

CHANGES IN THE MUSIC SECTOR UNDER THE INFLUENCE OF NEW TECHNOLOGIES

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FOREWORD

►► The factor, which is significantly changing the image and dynamics of the music sector in all its segments in the past 30 years, are modern technologies. The purpose of the study is not to explain how technologies work because there are enough sufficient specialized sources of information to which the study refers and readers may refer to them in order to understand the text while reading it. *The purpose is to make an attempt to identify, which technologies — including applied ICT¹ — have influenced the way of compositional thinking and thinking about music, performing and realization, spreading, selling and consumption of music and education, i.e. the condition of the music sector, and how they have done it. The study refers to technologies selectively and expeditiously.*

Obtaining information was a problem until 1989 because art, which was influenced or generated by new technologies, was a potential demonstration of an advanced technical level of the regime (at the EXPO exhibition, for instance) but it was definitely, and simultaneously, part of art, which was perceived as experimental, therefore it was connected to creative non-conformist international society in terms of communication. The continuous exchange of information, artists and professionals was strictly limited.²

Nowadays it is necessary to face oversaturation with information of variable quality, to work with it in order to facilitate the insight to the problem for people dealing with related disciplines in need of a comparison, or people who are concerned with a certain activity in non-technical disciplines, yet they have no capacity of embracing a changeable dynamic complex of the music sector. In the 20th century, music industry had rather fixed processes related to major labels (majors³) and public media, but, since the early 21st century, it has significantly become vivid, diversified and networked.

The purpose and the most difficult part of the study is to identify potential benefits/opportunities and risks of current trends, which could change their popularity and importance through the change in a context or a point of view. It is

1 ICT = Information and communication technologies. This term is also used by the Czech Statistical Office (NACE 21).

2 DOHNALOVÁ Lenka (2001) *Estetické modely evropské elektroakustické hudby a elektroakustická hudba v ČR*, PF UK Praha, chapter K historickému, politickému a kulturnímu kontextu, p. 153 ad.

3 https://cs.wikipedia.org/wiki/Major_label

most difficult due to a short hindsight from ongoing changes and overall changes in the art discourse, in which the discussion on values in production has transformed into discussions about how an artist or company can win through on a quantitatively bursting music market.⁴ The study evaluates short historical experience and information from contemporary professional press, which deals with testing devices and software, marketability of products, visitor's rates and audience's preferences. It is not based on statistic research as such. However, the output of the discussions led by the professionals in the field is that a generalizing axiological approach may be useful.

The author continues in her previous specialized work, especially in her PhD thesis *Aesthetic Models of European Electroacoustic Music and Electroacoustic Music in the Czech Republic*⁵ and the CD-R *Catalogue of Czech Autonomous Artistic Music as a Database with Acoustic Incipits*⁶. It also draws up on authors' comments on applied technologies and composition strategies at the international composition competition *Musica Nova*⁷. Regarding the topic of spreading and consumption, it draws up on studies on music industry as part of the research performed by the Arts Institute such as *A Study of the State, Structure, Conditions, and Funding of the Arts in the CR* and *Czech Cultural and Creative Industries Mapping*, which also include a summary of international state of things and trends.⁸ The footnotes of the English version are abridged as most of them refer to Czech information sources and literature. Quotes from foreign sources are in author's own translation.

4 RANTASHA Peter (2013/14) *Aesthetics of the Digital Revolution. Listening to a Post-Digital World*, in *Sounds in Europe*, No. 9, p. 12.

5 DOHNALOVÁ Lenka (2001) *Estetické modely...* (sold out), information in: review: M. Haase, *Opus musicum* 3/2001, http://www.lenkadohnalova.cz/recenze_opus_musicum.pdf

6 Praha 2002. VaV MK ČR. RIV/2002/MK0/DOHNA2/N/1:1 http://www.isvav.cz/resultDetail.do?rowId=RIV/68003684:____/02:0000001!RIV/2002/MK0/DOHNA2/N. It comprises of work analyses and sound incipits. Czech-English version.

7 <http://musicanova.seah.cz/>. The author has been the manager of the competition and a member of the jury since 1999.

8 VaV MK ČR, DD06P03 OUK 002 (2006-11) a DF 11 P01VV 031 (2011-15). Chapter *Hudební průmysl* pp. 190-231.

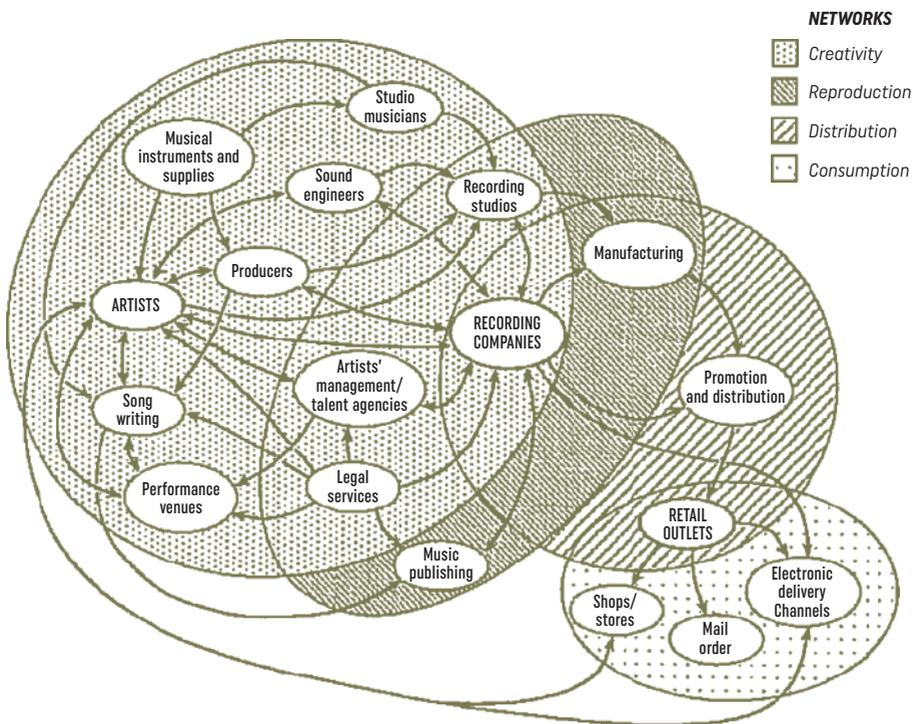
INTRODUCTION

►► The general introduction of the study describes a framework of the music sector; detailed information and lines of reasoning are to be found in the following chapters. Regarding catalysts of the sector change, the chapter on a new way to spread recordings is essential. However, the introduction highlights definitions of some used terms in links.

The frequently used *Leyshon Model* (2001) roughly describes segments and relationships in the music sector.⁹

LEYSHON MODEL OF THE MUSICAL INDUSTRY (2001)

The musical economy as a networked economy



⁹ in Cultural and Creative Industries Mapping, ed. ŽÁKOVÁ Eva, IDU, p. 193. Original source: WINKSTRÖM Patrik (2013) *The Music Industry. Digital Media and Society Series*, 2. rev., Polity Press, Cambridge. Further in LEYSHON Andrew (2014) *Reformatted. Code, Network, and the Transformation of the Music Industry*, Oxford Univ. Press.

By 2009, the global coverage of high-speed internet was virtually completed¹⁰ as well as the expansion of social networks and mobile technologies¹¹ — smartphones with relatively high-quality music playback (after 2013, in particular),¹² download, stream and cloud¹³ services, therefore the model has changed, too.

With the support of ICT, the key creative source of the system — authors and performers¹⁴ — can also choose the strategy of the direct contact with end users through, e.g., promotion (gathering and registration of fans on *Facebook*, *Instagram* and others) or monetization (crowdfunding¹⁵, direct payments for products and services on personal or community websites and others). With global reach, they can also work interactively from “home office” due to automated e-marketing. It is just one of the new possibilities and we must consider its pros and cons in specific cases. The music sector is distinguished by workforce mobility, so the trend of the development of mobile technologies and mobile applications is relevant.¹⁶

Speaking of spreading, the possibility of quick and massive sharing of information and cloud services complicated the control of processes in the sector “from the outside”. A question of an efficient degree of control was raised as it cannot criminalize big groups of people (mostly the young gen-

10 According to the *Czech Statistical Yearbook 2015*, 72.4 % Czech households had internet connection (93.7 % families with children). More than 90 % in the group up to the age of 44 uses the internet and more than 99.7 % students are familiar with the internet as well. According to the IDC prediction, Central and Eastern Europe can see the growth in expenses for mobile technologies. It should reach 82.5 billion USD on the market in 2019.

11 The most frequently used social network for the purpose of the music sector is currently Facebook (since 2004) with almost 1 billion registered users (6/2013). https://cs.wikipedia.org/wiki/Sociální_sítě and Youtube with more than 1 billion users (one third of all internet users), mostly due to the Vevo project (see chapter SPREADING) in: <https://www.youtube.com/yt/press/statistics.html>

12 https://play.google.com/store/apps/category/MUSIC_AND_AUDIO/collection/topselling_free
<https://www.androidpit.com/top-5-best-apps-for-downloading-free-music>

13 https://cs.wikipedia.org/wiki/Cloud_computing

14 A former term „Interpreter” of latin origin has been preferred in classical music field, while the term “performer” is used for the pop and jazz music fields, as they are both linked to the Anglo-Saxon culture.

