia* (ca - 500 BC) ; Virgil (Publius Vergilius Maro) (70-19 BC), *Aenis - Oracle in Delos* (-29BC) ; Pliny The Elder (23-79), *The tingling of ears — Paracusia* (ca 77 AD) ; Plutarch of Delphi (ca 46-120 AD), *De Pythiae Oraculis* (ca 100AD) ; Leo the Mathematician (866-912), *Automatons* (ca 900) ; Abbé Nollet (1700-1770), *Ventriloquism* (ca 1750) ; Wolfgang von Kempelen (1734-1804), *Sprachmachine (Speaking machine)* (1769) ; Abbé C. Braun (?), *Acousmate* (1784) ; Mr. Charles (?), *The Invisible Girl* (1803) ; Professor Joseph Faber (?), *Euphonia*

(1846) ; Guillaume Apollinaire (Wilhelm Albert Włodzimierz Apolinary de Wąż-Kostrowicki) (1880-1918), *Acousmate* (1899) ; Gaëtan Gatian de Clérambault (1872-1934), *Vaticinations* (1920) ; Dxing (1920) ; Sigmund Freud (1856-1939), *Traum und Telepathie (Dreams and Telepathy)* (1922) ; Upton Sinclair (1878-1968), *Mental radio* (1930) ; Alvin Lucier (1931-), *Sferics* (1981).

- *Source :* T.A. Watson. (1926). *Exploring Life: The Autobiography of Thomas A. Watson.* Chapter IX, pp. 81-82. New York & London : D. Appleton & Co.

- **1878 __ D'Arsonval galvanometer & galvanoscope**
- *Jacques Arsène d'Arsonval (1851-1940)*
- *Translated excerpt :* « I prepared a frog in Galvani's manner. I took Siemens's instrument of induction, used in physiology under the name of the chariot instrument. I excited with the ordinary pincers the sciatic nerve, and I withdrew the induced coil until the nerve no longer responded to the electric excitement. I then substituted the telephone for the nerve, and the induced current, which had ceased to excite the latter, made the instrument vibrate strongly. I withdrew the induced coil, and the telephone continued to vibrate. In the stillness of the night I could hear the vibration of the telephone when the induced coil was at a distance fifteen times greater than the mnimum at which the excitement of the nerve took place ; consequently, if the same law of inverse squares applies to induction and to distance, it is evident that the sensitiveness of the telphone is two hundred times greater than that of the nerve. The sensitiveness of the telephone is indeed exquisite. We see how much it exceeds that of the galvanoscopic frog's leg, and I have thought of employing it as a galvanoscope. It is very difficult to study the muscular and nervous currents with a galavanometer of 30,000 turns, because the instrument is deficient in instantaneous action, and the needle, on account of its inertia, cannot display the rapid succession of electric variations, such as are effected, for example, in a muscle thrown into electric convulsion. The telephone is free from this inconvenience, and it responds by vibration to each electric change, however rapid it may be. The instrument is, therefore, well adapted for the study of electric tetanus in the muscle. It is certain that the msucular current will excite the telephone, since this current excites the nerve, which is less sensitive than the telephone. But for this purpose some special arrangement of the instrument is required. It is true that the telephone can only reveal the variations of an electric current, however faint they may be ; but I have been able, by the use of very simple expedient, to reveal by its means the presence of a continuous current, also of extreme faintness. I send the current in question into the telephone, and, to obtain its variations, I break this current mechanically with a tuning-fork. If no current is traversing the telephone, it remains silent. If, on the other hand, the faintest curent exists, the telephone vibrates in unison with the tuning-fork. » *(D'Arsonval, research account in the records of the Académie des Sciences, April 1st, 1878, In Theodore du Moncel, "The telephone, the microphone, and the Phonograph", pp. 136-138, 1879, Ayer Publishing, 1974.*
- *Attached references :* Don Francisco Salva y Campillo (1751-1828), *Wireless telegraphy using freshly severed frogs' legs* (1798).
- *Source :* J. A. D'Arsonval. (1879). *Les nouvelles applications et les perfectionnements du téléphone.* In 'Revue scientifique', 1879, 1: pp. 200-212 ; Th. du Moncel. (1879). *The Telephone, the Microphone, and the Phonograph.* pp. 136-138.

- **1879 __ Note on the Invention of a Method for Making the Movements of the Pulse Audible by the Telephone. The Sphygmophone.**
- *Dr. Benjamin Ward Richardson (1828-1896)*
- *Comment :* "The Pulse Made to Speak" -- (From the London "Lancet") -- At the last meeting of the royal society, Dr. Richardson demonstrated the action of a new invention of his own, which he calls the sphygmophone, and by which he transmutes the movements of the arterial pulse into loud telephonic sounds. In this apparatus the needle of a Pond's sphygmograph is made to traverse a metal or carbon plate which is connected with the zinc pole of a Leclanche celle. To the metal stem of the sphygmograph is then attached one terminal of the telephone the other terminal being connected with the opposite pole of the battery. [...] In so moving, three sounds, one long and two short, are given from the telephone, which sounds correspond with the first, second , and third events of sphygmographic reading. In fact the pulse talks telephonically, and so loudly that when two cells are used the sounds can be heard by an audience of several hundred people. By extending the telephone wires, the sounds can also be conveyed long distances, so that a physician in his consulting-room might listen to the heart or pulse of a patient lying in bed (speaking modestly as to distance) a mile or two away. Dr. Richardson described to the Fellows of the Royal Society that the sounds yielded by the natural pulse resemble the two words "bother it". Not a bad commencement for a talking pulse. *(In "New Zealand Tablet", Volume VII, Issue 329, 8 August 1879, Page 14)*
- *Attached references :* Mathieu-François-Régis Buisson (1776-1804), *Auscultation* (1802) ; René-Théophile-Marie-Hyacinthe Laënnec (1781-1826), *On Mediate Auscultation* (1819) ; Hans Berger (1873-1941), *Sonification of brainwaves* (1934) ; Alvin Lucier (1931-), *Music for a Solo Performer* (1965) ; David Rosenboom (1947-), *Brainwave Music* (1975), *Piano Etude I (Alpha)* (1971).

- *Sources :* B.W. Richardson. (1879). *Note on the Invention of a Method for Making the Movements of the Pulse Audible by the Telephone. The Sphygmophone.* In 'Proceedings of the Royal Society London'. January 1, 1879, pp. 29-70 *;* and also : In 'La Lumière Électrique — Journal Universel d'Électricité', 1e série, vol. 1, n°1-12, 1879, Paris : Union des syndicats de l'électricité, Tome 1er, 15 novembre 1879, No. 10, pp. 196-197 ; E. Boughut. (1883). *Traité de Diagonstic et de Sémiologie.* Paris : Baillière et fils.

- **1881 __ Electric ore finder**
- *Comment :* « In a letter received by a Thames resident from a prominent mining man in Westralia reference was made to the new electric ore finder. We quote the following : "About the electrical ore finder - A current of electricity passing through a coil is made to enter the ground at one point in the property, and passes through the earth to another point where a telephone receiver allows observer to estimate the different intensity of sound made by the make and break in the circuit. The sound becomes louder under certain conditions of reef and mineral contents underground, but it is almost impossible to say whether the change in any particular instance is due to a fairly high percentage of iron pyrites or a small amount of gold, which gives practically the same result with the finder." » *(In 'Thames Star', Volume XXXXI, Issue 10687, 16 August 1904, p. 1)*
- *Attached references :* R. W. Fox (?), Metal detector (ca 1830) ; Joseph Henry (1797-1878) & Michael Faraday (1791-1867), *theory of electromagnetism* (1831) ; Heinrich Wilhem Dove (1803-1879), *earliest form of induction balance* (1841) ; Alexander Graham Bell (1847-1922), *experiments in induction balance with the telephone* (1877) ; Prof. David E. Hughes (1831-1900) & William Groves (?), *Induction Balance (I.B.) as a metal locator* (1879) ; George Hopkins (?), *Hopkins electric ore finder* (1881) ; Dr. John Girner (?), *experimentation with locating metallic masses in the human body* (1887) ; Captain McEvoy (?), *electric submarine detector* (1883 & ca 1905) ; London Electric Ore Finding Company Ltd, *Bristish patent of a metal detector* (1902) ; Electric Metal Locating Company of Chicago (and Fred H. Brown (?)), *metal detection* (?) ; Daniel Chilson (?), *electromagnetic radio-detector* (1924) ; George Williams (?), *Radio-Locator* (ca 1925) ; Gerhard Fisher (?), *Metalloscope* (1929) ; Theodore Theodorsen (1897-1978), *instrument for detecting metallic bodies buried in the earth : N.A.C.A Bomb Detector* (1930) ; George Maher (?), *Alpha* (?) ; Engineering Research Corporation, *Terrasearch* (?) ; Goldak Inc., *Radioscope* (ca. 1939) ; J. Evan-Hart & D. Stuckey (?), *Detectorist* (2007).