15 <https://en.wikipedia.org/wiki/Crowdfunding>

16 According to Microsoft in the Czech Republic, out-of-office work is relatively less frequent than in Europe (42 % in the CR compared with 51 % in Europe), but music agencies in the Czech Republic are very small, therefore the trend of the development of mobile technologies and applications is still important for them (source: ICT Revue, supplement of Ekonom magazine, 28 April — 4 May 2016).

eration) for illegal personal consumption or slow consumption down when applying user's discomfort (discussions about DRM)¹⁷.

Generally speaking, the music sector is currently considered dynamic, technologically progressive, yet unbalanced from the sustainability point of view. Most professionals agree that balance cannot be established by legislative norms only but technologies as such, which have given new opportunities and risks, are trying to solve the situation in a more elegant manner than using legal and technological conservatism, which was originally strictly promoted by the majors. Advocates of new ICT in management often justify the economic slump in music industry with initial inflexibility of traditional organizations. This fact is being discussed at international interdisciplinary platforms (*MIDEM*, *WOMEX*, *ClassicalNEXT*, *EUROSONIC* and others) and we can also find it in *IFPI* (International Federation of Phonographic Industry) news and copyright organizations.¹⁸ Imbalance occurs in the way royalties are assigned to the artists and performers (see chapter *SPREADING*) and due to great competition in music distribution and sale services, which companies compensate by territorial expansion, mergers, co-operation with other sectors and support of other technological innovations.

The *Music Working Group*,¹⁹ a brainstorming group of European Commission professionals, held a meeting in December 2015, and created a summary and a map of the sector with its priorities mostly with respect to ad-

17 https://en.wikipedia.org/wiki/Digital_rights_management

18 www.midem.com; DOHNALOVÁ Lenka, *Hudba jako tržní artikl*, *MIDEM 2014*, in Harmonie 4/2014; in: <http://www.casopisharmonie.cz/blog/lenka-dohnalova.html>.

19 The members of the Music Working Group, which was established as a result of approaching 47 European institutions, are: Alex Branson (INgrooves), Alexander Schulz (Reeprebahn Festival), Alison Wenham (AIM), Allan McGowan (Vip News, IQ Magazine), Allen Bargfrede (Re-think Music, Berklee College), Anna H. Hldibrandsdottir (Nordic Music Export), Audry Guerre (Réseau Live DMA), Benjamin Constantini (Connector Studio, Berklee College of Music), Burak Ozgen (GESAC), Chris Ancliff (Warner Group), Christof Huber (Open Air St. Gallen Festival), Didier Zerath (DZ Factory Ltd.), Dirk de Clippeleir (Ancienne Belgique), Emmanuel Legrand (Music Weeks, Legrand Network), Fabien Miclet (Liveurope), Frances Moore (IFPI), Francois Missonnier (festival Europavox), Helen Smith (IMPALA), Hervé Riesen (Radio France), Ian Smith (Creative Scotland, ISPA), Jake Beaumont-Nesbitt (IMMF), Jerome Delhaye (Reed MIDEM), Keith Harris (PPL), Laurent Langlois (Int. konsultant on strategies to classical music, dance and opera), Laurent Marceau (Eurosonic EBU), Lorenzo Ferrero (CIAM), Ludovic Pouilly (ESML), Manfred Tari (Pop 100), Marco Mencoboni (Cantar Lontano Festival), Michel Lambot (PIAS), Olivia Regnier (IFPI), Patrick Agenr (ECSA), Paul Pacifico (FAC, IAO), Peter Smidt (EuroSonic Noorderslag), Silvina Munich (CISAC), Sophie Goossens (August&Debouzy Avocats), Veronique Desbrosses (GESAC), Vincent Carry (Nuits Sonores festival), Vincent Sneed (Ass. of European Radios), Vincenzo Spera (Assomusica), Virginie Sautter (Reed MIDEM), Will Page (Spotify). Brainstorming of the group was led by Karel Barták — the DG for Education and Culture in Creative Europe programme.

ministration (subsidiarity, proportionality, decision making regarding the content of culture and education at a national level) and EU values.

Compared with previous materials, the document highlights the principle of a creative content value and artist support. Priorities of one of the crucial supporting programmes (Creative Culture) were developed as follows: *“In addition to its traditional ‘mandates’ such as audience development, intercultural dialogue, mobility of artists and social cohesion, the programme (i. e. Creative Culture) is responding to demands for EU support to go further in terms of driving creation and empowering creators by helping them make a living.”*²⁰ *“...Mainly for the representatives of individual music creators, the ‘value gap’ reverses not only to the gap that might exist at the level of content distribution, but also the one that exists in their opinion, at the level of content creation/acquisition where creators are not able to play by the same rules as a result of their huge difference in bargaining power and relative isolation when dealing with “the industry”.*²¹

In the map created by professionals²², the topic *“Digital transition. Reinventing the Music, Experience in the Digital Age”* is directly linked to the support of direct electronic marketing (e-commerce) for the creative part, and facilitation of neutrality in licensing and managing the copyright. Technological innovations should also create new unexpected opportunities in infrastructure, contribute to better communication with audiences and administration of funds. It does not deal with a direct link of technological innovations and education of authors and audiences in contents (e-learning, workshops for using technologies in production and interpretation) probably because this segment is managed nationally. The deficiency is now reflected in specification of calls for structural funds — at least in the Czech Republic.

The dynamics of the sector is generally influenced by the following relations professionalism (and its part — star top) vs. mass amateurism in pro-

20 Music Working Group, Brussels — Ancienne Belgique, 10–11 Dec. 2015, Summary Note, Introduction.

21 Ibid. chapter. 5.1.

22 *The AB MUSIC, Working Group Report*, December 2015 — June 2016, pp. 55–56 https://ec.europa.eu/programmes/creative-europe/sites/creative-europe/files/ab-music-working-group_en.pdf. Main activities in the map: 1) Culture policy linked to the copyright reform; 2) Data of the Global Repertoire Database and data of the social network, not linked to the stream of education; 3) Education, training and professionalization of authors and performers. Especially the marketing tools are underlined; 4) Support of creativity linked to the education and access to data about digitalisation and innovations; 5) EU umbrella music organisation with emphasis on the export out of Europe.

duction and performance, a more direct influence of fans on production, availability vs. control in production and monetization, the need to have something available or to own or rent something in the consumption segment.²³ The character of the polarities reveals that it is not only about the situation in music industry but these are problems related to culture and its values, and include a different angle concerning professionals and generations, which resonate in some sorts of music (those linked to modern technologies) more strikingly than in others.

23 Compare with: WINKSTRÖM Patrik (2013) *The Music Industry. Original Media and Society Series*, 2.ed. Polity Press, Cambridge.

TECHNOLOGY IN PRODUCTION

Technology is not dead ballast in fact...
it is the proverbial mirror,
in which imagination is created.

(P. Boulez, *Musikdenken heute*, 1963)

Music is a kind of art, which has been significantly influenced in the historical development by the *technology²⁴ of production of musical instruments*. What might look like a manifestation of specific ethnic traditions or author's ingenuity is often rather a practical development derived from the material choice, construction options and mechanics of operating musical instruments²⁵ or the linguistics/system code, or later also the selection of types of microphones, their placement, studio equipment or software (a typical sound of specific studio).

The background of author's approach to instruments or technologies in art conceals a *creative philosophical opinion*, which is not always fully realized and is:

- a/ more *functionalist* — when the author/performer treats the material, instruments and physiological dispositions in accordance with their qualities in order to find out and work out the maximum. Potential experiments focus on uncovering and multiplying natural dispositions,
- b/ more *phenomenological* — it primarily draws on a purely acoustic image (the sound of natural or social events) or
- c/ more *symbolic and semantic*, when the author uses and directs the means to some non-musical meaning or intertextuality. As a result, the author may use the means in an extreme, unnatural or destructive way.

24 The term “technology” is used in its general meaning here (from Greek *techné* — knowledge, skill), like a production process or an output of such a process (“modern technology”).

25 *Instrumentation* examines the relation of composition and technical dispositions of the instruments. The appropriate combination of instruments in an orchestra is examined by *orchestration*. The word instrumentation is used in a broader sense. In the Czech Republic, the *Musical Acoustic Research Centre* at the Sound Studio at HAMU deals with basic research in acoustics, music instrument acoustics and psychoacoustics in the long run <http://zvuk.hamu.cz/vyzkumnecentrum.php>. The summary of works of the centre: see SYROVÝ, Václav (2015), *Hudební zvuk*, AMU Praha, *Hudební akustika* (2008), revised edition, AMU Praha.

The semantic purpose is incorporated either in sound or behavior of the performer, operation of the instrument²⁶, or

- d/ *the principle of a play* dominates in it. Music is perceived as part of a certain situation, in which the fact of “making” or “happening”²⁷ of music and relationships amongst players, a player and an instrument/equipment, a player and an audience, is important. Finally, we should also mention a way, which
- e/ is connected to *spontaneity* and primary *unfamiliarity* with the character of instruments or devices, which can, as a consequence, generate new effects, which are later imitated and which create styles.

We must understand the outlined classification like a scale, as a primary focus of the author, style or work.

Looking through the history, composers that would fit the first-type category are Antonín Dvořák, Pyotr I. Tchaikovsky or Hector Berlioz — these are composers famous for their instrumentations and orchestrations.²⁸ The sound of their orchestra is full, balanced and well-structured, the music is played naturally by the musician, as the sounds are not masked. The acoustically good and natural sound combinations developed into fixed instrument sets (orchestras, choirs, chamber ensembles) that have been modified in the course of history.

Focus to a certain character and quality of sound can be found as a concept in music impressionism, some works by Olivier Messiaen, Iannis Xenakis or spectral music.²⁹ Speaking of their knowledge of acoustics, the authors look for the way how to achieve a certain acoustic idea. Sometimes the ideas behind it are scholarly argumentations (references to a harmonic spectrum, mathematic models) or an explanation within currently dominating paradigm, which seems to be metaphysical (acoustic regularities as one of the demonstrations of regularities of an universal order).³⁰

26 *Instrument Destruction*, Wikipedia, in: https://en.wikipedia.org/wiki/Instrument_destruction

27 “*Happening*” is a term for a segment of sound art, which lets other acoustic processes, amplified by resonance, happen naturally through installations (authors: Alvin Lucier, Max Neuhaus, Bill Fontana, Nicola Bašić and others).

28 Hector Berlioz was the first author, who systematically distinguished between instrumentation and orchestration in *Grand traité d'instrumentation et d'orchestration moderne*, 1844.

29 FINEBERG Joshua (2000) *Guide to the Basic Concepts and Technique of Spectral Music*, in: *Contemporary Music Review 2000*, vol. 19, part 2, pp. 81–113.

30 Speaking of contemporary composers, such a development is demonstrated in the work of K. Stockhausen (1928–2007): “*Each object in the world, even a smallest atom, produces waves,*

A symbolic and semantic treatment of instruments can be found mainly in rituals and ritualized music (even in popular music with numerous links and symbols in musicians' image and behavior — manipulation with the guitar, microphone and others; music should make the impression of social magic) or in program, film or scenic music. In this case, instruments can be used extremely in order to evoke a strong emotional or mental state,³¹ to express their adoration or a critical approach to music or reality. We encounter this approach in European music in expressionism, avant-garde, New Music, hard rock, underground subcultures, experimental electronics and others, when the artists want the sound to be artificial, rough, coarse, empty, disorganized or overflowing because of expression and sense. This approach may symbolically express an irony or protest against the mainstream acceptable from the point of view of taste, or to imitate various life qualities from an iconic point of view (sexuality, loudness and social isolation, adoration or resistance to technology, the lack of eco-friendliness of our lives and others), to emphasize or overcome the differences between the world of people and nature (the “raw and cooked” Claude Lévi-Strauss).³²

Nowadays, the principle of a play (playfulness) is frequently linked to interactivity and improvisation. Lately, it has been connected with the development of new electronic touch and sensory tools for laics and children,³³ or it expresses a detached view of technologies being virtual, thematization

which can be transformed into acoustic waves... There is basic periodicity in the whole cosmos... A music composition should reflect the universe (in: STOCKHAUSEN K. (1978), *Texte zur Musik 1977-84*, Bd. 4, . 405;), translated by LD

- 31 SHAMAN Leah, DINGLE Genevieve A. (21.5. 2015): Extreme Metal Music and Anger Processing, in: *Frontiers in Human Neuroscience*, <http://journal.frontiersin.org/article/10.3389/fnhum.2015.00272/full>
- 32 STRAUSS Cl. Levi (2006) *Mythologica 1. — The Raw and the Cooked* (1964). This topic is not the subject of the study but we may speak of a semantically motivated deformation approach to instruments, like with the “*prepared piano*” from 1928 ad. J. Cage; at the beginning of the concrete music (the early 1950s), when more extreme instrumental sounds were sought; Milan Knížák's *Broken Music*, in which he used mechanically damaged LPs long efore its style fixation in DJs (1963-64); primitive utilization of instruments in the 1960s and 1970s underground (*Plastic People of the Universe*, DG 307); the sound of *industrial* (since the 1970s), *gore-grind* (sound imperfection and deformation), *glitch music* (faults in electronics), *hardware hacking* and others. More information: REEVES Chris (2011) *Destroyed Music (After Milan Knížák)*, in: <http://classic.rhizome.org/artbase/artwork/53428/>
https://en.wikipedia.org/wiki/Noise_music
[https://en.wikipedia.org/wiki/Glitch_\(music\)](https://en.wikipedia.org/wiki/Glitch_(music))
- 33 The project *Reactable* by S. Jord, G. Geiger, M. Kaltenbrunner and M. Alonso from Barcelona University, may be a nice example, quoted from FLAŠAR Martin (2015) p.107.

of “manufacturing” or ironization of hardware or software functions.³⁴ The projects dealing with art/science/game, which clarify how certain technologies (like a lossy MP3 compression) work, are created.³⁵ Installations and sculptures rank among different types; they amplify vibrations and resonances of natural processes (air flow, sea waves, sounds of the Earth, vibrations of wood, trees, strings and the like).³⁶ To a certain extent, this principle exempts art from its socially critical roles, which are emphasized in modernism, and opens it to a broader ecological perspective.

The last option is using tools spontaneously or in an unknowledgeable manner, like in folklore, early jazz or underground, when a performer wants to find out how to create sound or s/he uses established practice of different instrumental traditions (like in early jazz), therefore other options, which are intentionally used later like those creating styles (traditional blues), can be revealed. All the approaches are present in a modified way in using technologies, especially when doing acoustic “ready-mades”.³⁷

Pierre Schaeffer's typology (1966) may be useful for possible typology of current aesthetic approaches of authors to works. Schaeffer is one of the founders of electroacoustic (EA) music³⁸, used by his followers (Michele Chion, for instance)³⁹. EA differentiates between

34 Nicolas Collins's “*Hardware Hacking*”, see his (2006, 2009) *Handmade Electronic Music — The Art of Hardware Hacking*, Routledge, NY. Hans W. Koch's projects (the most famous *Benchmark Consort*, <http://www.hans-w-koch.org/video/benchmark.html>).

35 The PhD student of composition and computer technologies at Virginia University created the project “*The Ghost in the Mp3*”, in which he used sounds reduced during compression (here demonstrated on a Suzanne Vega's *Tom's Diner*, in: VEIX Joe *All the Ghostly Sounds That Are Lost When You Compress To mp3*, http://www.deathandtaxesmag.com/237292/all-the-ghostly-sounds-that-are-lost-when-you-compress-to-mp3/?utm_source=share-fb&utm_medium=button

36 Examples of sound art: *Music on a Long Thin Wire* (1977) by Alvin Lucier, also presented at the Ostrava Days — New and Experimental Music Festival 2015, Max Neuhaus's *Time Square* (1977–92) (amplified sound of subway ventilators), Bill Fontana's *Harmonique Bridge* (2009), sounds of the Millenium Bridge, see <https://www.youtube.com/watch?v=L2KO38Z-2SU>; Christina Kubisch's *Il respiro del mare* (1981), Jakob Kirkegaard's *Eisenwind* (2006) with the resonating railings in Köln, *Sea Organ* (2005) by architect Nicola Basić in Zadar and others.

37 Currently *Das erste Wiener Gemüeorchester*: <https://www.youtube.com/watch?v=pwOXFOTagSE&feature=share>, Czech band *Jablkoň* — <http://www.jablkon.com/>, Tomáš Žižka (the teacher at DAMU-KALD) playing a root http://www.chr.nipax.cz/hrajeme_si_s_hudbou.cz and others.

38 P. Schaeffer's typology (1910-95) was influenced by his theoretical interest in anthropology, especially structuralist anthropology of Claude Lévi Strauss, in linguistics (we can find references to R. Jakobson and French structuralism), informatics (W. Meyer-Eppler, A. Moles), gestaltism and phenomenology (A. Husserl), semiotics (F. de Saussure, J. Molino and others). Schaeffer was also a writer. More information: in: DOHNALOVÁ Lenka (2001): *Estetické modely elektroakustické hudby...* pp. 29–55).

- 1/ *causal listening*, when we understand sound as an index of a source,
- 2/ *semantic listening*, which primarily refers to a certain code/language /message, which is yet another aspect of routine listening and creative intention (in postmodernism, we may often find a strategy of the code play within a work or among works with regard to a various degree of listener's knowledge, especially being inspired by semiotician Umberto Eco⁴⁰),
- 3/ *reduced listening* (phenomenological or aesthetic, in fact), which primarily focuses on sound parameters regardless sources or functions. This approach was an inseparable part of the methodology of classification of new music material and its biggest advantage is composing from what is heard, not "making" music⁴¹.

With regard to further development, we could complete the classification (on a rather different logical level) with

- 4/ *pragmatic (according to the semiotic terminology) interactive attitude*, in which a performer and sometimes a listener are part of a creative situation — be it a performance or an installation. The key strategy here is the principle of a "game", when "rules of the game" may change in the course of time. The aforementioned types of listening and creator's intentions may alter. Music then serves as both art and the field of research of non-verbal communication.⁴²

39 CHION Michel red. (1976) *La traité des objets musicaux 10 ans après*. Cahiers Recherche Musique, N.2. CHION Michel (2015) *Sound: An Acouological Treatise*, Duke Univ. Press, in French 1998, <http://sonic-terrain.com/2015/11/sound-an-acouological-treatise-new-book-by-michel-chion/>

40 The deliberate references to inspiration by U. Eco and his semiotic constructions can be find in P. Boulez's work when composing *Répons*. The author explains it in the article *Répons: un miroir pour l'histoire*, in: *le Monde de la Musique*, N. 77, avril 1985, p. 78-83, and the in the essay *Le système et l'idée*, in: *InHarmonique* N.1, 1986, p. 74. More information DOHNALOVÁ Lenka: *Estetické modely evropské elektroakustické hudby...* p.110-112.

41 Based on reduced listening, first classifications of new materials took place in *Groupe de recherche musicales*. This period was reflected as "enlightening" even by composers advocating a different aesthetic opinion (K. Stockhausen, for example). See DOHNALOVÁ Lenka (2001) *Estetické modely evropské elektroakustické hudby...* p. 58.