- **1882 __ Suggestion of electromagnetic radiations sonification**
- *Léon Voirin (1833-1888)*
- *Comment :* Sonification of electromagnetic radiations also appears to be an interesting source of acoustic and musical material. The principle is not new, having been suggested, for example, by the French painter Leon Voirin in Nancy during the 19th century (Voirin 1882; Roger Marx 1883). *(Thierry Delatour)* [Ed. : This source is not verified]
- *Source :* T. Delatour. (2000). *Molecular Music: The Acoustic Conversion of Molecular Vibrational Spectra.* In 'Computer Music Journal'. Vol. 24. Issue 3. September 22, 2000 (Autumn, 2000). p. 46-68. The M.I.T. Press, Massachusetts Institute of Technology. R. Marx. (1883). *L'Art à Nancy en 1882*. Paris, Paul Ollendorf & Nancy : René Wiener et Grosjean-Maupin.

- **1899 __ The Singing Arc**
- *William Du Bois Duddell (1869-1942)*
- *Comment :* Prior to the invention of the incandescent light bulb, arc lamps were used to light the streets. They created light by means of an electrical arc between two carbon electrodes. These lamps also produced a constant audible hum. Duddell was appointed in 1899 to solve this problem. As a result of his research (through which he demonstrated the humming was caused by a fluctuating electric current), he invented the singing arc, which could generate musical notes by way of a keyboard which interrupted oscillations in a circuit, making it one of the first examples of electronic music, and the very first that did not use the telephone system as an amplifier or speaker. When Duddell exhibited the singing arc to the London Institution of Electrical Engineers, arc lamps on the same circuit in other buildings were noticed to play the tones of Duddell's machine [Ed. : by generation of frequencies up to about 1MHz]. Despite the potential of music delivered over the lighting network, Duddell did not capitalize on his discovery as anything more than a novelty. *(Comment under Creative Commons CC-BY-SA license, In Wikipedia: The Free Encyclopedia. Wikimedia Foundation. Retrieved November 4, 2010)*
- *Sources :* G.L. Frost. (2010). *Early FM Radio : Incremental Technology in Twentieth-Century America.* pp. 24-25. Baltimore : The John Hopkins University Press ; M. Babbitt. (1960). *The Revolution in Sound : Electronic Music.* In 'Columbia university Magazine', (Spring 1960) : 4-8 ; and also : In 'Music Journal' 18, n° 7 (1965). pp. 34-35 ; and also : In 'The Collected Essays of Milton Babbitt'. Edited by Stephen Peles with Stephen Dembski, Andrew Mead, & Joseph N. Straus. p. 76. Princeton : Princeton University Press, 2003.

- **1900 __ Die Erweiterung unserer Sinne** (The Extension of our Senses)
  - *Otto Wiener (1862–1927)*
  - *Translated excerpt :* « Is there any phenomenon which works upon neither our natural senses, nor upon their extensions, our present-day instruments and apparatus ? Then, unless it be out of relation with things, must it still be bound up with other phenomena which do work upon our senses or our instruments. Thus it must sooner or later become perceptible to us. » *(Otto Wiener, 1900)*
  - *Source :* O. Wiener. (1900). *Die Erweiterung unserer Sinne.* (Akademische Antrittsvorlesung gehalten am 19,Mai 1900), Leipzig: Verlag von Johannn Ambrosius Barth.

- **1912 __ Optophone**
  - *Edmund Edward Fournier d'Albe (1868-?)*
  - *Comment :* Edmund Edward Fournier d'Albe [...], Physicist, appointed Assistant-Lecturer in Physics at Birmingham University in 1910 where he did research on the electro-optical properties of selenium - the 'reading optophone' used a vertical arrangement of five light sources and detectors that was scanned across printed characters, each detector corresponded to a note on the musical stave with the amplitude indicating the amount of reflected light. [...] *(In 'MANNIN: a Journal of Matters Past and Present relating to Mann (Isle of Man)'. Vol. II, n°1. November 1914. Notes, p. 248. Published by Yn Cheshaght Gailckagh, the Manx Language Society. Editor: Miss Sophia Morrison. Printer: L. G. Meyer, Douglas. May, 1913, to May, 1917)*
  - *Attached references :* Fay Cluff Brown (1881-1968), *Phonopticon* (ca 1912).

- **ca 1914 __ The Gamage Ltd Sound Locator No1 Mk1**
  - *Comment :* The Mk 1 Sound Locator was manufactured by A.W. Gamage Ltd. in Britain during the first World War. In the early days of the First World War, anti-aircraft defence was a totally new field. The detection of unseen incoming aircraft was a major problem. The only possible solution with the technology available at the time was sound detectors, which could provide a rough idea of an aircraft's direction and height based upon the sound of its engine. Tubes connected the bases of two horizontally mounted gramophone-style horns to a pair of stethoscope earpieces. An operator moved the detector until the sound was heard equally in each ear, at which point (theoretically) it would be pointed in the direction of the aircraft. A second operator used the vertically mounted horns to estimate height. The system was rudimentary at best, however, as the location of the aircraft could only be established for the time that the sound was recorded. After a sound contact was made, laborious calculations were then required to properly aim an anti-aircraft gun, and any deviation in the aircraft's flight path rendered the system useless. It was, however, the only system available for detecting the approach of unseen aircraft until the development of radar in the 1930s. *(Entry content by courtesy of the Canadian War Museum, Ottawa, Canada)* — The acoustic location system was an attempt to use means which were independent of visibility. *(In 'Discovery', 1945)*
  - *Attached references : Jean Auscher (?), Acoustic locator (1960).*

- **1919 __ Ur-Geräusch** (Primal Sound)
  - *Rainer Maria Rilke (1875-1926)*
  - *Translated excerpt :* « [...] The coronal suture of the skull (this would first have to be investigated) has –let us assume– a certain similarity to the closely wavy line which the needle of a phonograph engraves on the receiving, rotating cylinder of the apparatus. What if one changed the needle and directed it on its return journey along a tracing which was not derived from the graphic translation of a sound, but existed of itself naturally –well : to put it plainly, along the coronal suture, for example. What would happen ? A sound would necessarily result, a series of sounds, music … Feelings –which ? Incredulity, timidity, fear, awe–which of all the feelings here possible prevents me from suggesting a name for the primal sound which would then make its appearance in the world … Leaving that side for the moment : what variety of lines then, occurring anywhere, could one not put under the needle and try out ? Is there any contour that one could not, in a sense, complete in this way and then experience it, as it makes itself felt, thus transformed, in another field of sense ? [...] The achievements of the microscope, of the telescope, and of so many devices which increase the range of the senses upwards and downwards, do they not lie in another sphere altogether, since most of the increase thus achieved cannot be interpenetrated by the senses, cannot be "experienced" in any real sense ? It is, perhaps, not premature to suppose that the artist, who develops the five-fingered hand of his senses (if one may put it so) to ever more active

and more spiritual capacity, contributes more decisively than anyone else to an extension of the several sense fields, only the achievement which gives proof of this does not permit of his entering his personal extension of territory in the general map before us, since it is only possible, in the last resort, by a miracle. [...] » *(Rainer Maria Rilke, 1919 ; Trans. by Carl Niemeyer)*

- *Attached references :* Jean-Marie Guyau (1854-1888), *La Mémoire et le Phonographe* (1880).
- *Source :* R. M. Rilke. (1919). *Primal Sound & Other Prose Pieces.* Trans. by Carl Niemeyer. Massachusetts: Cummington Press, 1943.