42 LEMAN Marc, DEMEY Michiel, LESAFFRE Micheline, NOORDEN Leon van, MOELANTS Dirk (2009): *Concepts, Technology, and Assesment of the Social Music Game "Sync-inTeam"*, in: International Conference on Computational Science and Engineering, p. 837-841, IPEN, Dept. Of Musicology, Ghent University, Belgium.

CHANGES IN ONTOLOGY OF CREATION AS A CONSEQUENCE OF NEW TECHNOLOGICAL OPTIONS

Let us draw attention to several technological innovations, which have left their marks in the change of understanding the essence of music since the mid-20th century. With hindsight, some innovations seem to be more fundamental (and vice versa) than they were at the time of their arrival. The sequence is methodical rather than chronological (some innovations happened at the same time). We also mention the branch of production, which is directly influenced or generated by technologies because there is always a simultaneous creative trend, which follows traditional instrumental possibilities or it intentionally defines itself negatively against technologies. In the chapter dedicated to interpretation/performance and production, we may see that these acoustic trends use technologies in recordings or when installing a sound system in spaces, which are unsuitable for live performances. Every fundamental technological “transition” has schematically described main strengths and risks of being used in art in the way we understand art in Euro-American environment, i.e. as a field of free and individual production, although technologies rarely prepare the way for collective works, and institutions tend to “programming” individual free creativity by the character of the contracts, grants or project focus (i.e. the power of institutions reflected by Michel Foucault, for instance).

I. PURPOSEFUL USE OF SOUND RECORDING⁴³ FOR PRODUCTION (since about 1948)

At first, sound recording was used in the practice of so-called *concrete music* (France, since Pierre Schaeffer), *music for tape* (USA, since John Cage), later in *soundscape*⁴⁴ (the founder is Raymond Murray Schafer from Canada)⁴⁵ or

43 About the history of a recorder, its functions and types: <https://en.wikipedia.org/wiki/Magnetophon>. In the Czech Republic, the studio in Czech Radio Pilsen was equipped with a four-track recorder in 1968, an eight-track recorder in 1970 and later a 16-track recorder. SEAN (30.9.2014) *The Top Best Portable Audio Recorders*, <http://www.wirerealm.com/guides/top-10-best-portable-recorders>

44 *Soundscape* is, in fact, environmental sound mapping, i.e. field recordings that can be adapted by artists. They are part of acoustic ecology.

45 About terminology — see DOHNALOVÁ Lenka (2001) *Estetické modely evropské elektroakustické hudby...* FLAŠAR Martin (2015) *Elektroakustická hudba*, university textbook, FF MU Brno.

radioart.⁴⁶ The aesthetics of the first period is defined by the potential of the audio tape.

BENEFITS/OPPORTUNITIES

- A/ extension of the music material** the composer could work with for
- a) non-musical real sounds of nature, cultural environment,
 - b) field recordings of ethnical cultures, folklore,
 - c) new, synthetic sounds.

At first, being prospective artistic material, music potentially absorbed all sounds from natural sources or existing musical instrument; artificially generated, synthesized or modeled material was included later. Then music started to work with inhomogeneous and yet non-systemized⁴⁷ material with a various degree of complexity and syntax ranking from traditional forms to brand new ones (mathematic modeling⁴⁸, the conversion of the visual into the acoustic etc.), which is quite an essential change. *Music became a potentially open, complex and multi-code acoustic art.* This step is comparable to gradual dissemination of material and syntax on other kinds of art. The founder of concrete music Pierre Schaeffer spoke about “*the necessity of revising*”⁴⁹ the Euro-centric paradigm of music under the influence of technologies.⁵⁰ At the start of expansion of new technologies, Pierre Boulez maintained the opinion of “*a thorough revision in the field of music*” like Schaeffer did, although Boulez has a different point of view. Similar thoughts on a necessary revision can be found in *Fluxus* (the influence of J. Cage and dada).

- B/ Music production updated its *contact or penetration with science and research***, which is a benefit and risk at the same time.

Since 1948, workplaces dedicated to research of sound, development of devices, music hardware and software, psycho-physiological and infor-

46 RATAJ Michal (2007) *Elektroakustická hudba a vybrané koncepty radioartu*, Kant, Praha.

47 The effort to classify material of “sound objects” and other methods according to various criteria started immediately. See DOHNALOVÁ L.: *Estetické modely evropské elektroakustické hudby...* p. 35-47.

48 *Combining Math and Music to Open New Possibilities* (25 August 2014), source Univ. Of Chicago, in: Science Daily, <https://www.sciencedaily.com/releases/2014/08/140825185317.htm>

49 Schaeffer P. (1966) *Traité des objets musicaux*, Seuil Paris, p. 15

50 In: Schaeffer P. (1959) *La musique expérimentale*, p. 165; reprint in: *La Revue musicale* 1977, p. 303-305.

mation research linked to music and audiovisual production started their mass formation.⁵¹ The object of research is not only basic research on functions of sound in various environments, its storage, transfer, effects on organisms and humans, but on applied research regarding the production and research of acoustics of instruments, devices, hardware, software, manipulation with sound, coordination with visual and motion parts etc.

According to the concept of Pierre Schaeffer, the founder of one of the first workplaces of its kind, composition work was supposed to be preceded by collective research, i.e. reduced listening and classification of sound objects (“*objets sonores*”), performed by an interdisciplinary team. The potential result ought to be an universal music morphology.⁵² The model and methodology was criticized as ponderous and inadequate, and soon relativized by the author himself. Acoustic, psychoacoustic, ET and IT research continues at other workplaces (*The Research Institute of Radio and Television* was founded at that time in the Czech Republic, *Sound Laboratory* at the Academy of Sciences was founded in 1965). A model classification of the research has been found at another renowned research institute — *Institute de Recherche et Coordination d’Acoustique et Musique* (IRCAM) in Paris (since 1974, founded by P. Boulez); An exemplary case of the relationship between the fundamental and applied research, and art praxis.⁵³ In any case, the idea of a scientific basis of music (acousto-mathematical) is not new.

From the 1950s to the 1970s, other workplaces were founded by media or universities with the origin of brand new research institutes. Some of them exist until now, although they are more project-oriented.⁵⁴ In the Czech Republic, the most productive public research institute in this field

51 The oldest in Paris is Schaeffer's *Club d'essai de la R.T.F.*, since 1959 transformed into *Groupe de Recherches Musicales/tj. GRM*, since 1975 transformed into *Institute National de l'Adiovisuel et Groupe de Recherches Musicales, tj. INA-GRM*, since 1974 it is *Institute de Recherche et Coordination d'Acoustique et Music (IRCAM)*.

52 “I say that my utopia or ‘program’ suffered from too much hurry, when I wanted to devise a universal language in the form of grammar and syntax — something like language Esperanto. Why is it not possible in music? Because individual music pieces, various kinds of music are untranslatable and unpredictable. They cannot be generalized.”, in: Schaeffer P. (1977) *Ecrire sure la musique*, in: *La Revue Musicale* N. 303-305, p. 198, translated by LD

53 Fundamental research included: 1) research and the development of hard- and software technologies (the first advisor was M. Mathews), 2) research of acoustics, acoustic sources and space acoustics, psychoacoustics, 3) research of the analysis and synthesis of sound, 4) research of symbolic representation and fixation of production, 5) informatics, 6) production in studios, 7) pedagogy. This division designed by P. Boulez is meaningful.

54 A selection of public workplaces in FLAŠAR Martin (2015) *Elektroakustická hudba...*

is probably *Musical Acoustic Research Centre*, a large number of works on a specific relation between technologies and music are done at the *Masaryk University in Brno*,⁵⁵ specialized ICT works are produced at the respective faculties of the *Czech Technical University*.

It is important for the authors, in what extent these institutions influence their own production: whether they inspire it or violate it (what are the conditions and opportunities to work in these institutions). These institutions create a kind of “company style” by the development of new products (by public institutions or private companies) and their testing by established authors. The development may be shaped by hardware or software equipment and sound libraries, or by specialization of a group of professional workplaces (the development of acoustics, interactivity, new sensors, multimedia etc.).

C/ *The audio tape has changed the character of the creative process.* The composer could accelerate, decelerate or transpose the piece, to reverse the course of sound, to edit and layer in the extent that was unthinkable regarding classic instruments. The basic kind of work was *editing and montage*, or micro-montage — an example may be the first composition of Karlheinz Stockhausen on a millimeter magnetic tape in GRM *Etude aux mille collants* (1952)⁵⁶. Music, which was processual by definition, was fixed, therefore sounds could be analyzed and manipulated better (see B).⁵⁷ Editing and montage have influenced music thinking in the future development of audio production.

55 Other institutes that were established in the 1950s: *Columbia — Princeton Electronic Music Center* in NY, *WDR Studio* in Köln, *Fonologic Studio* in Milan, *NHK Studio* in Tokio, others in Munich, Eindhoven, Santiago de Chile, Warsaw, *EMS University* in Illinois, *EFM* in Buenos Aires, *Apelac* in Brussels, *EMS* in Moscow and Geneva. In the 1960s: P. Henry's *Apsôme* in Paris, *Sonology Institute* in Utrecht, *EMS* in Montreal and Stockholm, *Experimental Studio* in Bratislava, at Simon Fraser University in Vancouver, studios in Padova and Madrid, *Bell Telephone Laboratories* in New Jersey, *Experimental Studio* in Pilsen, *CEMAMu* in Paris and others. Except for the older ones (*INA-GRM*, *IRCAM*, *CEMAMu*, *University Paris VIII*, *SCRIME* in Bordeaux, *Sonology Institute* in Utrecht, Canadian universities, *CCRMA* in Stanford), the most creative ones nowadays are the *Art Institute* in Chicago, *Carnegie Mellon University*, one of the recent and innovative destinations is Great Britain (*BEAST* in Birmingham, *City Univ. London*, universities in Aberdeen, Sheffield, Manchester and others). In the Czech Republic: *Musical Acoustic Research Center* see <http://zvuk.hamu.cz/vyzkumnecentrum.php>.

56 In: *Repertoire acousmatique 1948-1980*, *INA-GRM*, 1980, p. 269. The words *aux mille collants* refer to a labourious technique of editing and tape sticking.

57 In the Czech Republic, Miroslav Hlaváč specialized in micromontage. Hlaváč was a composer and bridge engineer, therefore his discipline inspired him to perform detailed work and creation of graphic scores on a graph paper.

D/ *Music could be replicated without changes and independent on the performer.* The author was “liberated” from necessary conditionality of interpretation and worrying variability at some point. There was higher probability the result was going to be correct, then. This fact is a risk when encountering the audience at the same time because they are used to live performances.

RISKS

A/ People start to think about music as *a montage of sound objects* (see above)⁵⁸, which resulted in underestimation of an overall point of view of works and small flexibility of the course of music in some composers’ works. The method of montage and editing had affinity to film work, which was “trendy” in the 1960s. It seemed to be so interesting and progressive for other kinds of art that it was theoretically projected as a method into older art (and not quite adequately) — like Leoš Janáček’s works.⁵⁹

B/ There was *a possibility to surpass anthropological and physiological limits* in heights, contrasts, a natural course of soundwaves (reverse run, editing), phrases, especially when using synthesis. Ecological and medical issues regarding the effect of sound on human organisms and environment (acoustic smog) were updated and have been fortified by other inventions.

C/ *Music is practiced by new social and professional groups of creators:* even the people unfamiliar with traditional compositional skills “compose”. In the first phase, we may notice the increase in so-called engineer production and then a surge of the laic movement “do-it-yourself” after a swift development in IT technologies. Both extremes now refer to the strengths of classical music education even for composing with technologies from the point of author’s know how, an-

58 In Czechoslovakia: in his essay, Milan Meninger in characterized electronic music as music “which is created by reproducing artistically depicted, partially created and assembled recordings.” He speaks of material as “raw materials” (quoted according to RASTA Tomáš (2010) *Elektroakustická hudba, její technologie a proces se zaměřením na čs. scénu*, in: https://is.muni.cz/th/262152/ff_b/BC.txt, highlighted by LD).

59 The work of Miloš Ištvan (1973) is generally known speaking of Czech works. He wrote *Metoda montáže izolovaných prvků v hudbě*, Pantón. Miloš Štědroň used the word “montage” when analyzing Janáček’s music (in: *Leoš Janáček a hudba 20. Století, Paralely, sondy, dokumenty*, 1999, MU Brno, Nauma).

thropologically and psychologically appropriate phrasing, gestures, perceptibility and the ability to remember the sound course. This fact may potentially be an opportunity as well.

D/ Independence of the performer has transformed into dependence on technologies — on electric input power (in case of a power cut, most bands must leave the stage), quality of studio or hall equipment, and a necessary close cooperation with the sound masters⁶⁰ or other (during audiovision), especially in the first phase of the development (until computerization).

II. RECORDING OF SOUND AND SPATIALITY AS PART OF THE COMPOSITION

One of the first compositions, which systematically and explicitly refer to work with microphones is K. Stockhausen's *Mikrophonie I* and *II* from 1964/65. One of the first successful Czechoslovak electroacoustic compositions, which thoroughly works with microphones and spatiality, is Rudolf Růžička's *Gurges* from 1969 (sound recording of percussions with contact microphones; spatial topology realization). Contact microphones were also used by Miroslav Hlaváč in *Fontana cantans* from 1971.

Recording the sound and its amplification play crucial roles for the founders of *sound production*: Joe Jones and his "music machines", Max Neuhaus in the project *Time Square* (recording and amplifying sound of metro ventilators), Terry Fox's installation, which records and amplifies natural sounds of common objects, Bill Fontana's *Earth Tones* amplifying the sounds of the Earth, Christina Kubisch's "resounding" of electric current in *Electrical Walks* and others.

Composers worked with *sound spatial projection* in the time when realization effort was required: K. Stockhausen in *Gesang der Jünglinge*/1956, *Tunnel Spiral*/1969, Edgard Varèse/I. Xenakis v *Poème électronique*⁶¹/Expo Brusel 1958 and others. These projects foreshadow the currently developing acous-

60 In Czechoslovakia in the first period of high-quality EA, we must emphasize the contribution of radio sound masters Čestmír Kadlec, Milan Křivohlavý, Ivo Bláha, Vlastimil Ježek. See DOHNALOVÁ Lenka: *CD-R Česká elektroakustická hudba*, 2001

61 In *Gesang der Jünglinge*, K. Stockhasen used five groups of loudspeakers in the circle around listeners with the effect of circling sound. In *Tunnel Spiral* (1969), he wanted to place one hundred loudspeakers in 10 circles in the tunnel. I. Xenakis in cooperation with E. Varese and Le Corbusier projected a 3-channel transmission to 450 loudspeakers in his project *Poème électronique*.

matics.⁶² Composers use a “loudspeaker orchestra” (*Acousmonium*, Francois Bayle from 1974 assembled from 80 loudspeakers of various sizes, shapes and locations).⁶³ Another possible output of composed music spatiality is acoustic (or interactive) installations.⁶⁴

From the technical point of view, we need to distinguish between the formats of spatial parameter recording (DVD-A, SACD, DD, DTS, DVD-V, Surround, SDDS and others.), a typical solution of spatial impression through dynamism of elements in the composition (ppp-sf) and spatial projection of sound into loudspeakers and their arrangement (most frequent ones: 2.0., 4.0, 5.1., acousmatic composers ask for a higher number of loudspeakers).⁶⁵

BENEFITS/OPPORTUNITIES

A/ Characteristic traits of recorded sound became part of author’s intention when using contact microphones or amplifiers that can inject detailed and unusual insight into sound structure⁶⁶. Quality and various types of microphones have become part of composition strategies. Sound installations and sculptures in particular work with these principles.⁶⁷

B/ Spatial music projection has become part of a composition strategy. It multiplied the possibilities of sound impact, composition attractive-

62 Pierre Schaeffer’s term refers to pythagoreism (concentration on purely acoustic information). *Acousmatic music* is currently pursued in France, Great Britain and Canada. See: DE-SANTOS Sandra, ROADS Curtis and BAYLE Francois (Autumn 1997): *Acousmatic Morphology: An Interview with Francois Bayle*, Computer Music Journal, Vol., 21, No 3, p. 11-19, The MIT Press.

63 A topical example from the Czech Republic, 2015: inspiration by acousmatics: M. Rataj’s project in Ostrava Days 2015 (*Small Acousmonium*), <http://www.newmusicostrava.cz/cz/os-travske-dny/program-festivalu/24-minimaraton-elektronicke-hudby.html> Alvin Lucier’s installation, which works with space as part of the composition *Music on a Long Thin Wire*, in which “the sound of the string is amplified and waves pour out into the space in which it is echoed and reversely influences string vibrations.” See: <http://plato-ostava.cz/alvin-lucier-music-on-a-long-thin-wire/>.

64 https://en.wikipedia.org/wiki/Sound_installation
<http://www.everydaylistening.com/>

65 *Sound Spacialisation*, in <https://www.youtube.com/watch?v=nd2q8uCi6Qk> *About Sound Spacialization and Spatial Music*, in: *KineticMusic*, <https://kineticmusic.wordpress.com/sound-spacialization-and-spatial-music/> BRESSON Jean (2015) *Control of Spacialization and Spatial Sound Synthesis*, <http://repmus.ircam.fr/bresson/projects/spatialisation>

66 Detailed information in DOHNALOVÁ Lenka *Estetické modely elektroakustické hudby...*, p. 147; CD-R *Česká elektroakustická hudba 2001 / analysis of the work*.

67 <https://en.wikipedia.org/wiki/Microphone>
[https://en.wikipedia.org/wiki/Mikrofonie_\(Stockhausen\)](https://en.wikipedia.org/wiki/Mikrofonie_(Stockhausen))

ness and it develops a traditional parameter in music especially in a dynamic and kinetic solution in a new way.

Composers used stratifications of sounds in space before, but technologies allowed for unusual location of the sound source (from above, from below) and spatial dynamism (circulation, alteration of horizontal and vertical motion and others).

- C/** The strategy of sound recording and possibilities for spatial projects are very well *applicable in film music*, computer games, advertisements etc., where music can iconically simulate visual characteristics and a plot.⁶⁸

RISKS

- A/** Significant *dependence on technological equipment of spaces* (fixed installation “acousmonium”), or long preparations for a concert if acousmonium is installed in unequipped spaces (problems with cables, compliance with the device and author’s intention)
- B/** *compatibility* of various devices in fixed equipment and mobile installation.
- C/** *there are few optimal places from the acoustic point of view* regarding author’s intention⁶⁹, if listening is not modeled by interactive sensors of recipient’s motion (sound installations, site specific).

III. ANALYSIS/RE/SYNTHESIS AND SOUND MODELLING

This invention is chronologically parallel to the previous two. It is separated only methodically. We can find a lot of information about the types of an analysis/re/synthesis and a historical development of instruments for the synthesis of sound.⁷⁰ Speaking of the topic of the study, we will focus on

68 These are the reasons why sound masters asked for the acknowledgement of protection and payments like authors (Sound Designers’ Protective Organization/OAZA, <http://www.oaza.eu/>). Prestigious awards are given out for sound processing as well (Oscar, for example).