- **1922 __ Optophonetics**

- *Raoul Hausmann (1886-1971)*
- *Comment :* « I wanted to draw your attention to the fact that I developed the theory of the Optophone, a device for transforming visible forms into sounds and vice versa, back in 1922. » *(Raoul Haussmann, In a letter to Henri Chopin dated 23 June 1963)* — « With the appropriate technical equipment the Optophone can give every optical phenomenon its sound equivalent, in other words, it can transform the difference in the frequencies of light and sound. » *(Raoul Hausmann, 1922)*
- *Attached references :* László Moholy-Nagy (1895-1946), *Production - Reproduction* (in 'De Stijl') (1922) ; Abram Room (1894-1976), *Piatiletka. Plan Vélikih Rabot (Plan of Great Works)* (1929) ; Evgeny Sholpo (Е.А.Шолпо) (1891-1951), *Variophone (1930)* ; Nikolai Voinov (1900-1958), *Nivotone* (1931) ; Oskar Fischinger (1900-1967), *Tönende Ornamente (Sound Ornaments)* (1932), *Tönende ABC* (1933), *Lumigraph* (1950) ; Erkki Kurenniemi (1941-), *DIMI-O* (1970) ; David Behrman & Bob Diamond & Robert Watts, *Cloud Music* (1974) ; Yasunao Tone (1935-), *Voice and Phenomena* (1976).
- *Sources :* R. Hausmann. (1922). Optophonetika. In 'Vehsch'-Gegenstand-Object' 3, May 1922 ; J. Donguy. (2001). *Machine Head. Raoul Hausmann and the Optophone.* In 'Leonardo - Journal of the International Society for the Arts, Sciences and Technology' 34, Number 3, June 2001, pp. 217-220. MIT Press ; J. Donguy. (2000). *L'optophone de Raoul Haussmann.* In 'Art Press' n°255, mars 2000.

- **1929 __ Three Places in New England (Orchestral Set No. 1)**

- *Charles Ives (1874-1954)*
- *Comment :* Each of the three movements is named for a place in New England, USA. Each is carefully composed to make the listener feel as though he or she is at that very place, experiencing its unique atmosphere. Ives' use of paraphrasing American folk tunes is particularly important in creating such an effect, as it provides the listener with some sort of tangible reference point from which to access the music. *(Comment under Creative Commons CC-BY-SA license, In Wikipedia: The Free Encyclopedia. Wikimedia Foundation. Retrieved November 4, 2010)* — « II- Putnam's Camp — Near Redding Center, Conn., is a small park preserved as a Revolutionary Memorial; for here General Israel Putnam's soldiers had their winter quarters in 1778-1779. Low rows of stone camp fireplaces still remain to stir a child's imagination. The hardships which the soldiers endured, and the agitation, of a few hot-heads, to break camp and march to the Hartford Assembly for relief, is part of Redding history. Once upon a '4 July,' some time ago, so the story goes, a child went here on a picnic, held under the auspices of the first Church and the Village Cornet Band. Wandering away from the rest of the children past the camp ground into the woods, he hopes to catch a glimpse of some of the old soldiers. As he rests on the hillside of laurels and hickories the tunes of the band and the songs of the children grow fainter and fainter; --when-"mirabile dictu"-- over the trees on the crest of the hill he sees a tall woman standing. She reminds him of a picture he has of the Goddess Liberty, --but the face is sorrowful--she is pleading with the soldiers not to forget their "cause" and the great sacrifices they have made for it. But they march out of camp with fife and drum to a popular tune of the day. Suddenly, a new national note is heard. Putnam is coming over the hills from the center,-the soldiers turn back and cheer. --The little boy awakes, he hears the children's songs and runs down past the monument to "listen to the band" and join in the games and dances. — III- The Housatonic at Stockbridge — Housatonic Church across River sound like Dorrnance. River mists, leaves in slight breeze river bed--all notes and phrases in upper accompaniment ... should interweave in uneven way, riverside colors, leaves & sounds--not come down on main beat ... » *(Charles Ives, "Three Places In New England", program notes on the score)*
- *Attached references :* Ludwig van Beethoven (1770-1827), *Pastoral Symphony op. 68* (1805-1808) ; Walter Benjamin (1892-1940), *Die Wiederkehr des Flaneurs (The Return of the Flâneur)* (1929) ; Henri Bergson (1859-1941), *La pensée et le mouvant (The Creative Mind)* (1934) ; Gaston Bachelard (1884-1962), *L'intuition de l'Instant* (1934), *Droit et Rêverie, Logosphere* (1951), *La Poétique de l'Espace (The Poetics of Space)* (1958), *La Poétique de la Rêverie* (1960) ; Heitor Villa-Lobos (1887-1959), *New York Skyline* (1939), *Symphony n°6 : On the Profiles of the Mountains of Brazil* (1944) ; Pierre Teilhard de Chardin (1881-1955), *Noosphere* (1955) ; Guy-Ernest Debord (1931-1994), *Psychogeography & Theory of the Dérive* (1956) ; John Cage (1912-1992), *Atlas Eclipticalis* (1961-62), *Etudes Australes* (1974-75), *Etudes Boreales* (1978) ; Charles Dodge (1942-), *Earth's Magnetic Field* (1970) ; Henri Lefevre (1901-

1991), *La Production de l'Espace (The Production of Space)* (1974) ; Michel de Certeau (1935-1986), *L'Invention du Quotidien (The Practice of Everyday Life)* (1980) ; see also : program music, descriptive music.

- *Source :* B.G. Tiranny. (2003). *Out To The Stars, Into The Heart: Spatial Movement in Recent and Earlier Music - Antiphonal Space*. In 'NewMusicBox', the Web magazine from American Music Center, published : January 1, 2003.

- **1933 __ La Radia - Manifesto futurista della Radio**, La Gazetta del Popolo, 22 settembre 1933
- *Filippo Tommaso Marinetti (1876-1944), Pino Masnata (1901-1968)*
- *Translated excerpt :* « […] 3. The immensification of space. No longer visible and framable the stage becomes universal and cosmic. 4. The reception amplification and transfiguration of vibrations emitted by living beings living or dead spirits dramas of wordless noise-states. […] 7. An art without time or space without yesterday or tomorrow. The possibility of receiving broadcast stations situated in various time zones and the lack of light will destroy the hours of the day and night. The reception and amplification of the light and the voices of the past with thermoionic valves will destroy time. 8. The synthesis of infinite simultaneous actions. […] 11. Struggles of noises and of various distances that is spatial drama joined with temporal drama. [...] » *(Translated by Stephen Sartarelli in KAHN, D. and WHITEHEAD, G. (ed.), Wireless Imagination. Sound, radio and the Avant-garde, The MIT Press, Cambridge, Massachusetts / London, England, 1992, pp.265-268)*