69 Like at *Ostrava Days 2015*, Peter Ablinger’s sound installations, in which the motion of listeners significantly influenced perceived sound. See <http://www.ostravan.cz/23829/prvni-koncert-ostravskych-dnu-2015-nova-hudba-znela-na-hlubine-sugestivne/>.

70 The patent for “*the device for electric generation of music*” was registered in 1895 by Thaddeus Cahill. Types of sound synthesis: https://en.wikipedia.org/wiki/Category:Sound_synthesis_types <http://synthesizeracademy.com/category/lessons/types-of-synthesis/> VIHOLA Matti (23.8.2001): *Sound Synthesis Methods*, <http://www.cs.tut.fi/sgn/arg/synteesi/vihola.pdf>

crucial turning points for character of production, benefits and risks associated with the invention.

Sound synthesis has had two aims since the very beginning:

- 1/ from the point of view of our typology, it is a *primarily phenomenological aim*: to enrich acoustic music possibilities with simple sinus waves and their synthesis, complex noises or unknown mathematically modeled sounds combining the envelope⁷¹ of various instruments, when creating various virtual music “instruments” or new “sound worlds”. Micro-modeling is possible in all sound parameters.
- 2/ the purely *practical and functionalist*: to find a “substitution” for instruments that are difficult to transport (e.g. the organ), to facilitate operation practice and to imitate specific sound of the instruments or allow for the representation of groups of instruments from the sound library through simple operation, such as pressing the keys⁷² (see below). This research and technical task had a number of development stages and some of them are essential from the point of view of production ontology.

BENEFITS/OPPORTUNITIES

A/ New sound — the first audio music studios in the 1950s and 1960 embraced sinusoidal generators and noise generators, oscillators and filters for a subtractive synthesis — like in the *Research Institute of Radio and Television* in Czechoslovakia (since 1965) or *Experimental Studio in Czech Radio Pilsen* (since 1967). Produced sound was either extremely simple (sinusoidal sounds), complex (noises) or it was filtered into typical shapes. Composers have used, and some to this time preferred, sinusoidal sounds and their additions for a purist emphasis of the form.⁷³

71 Envelope = the course of volume in time. Each instrument has typical attack, sustain and decay.

72 Speaking of top instruments, organist Cameron Carpenter preseted his unique mobile organ Marshall & Oglotree at the festival *The Strings of Autumn* in 2015, see: <http://www.denik.cz/hudba/na-struny-podzimu-miri-extravagantni-varhanik-cameron-carpenter-20151024.html>
The Sound of Tomorrow: Cameron Carpenter in Conversation with Michael Eisner (3rd July 2015) in: <https://www.youtube.com/watch?v=m836JSYQzvY>
Equipment of home studios: *Reaktor 6*, viz: <http://www.native-instruments.com/en/products/komplete/synths/reaktor-6/>

73 The first systematic use of sinusoidal sounds addition as exklusive material for composition can be found in K. Stockhausen’s *Study I* written in 1953 (made in the WDR studio in Köln). Stockhausen wrote about it to his colleague K. Goeyaerts “It is beautiful to hear such sounds,

The first stage of electronic music of this kind was exclusively linked to institutions (public radios, universities, research institutes). In 1957, electrical engineers Max Mathews⁷⁴ and John Pierce performed a sound synthesis in *Bell Telephone Laboratories*. The most significant people who used peculiarities of the first stage of electronic music in Czechoslovakia were Miroslav Hlaváč (in *Angelion* and *Astroepos* in 1969, *Chimerion* in 1970) and Rudolf Růžička (*Elektronia A, B, C* in 1965, 1967, *Discordia* in 1971, *Arcanum* in 1984). Their pieces received international acknowledgement and were included in IDEAMA, the international EA music databank. The sound world of this stage is symbolically used for topics that contrast with ordinariness (abstractly formal, technical, metaphysical, surreal, cosmic, sci-fi and others).

B/ *New electronic instruments — analogue,*⁷⁵ later *digital synthesizers*⁷⁶ that use various types of sound synthesis and use a certain sound image as a part of the style characteristics, especially in popular music, which they divide in stages in a way. Their instrumental forerunners were *electrophones*.⁷⁷

Since the mid-1960s, there was a transition from analogue to digital/analogue and digital technologies, which are the two operational modes of sound processing. Since 1971, numeric synthesizers were used commercially (*Darthmouth Digitale Synthese*, *Synclavier I, II*, *Fairlight* and others), since 1971, a granular synthesis⁷⁸ has been used in composition (I. Xenakis). Professional studios focus on high-performance synthesizers, such as *Syter* (1977, F. Allouis, GRM), *Samson Box*

which are absolutely balanced, calm, static and illuminated by structural proportions only. Like raindrops in the sun." (in: TOOP R. (1979) *Stockhausen and the Sine-Wave. The Story of and Ambiguous Relationship*, Musical Quarterly N.3. p. 391; Contemporary composers, who prefer minimalist elementary sound material for transparency of the form: Hubert Howe (USA), Gilberto dos Santos Agostinho Filho (Brazil) and others. We may find interest in extremes using the sinusoidal sounds, very complex sounds in industrial and noise production in Japanese works.

74 One of the most progressive programs for music and multimedia Max/MSP devised by Miller Puckette refers to Max Mathews.

75 10 Best: *Analogue Synths*, in: JunoPlus, <http://www.junodownload.com/plus/best-analogue-synths/>

76 *Digital Synthesizer*, in: https://en.wikipedia.org/wiki/Digital_synthesizer

77 *Electrophone*, in: <https://en.wikipedia.org/wiki/Electrophone>
Electrophone System, in: <http://www.britishtelephones.com/electrophone.htm>

78 *Granular Synthesis*, in: https://en.wikipedia.org/wiki/Granular_synthesis
<http://granularsynthesis.com/guide.php>

(CCRMA Stanford), interface development,⁷⁹ API (*Application Programming Interface*)⁸⁰ and controllers.

Commercial promotion and standardization are essential for pop music. To move pop music forward, it was necessary to develop *MIDI standards* (commercially from 1983)⁸¹ and *samplers*⁸². The first synthesizers with a MIDI standard were *Prophet 600* and *Yamaha DX7*.

New instruments and new interesting controllers, which can simulate various kinds of instruments, are in the process of development (e.g., the Seaboard keyboard).⁸³

Today are available also synthesizers using wavetable synthesis (i.e., using library of sounds recorded from real instruments), virtual-analogue modeling synthesizers (since 1993, Yamaha company and others), which are more *flexible in sound generation*. In the Czech Republic, we can find various brands like: *Korg*, *Kurzweil*, *Novation*, or more expensive instruments like *Yamaha* (MOTIF generation), hardware and software programmes for synthesis and sound modulation (see chapter COMPUTERIZATION). Although it seemed that analogue synthesizers would completely disappear (as a software or hardware), they are still available today, and some authors and performers prefer them due to their “sound image” and the way qualities of such sounds influence people.

RISKS

A/ One of the risks is mostly the *impact of artificially created and micro-manipulated sounds on organisms*. The topic has not been well-researched so far. Considering the fact that various kinds of waves and frequency combinations are used for resonance physiotherapy or

79 www.turntablelab.com/pages/what-is-an-audio-interface-dj-interface
PARADISO Joseph (1998) *Electronic Music Interfaces*, MIT Media Laboratory, Cambridge, USA, <http://web.media.mit.edu/~joep/SpectrumWeb/SpectrumX.html>

80 *Beatport Announces Definitive API for Electronic Music Culture*, Press Release (11th April 2014), in: <http://www.reuters.com/article/co-beatport-idUSnBw115642a+100+BSW20140411>

81 MIDI, in: <https://en.wikipedia.org/wiki/MIDI>

82 *Sampler (musical Instrument)* in: [https://en.wikipedia.org/wiki/Sampler_\(musical_instrument\)](https://en.wikipedia.org/wiki/Sampler_(musical_instrument))
FINTONI Laurent (22. 4. 2015) *The Samplers that Shaped Modern Music*, in: <http://www.factmag.com/2015/04/22/the-samplers-that-shaped-modern-music/>
ROSSITER Joe (2.12.2015): *The 16 Best Software Samplers in the World Today*, in: Music Radar, <http://www.musicradar.com/tuition/tech/the-16-best-software-samplers-in-the-world-today-361804>

83 *Introducing the Seaboard*, in: <https://www.youtube.com/watch?v=8n-bEy9ISpM>

military purposes (e.g., ship equipment against pirate attacks), we cannot deny direct influence on human organisms speaking of resonance. There are a lot of projects concerning visualization of sound-waves and frequencies, which can allow for sound structuration (used in the *CYMATICS* project).⁸⁴ We may formulate the hypothesis that it depends on intensity, structuration, the degree of contrasts and length of exposition to this kind of music with micromanipulated and frequently inadequately amplified material.⁸⁵

- B/** Often excessive sound intensity of electronic music, especially dance music, which started to be used as stimulant or a means which helps to alter the consciousness (electro trance and psychedelic trance in particular⁸⁶). In this sense, the much boundary sound intensity understood as part of the music style.

IV. COMPUTERIZATION/SOFTWARE FOR COMPOSITION AND PROCESSING OF SOUND

We have distinguished between music created with the help of computer so called *Computer Assisted Composition* (only in a particular musical segment), or *computer music* (used in the course of creation and realization, in fact). From the point of view of the influence on production, computerization has the following *hardware stages*

- 1/** research stage — only in big R&D departments,
- 2/** commercial stage — connected with the development of personal computers and their standardization (research continues),
- 3/** development for music in special devices and functions — high-quality sound cards, module integration, compatibility of hardware, software, controllers, sensors etc.

84 <https://www.youtube.com/watch?v=Q3oItpVa9fs>. About the history of music visualisation: ASHTON Anthony (2015) *Harmonograph: A Visual Guide to the Mathematics on Music* (2003), Hardcover, Wooden Books Limited.

85 Compare with DOHNALOVÁ Lenka *Vliv hudby a zvuku na člověka*, in.: ČENČÍKOVÁ, O., DOHNALOVÁ L.: *Sborník k problematice ekologie zvukového prostředí a hudby*. 1st edition. Ústí nad Labem : Pedagogická fakulta UJEP/ČHR, 1998, 84 pp.

86 https://www.youtube.com/watch?v=qYW_vp_5u9g
<https://www.youtube.com/watch?v=wbDxHDFEoeA>
https://www.youtube.com/watch?v=_gp51t9kdA
<https://www.youtube.com/watch?v=vNVp5IwQcYc>
and others.

We also speak about different *software stages*

- 1/ the stage of alphanumeric programs
- 2/ graphic programs for operation with sound (graphic mode, transformation of image into sound)
- 3/ the development of plugins, applications (API), sound libraries,⁸⁷ programs for real time operations, interactivity, real-time coordination of various devices and multimedia operations.

Additions: programs for

- 4/ algorithmic composition and simulation of a creative composition process.

Ad HARDWARE

The first sound generators and composition programs come from the 1950s and were designated for vacuum tube computers — CSIRAC⁸⁸ (Australia), *Ferranti Mark 1*⁸⁹ (Great Britain), *ILLIAC I* (USA)⁹⁰, *TOSBAC*⁹¹ (Japan) and others. Computer workstations for a structured real-time sound synthesis are associated with the 1970s and 1980s⁹².

The commercialization period (stage 2) falls within the early 1980s. It is conditioned by the development of the MIDI standard⁹³, DSP programmable digital processors⁹⁴, promotion of personal computers — IBM in 1982, *Apple Macintosh* in 1984 (the most suitable and frequently used one for music), *Atari ST* in 1987.

The development of user-friendly software, processor speed and capacity of main memory and the development of sound cards (stage 3)⁹⁵ were crucial for promotion of using computers for music. Older sound cards were not able to record and play simultaneously and they had insufficient sound

87 Virtual sound libraries *Garritan*, in: <http://www.microdesignum.cz/>, or libraries as part of a complex product, like *Reaktor*.

88 <http://museumvictoria.com.au/csirac/>. The piece *Colonel Bogey March* was performed in 1951.

89 https://en.wikipedia.org/wiki/Ferranti_Mark_1, the author of the music program was Chr. Strachey. The machine “played” the English anthem, a folk song and swing music on BBC.

90 The piece *Illac Suite* for the computer *ILLIAC I* at University in Illinois in 1957 for a string quartet was the first komputer composition of L. Hiller and L. Isaacson.

91 The piece *TOSBAC Suite*, 1962.

92 One of the first ones: the project *Sound Synthesis Project*, Toronto.

93 MIDI=Musical Instrument Digital Interface, international standard. In: <https://en.wikipedia.org/wiki/MIDI>

94 Digital Signal Processor, in: https://en.wikipedia.org/wiki/Digital_signal_processor

95 Sound Card, In. https://en.wikipedia.org/wiki/Sound_card

quality. Most of contemporary cards are duplex. Built-in cards have been in operation since the 1990s. There are currently cards in HD definition even in multi-channel sound. The development toward miniaturization, compactness, performance and user-friendly operation enabled the composers to use laptops for professional work and live presentation, or even *sui genesis* finishing of composition at concerts.

Ad SOFTWARE:

The first research stage derives from programs for sound generation for vacuum tube computers (M. Mathes' s *Music I, II, II, IV* in *Bell T. Laboratories*, since 1957), composition programs (I. Xenakis's *ST* stochastic program for IBM 7090, 1958) and the birth of L. Hiller's and L. Issacson's *computer assisted compositions* (CAC) in the *MusicComp* program from 1959). Other programs that did not work in real time were *Project I, Project II* (*Sonology Institute* in Utrecht), M Matthews's *Music V* (from 1967 programmed in *Fortran*) and other *Music* series. In 1977, *CEMAMu*⁹⁶ *UPIC* (Unité Polyagogique Informatique CEMAMu) develops a kind of a tablet with a vector display, which allows for work in a graphic mode.

Real-time work and graphic programs have been present since the end of the 1970s and early 1980s. Such projects were *Sound Synthesis Project* in Toronto, which used an interactive graphic mode of control for the real-time sound synthesis. Another upgrade of the *SYTER* system was similar.

In the 1990s, composers of artistic sound production worked mostly with products by *GRM* and *IRCAM* — with their upgrades being the most frequently used in composition, sound editing and postproduction now (*GRM Tools, SoundDesigner, Chant, Max a Max/MSP, PatchWork* and others)

According to statistics of international competition *Musica nova* in the past 10 years (1007 pieces)⁹⁷ and specialized sources about pop music⁹⁸, *the most frequently used professional software* in production is (in alphabetical order, the most common ones are underlined): Ableton Live used in popmusic, DJ⁹⁹; Absynth for synthesis,¹⁰⁰ Audio Sculpt, *IRCAM* product — very pop-

96 *Centre d'Etudes de Mathématique et Automatique Musicales*, the establishment of an interdisciplinary workplace initiated by composer I. Xenakis.

97 There is no point in including the period in the statistics regarding the dynamics of the development and fast outdated of the products.

98 Specialized websites and portals, which keep tranck of the recent development. They are quoted in this study as well.

99 <https://www.ableton.com/en/live/>

100 <http://www.adsrsounds.com/category/absynth-tutorials/>

ular for the analysis and synthesis/modulation of sound used sound artistic production professionals¹⁰¹; *Cubase*, production and editing software of Steinberg company used especially in pop and by DJs; *GRM Tools*, constantly innovated GRM-INA product used in acousmatic music; *LogicPro*, an original product of C-Lab from Germany, then for Apple for recording, synthesis, effect utilization used across genres; *Max/MSP*, currently one of the most frequently used programs for music and multimedia productions, which coordinates a number of connected external instruments and devices in real time. It was originally developed in IRCAM, since 1990 (D. Zicarelli, Cycling 74 company), since 1996 a free version of *Pure Data*¹⁰²; a program for sound synthesis *MetaSynth*; *Pro Tools*, a standard in media for recording and post-production; *Reaper*, *Supercollider* and some others.

A special issue is operation with notes and score printing (programs *Sibelius*, *Finale* etc.)¹⁰³ Professional software also has high-quality freeware versions that also contribute to laicization of production.¹⁰⁴

BENEFITS/OPPORTUNITIES:

- A/** The computer has become *a complex, compact and affordable composer's instrument*, which can represent creative, realization and archival functions. Thus this kind of production could spread, e.g., “*electro*” dance style and its various modifications (*house, trance, dirty electro, psychedelic* and others) rank among the well-represented ones in young audience’s preferences (see below, chapter CONSUMPTION — AUDIENCE).
- B/** It is possible to *work with complex models* of audio transformation and structuralization. Production can follow previous traditional forms and genres, but it can realize other types of structures and processes in the form of generative algorithmic music (software SSEYO *Koan*,¹⁰⁵ *Air, Bloom, Scape, Trope* and others), or simulation of various physical and biological structures or processes.¹⁰⁶

101 <http://forumnet.ircam.fr/product/audiosculpt-en/>

102 [https://en.wikipedia.org/wiki/Max_\(software\)](https://en.wikipedia.org/wiki/Max_(software))

103 <http://music-notation-software-review.toptenreviews.com/>

104 WILSON Scott (23 May 2015): *The Best Free Music Production Software*, in: <http://www.factmag.com/2015/05/23/best-free-vst-plugin-daw-music-production-software/>

105 The founder of ambient Brian Eno (*Generative Music 1* album) used and participated in it.

106 See I. Xenakis’s concept of a “mass”. Compare with: XENAKIS I. (1968) *L Entretien avec I. Xenakis par M. Perrot*, in: *La revue musicale*, No. 265-66, p. 69.

- C/** *Work in a graphic mode, conversions of image to sound, sound to visualization* made production more effective and brought new possibilities of comparing various systems of codes (e.g. the project of *Pattern Language* by Robert Scott Thompson¹⁰⁷ from the USA; they convert snowflake, cobweb patterns or geometric constructs to sound).
- D/** *Current computer and high-performance software, which is able to coordinate many processes*, connected devices and instruments in sound and audiovision in real time (the most frequent combination now is *MacBook/Max/MSP*).
- F/** *Interactive composition* is possible — “live coding” of laptop music (TOPLAP international association since 2004)¹⁰⁸ or as reactive composition (sensory reactions to motion of performers or audience).¹⁰⁹
- G/** It is possible to *simulate a creative process* — a creative process of a specific composer (the most frequent objects of simulation are works by Johann Sebastian Bach),¹¹⁰ or to test an accidental model of simulation of music creation, such as the project of *Darwin Tunes*.¹¹¹

RISKS

- A/** A possible risk is *overproduction and controversy in the quality of the production*, as it appears simple due to financial availability of the hardware and software, existing sound/software “semi-finished products”. Many works are sui generis tests for software, plugins, a play with existing audio samples without a special intention and need (except for financial need). The authors usually rely on the fact that

107 https://en.wikipedia.org/wiki/Robert_Scott_Thompson

108 TOPLAP=The Temporary/Transnational/Terrestrial/Transdimensional Organisation for the Promotion/Proliferation/Permanence/Purify of Live Algorithm/Audio/Art/Artistic Programming. Od r. 2004. The name itself manifests the shift in the music discourse from the principle of the work towards a play.