- **1934 __Art As Experience**
- *John Dewey (1859-1952)*
- *Original Excerpt :* « [...] The ear and eye complement one another. The eye gives the "scene" in which things "go on" and on which changes are projected — leaving it still a scene even amid tumult and turmoil. The ear, taking for granted the background furnished by cooperative action of vision and touch, brings home to us changes as changes. For sounds are always effects; effects of the clash, the impact and resistance, of the forces of nature. They express these forces in terms of what they do to one another when they meet; the way they change one another, and change the things that are the theater of their endless conflicts. The lapping of water, the murmur of brooks, the rushing and whistling of wind, the creaking of doors, the rustling of leaves, the swishing and cracking of branches, the thud of fallen objects, the sobs of depression and the shouts of victory — what are these, together with all noises and sounds, but immediate manifestation of changes brought about by the struggle of forces ? Every stir of nature is affected by means of vibrations, but an even uninterrupted vibration makes no sound; there mus be interruption impact and resistance. Music, having sound as its medium, thus necessarily expresses in a concentrated way the shocks and instabilities, the conflicts and resolutions, that are the dramatic changes enacted upon the more enduring background of nature and human life. The tension and the struggle has its gatherings of energy, its discharges, its attacks and defenses, its mighty warrings and its peaceful meetings, its resistances and resolutions, and out of these things music weaves its web. [...] The eye is the sense of distance — not just that light comes from afar, but that through vision we are connected with what is distant and thus forewarned of what is to come. Vision gives the spread-out scene — that "in" and "on" which, as I have said, change takes place. [...] Sound stimulates directly to immediate change because it reports a change. [...] Sound is the conveyor of what impends, of what is happening as an indication of what is likely to happen. It is fraught much more than vision with the sense of issues; about the impending there is always an aura of indeterminateness and uncertainty — all conditions favorable to intense emotional stir. [...] » *(John Dewey, pp. 245-246)*
- *Sources :* J. Dewey. (1934). *Art as Experience.* Rahway, NJ : The Barnes Foundation Press; New York : Perigee Books, 1980; and also, New York : The Berkeley Publishing Group, Perigee, The Penguin Books, 2005 ; J. Dewey. (1934). *L'Art comme expérience.* In 'Oeuvres philosophiques III', dir. J.-P. Cometti, trad. J.-P Cometti, Ch. Domino, F. Gaspari, C. Mari, N. Murzilli, Cl. Pichevin, J. Piwnica, G. A. Tiberghien, Publications de l'Université de Pau/éd. Farrago, 2005.

- **1939 __ Music as an Art-Science**
- *Edgard (Edgar) Varèse (1883-1965)*
- *Original excerpt :* « At different times and in different places music has been considered either as an Art or as a Science. In reality music partakes of both. H. Wronsky and Camille Durutte (H. Wronsky (1778-1853), also known as Joseph Marie Wronsky, was a Polish philosopher and mathematician, known for his system of Messianism. Camille Durutte (1803-1881), in his "Technique Harmonique" (1876), a treatise on "musical mathematics," quoted extensively from the writings of Wronsky), in their treatise on harmony in the middle of the last century, were obliged to coin new words when they assigned music its place as an "Art-Science," and defined it

as "the corporealization of the intelligence that is in sounds." Most people rather think of music solely as an art. But when you listen to music do you ever stop to realize that you are being subjected to a physical phenomenon ? [...] Let us look at music as it is more popularly considered -as an Art- and inquire: what is composition ? Brahms has said that composition is the organizing of disparate elements. But what is the situation of the would-be creator today, shaken by the powerful impulses and rhythms of this age ? How is he to accomplish this "organizing" in order to express himself and his epoch ? Where is he to find those "disparate elements" ? [...] Preceding ages show us that changes in art occur because societies and artists have new needs. New aspirations emanate from every epoch. The artist, being always of his own time, is influenced by it and, in turn, is an influence. [...] Yet science is even now equipped to give them everything they may require. Personally, for my conceptions, I need an entirely new medium of expression: a sound-producing machine (not a sound-reproducing one). Today it is possible to build such a machine with only a certain amount of added research. [...] *(From a lecture given at the University of Southern California, 1939)*

- *Sources :* E. Varèse. (1939). *Music as an Art-Science.* In Bennington college Alamnae Quaterly, vol. VII, n°I, 1955 ; J.-C. Risset. (2004). *The liberation of sound, art-science and the digital domain: contacts with Edgard Varèse.* In 'Contemporary Music Review', Volume 23, Issue 2 June 2004 , pages 27-54.

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About the author : *Jérôme Joy is a composer, performer and artist. He is currently professor at the National School of Arts of Bourges and co-director of research -with Peter Sinclair- of Locus Sonus, audio in art, research lab. He is currently working towards a PhD student in audio art & experimental music at Laval University Québec (title : Distance Listening & Internet Auditoriums - A new paradigm of the listening into the contexts of networked music and soundart). Recent projects include : networked music performance and telemusic (Sobralasolas !, Sumphoty, etc.), audiovisual net-projects (nocinema.org), net-art and netmusic collectives (The Thing, Collective JukeBox, etc.), noise instrumental & live music. He has played, performed and lectured widely in Europe and internationally.*
http://jeromejoy.org/ http://locusonus.org/