Golan Levin’s interactive sound production https://www.cmu.edu/cas/people/levin_golan.html

109 David Rokeby’s project *Very Nervous System* (1982-1991), in: <https://vimeo.com/8120954>

110 In 2015, Donya V. Quick’s software *Kulitta* was presented at the Yale University. It attempts to generate a creative process based on the analysis of a specific work. See: https://www.youtube.com/watch?v=VXo-4wOb_vo

111 HOEKENGA Christin (18. 6. 2012) *Darwin Tunes: Scientists Examine How Consumer Choice Can Drive the Evolution of Music from Noise*, in: <http://www.visionlearning.com/blog/2012/06/18/darwin-tunes-scientists-examine-how-consumer-choice-can-drive-the-evolution-of-music-from-noise/>

only professionals can tell what is a pre-programmed software and studio product and what is a real creative added value in sound operation. There is a huge number of standard and substandard design production.¹¹²

- B/** *A high rate of conceptualism work production*, inter-textual music “comments”. A number of quickly published ideas, or the danger of *self-stylization*, i.e. stagnation on the level of replicating one’s own language, which the audience likes. One of the reasons is high pressure on showing “results” even in creation, if the artist concerned is an employee or a member of a project team.
- C/** This kind of production sometimes *neglects anthropological and psychoacoustic parameters of perception and impact of sound*, which can be intentional (*techno, industrial, noise*), yet it is sometimes an unwanted product of production shallowness.

V. MULTIMEDIA AND MUSIC VISUALISATION

Speaking of history, music is naturally connected to more complex activities — rituals, theatre, dance or film. Regarding this aspect, Czechoslovakia ranked first in using new technologies in the first multimedia theatre with projection: *Laterna Magika*¹¹³ (since 1958). Since then, the fusion of music, live theatre/performance and projections or light design has become a common thing, especially in musicals and pop stars’ mega shows (see chapter INTERPRETATION — REALIZATION below) because even the audience is now rather demanding due to a popular use of virtual reality and effects in film and videogames. *Live holographic concerts* have been a rave recently (since 2012); they combine live singers and those who are projected (like the holographic concert of late Michael Jackson, 2014).¹¹⁴

A relatively new phenomenon, especially since the early 1980s, was the *music video* as a new mode of music presentation in pop music, in particular. This mode has retrospectively influenced the character of music and its means. The video was standardized due to the first music TV channel *Music Television (MTV)*, since 1981) owned by Warner and MaEx.¹¹⁵ Czechoslovakia

112 Almost 3,000 composers participate in the biggest international competition of this kind: *Ars electronica* in Austria. In: <http://www.aec.at/solutions/about/>.

113 https://en.wikipedia.org/wiki/Laterna_Magika

114 <https://www.youtube.com/watch?v=XEVQgpTyZD4>

115 <https://en.wikipedia.org/wiki/MTV>

was ahead even in this field, speaking of the quality of directors and visuals of Suchý and Šlitr's TV songs in the 1960s (e.g. *Pramínek vlasů*, *Marnivá sestřenice*, *Obnošená vesta*, *Mackie Messer* with M. Kopecký and others).¹¹⁶ Multimedia presentation as a requested mode of pop music was enforced by stars, who paid special attention to the style and perfect realization of the video as well as multimediality of their live shows (M. Jackson, Madonna and others). Some contemporary stars work primarily on their videos, and their visual and multimedia image, which increases their ratings (K. Perry, for example with *Dark Horse*).¹¹⁷

Another relatively new products are *sound and multimedia installations*. The initiative of the extension of this format came from experimenting visual artists (e.g. from the *Fluxus* association).¹¹⁸ Some artists have already been mentioned when we spoke of sound art, the Czech artists are (in alphabetical order): Tomáš Dvořák, Jiří Havlíček, Tomáš Hruža, Martin Janíček, Jan Krtička, Radim Labuda, Petr Nikl and Roman Štětina.

The relation of music and visual codes is sometimes motivated by the *synesthesia principle* — based on personal predispositions of a composer or referring to philosophical concepts (anthroposophy, for example).

This trend is accompanied by construction of new instruments using new technologies, a *color piano* in A. Scriabin's Prometheus Symphony (1910), A. László's *sonchromatoscope* (1925), a different *color piano* of Z. Pešánek (E. Schulhoff performed on it in 1928).¹¹⁹ Speaking of software, there are more programs for the conversion of image to sound nowadays: *SonicPhoto*,¹²⁰ *Photosounder*,¹²¹ or the above-mentioned *MetaSynth*, which is a more complex program speaking of functions.¹²²

116 <https://www.youtube.com/watch?v=0aGGYg7adnE&list=PL4138C1FC2BEDB237>

117 We may find several charts according to viewer's ratings as *Top Trending Music Videos* on YouTube <https://www.youtube.com/watch?v=0KSOMA3QBU0&list=PLSTz8jpJdr5qrbVEbur-BasItcSBO43xPv>. Top videos reach the rating of more than 1,5 billion. See below.

118 <https://en.wikipedia.org/wiki/Fluxus>
<http://sound-art-text.com/post/52086436001/60s-fluxus-artists-emancipating-sound-from-the>

119 *Synestheia*, in: <https://en.wikipedia.org/wiki/Synesthesia>
<https://www.sciencedaily.com/releases/2007/07/070724113711.htm>

120 *Hearing Colors and Seeing Sounds? How Real is Synesthesia?* (26th July 2007) in: Science News, <https://www.sciencedaily.com/releases/2007/07/070724113711.htm>
<http://www.skytopia.com/software/sonicphoto/>

121 <http://photosounder.com/>

122 <https://www.youtube.com/watch?v=1L3XfnNomfo>

Music visualization may be of a different character. The first objectively based physical device of this kind was a *harmonograph* (1844, H. Blackburn).¹²³ The current software for music visualization in real time — also included in *Windows Media Player* — does not transfer the sound source exactly to the visual form in particular. It coordinates only some parameters of the sound course with the visualization, the others are free-parameters, i.e. creative. There are a lot of plugins for these programmes.

BENEFITS/OPPORTUNITIES

A/ Authors potentially have *bigger opportunities for inspiration and use in interdisciplinary cooperation and use in new disciplines* (sound system installation and music for computer games,¹²⁴ video ads and others).

RISKS

A/ *Financial demands of multimedia projects.*

THE CHANGES OF MUSIC DISCOURSE¹²⁵

Technologies have changed the way composers comment on their works and projects and the way they communicate about them. Apart from professional technical vocabulary linked to the employment of hardware and software in music, we can see that even the language describing an aesthetic intention, composition methods or work symbolism is usually significantly different from a traditional music discourse. Authors then adopt the vocabulary from theories of systems, mathematics or structuralism — they have adopted

1/ *the terminology of the founders of EA music*, linked to “elements” (sound objects, sound events, samples, cells), structuration (smooth, clustered, grainy, unorganized, homogenous, unhomogenous, dense, sound field, mass and others) as well as operation terms (articulation, aggregation, trajectory and others);

123 ASHTON Anthony (2003) *Harmonograph. A Visual Guide to the Mathematics of Music*, Walker Books.

124 *Video Game Music*, in: https://en.wikipedia.org/wiki/Video_game_music
TOP 50 Videogame Music, in: <https://www.youtube.com/watch?v=A9VuiOVduJg>

125 The term “discourse” is used as in M. Foucault’s works.

2/ they use *terms from other disciplines* — physics, mathematics (linear, multidimensional, static, kinetic, stochastic), or biology (a cell, fibers, a tree, a network, growth).

The selection of themes and topics is also inspired by new material, means and the way of work. Apart from traditional motives, we can find a number of relatively new motives that are reflected in the names of compositions:¹²⁶

- 1/ *generally formal and technical* (*Electronia, Fluctuation, Invariant, Constellation, Modulation, Reverberation, Static Music, Synthesis, Transposition, Patterned Music* and others);
- 2/ *philosophical, cosmological, sci-fi* (*Biochronnos, Evidence of Unseen Spaces, Kinechromie, Comet, Maxwell Law, Masks of Eternity, Meditation, Metaanthroepos, Metta, Pantha rei, Per aspera ad astra, Streams of Consciousness, Balance Violation, Sattva, Shapes of Silence, Mirrors of Silence* and others);
- 3/ *motivated by natural and industrial sounds* (*Baobabs, Distant Trains, Fontana, Earth Tones, cantans, Magma, Prague — the Pearl of the Cities, Reflex of Rain, Dreaming Mountain Range, Tree-Like, Three Cities, Volcano, Air-Like, Water Whistle* and others).

In dance and experimental electronics, we can hear the terms related to *fantasy or inspired by unintelligible graffiti texts*. Authors often use pseudonyms, codes, collective names, project names and others (*Ø-Loihdittu, Uakti, Opposite 8, E-Mov, Akoustik, Techyon* and others.)¹²⁷. The attitude of the authors has generation traits. They demonstrate their different relation to authorship, individuality, ownership and professionalism.

FINAL REMARKS

The artists of modernism philosophers expressed their relation to technologies by production, verbally and by manifestos (such as *Bruitists*, the founders of electroacoustic music, computer and stochastic music). The rapid growth in using new technologies in the 1950s is linked to ambitious futuristic visions and faith in a constructive civilization function of technologies for society. These tendencies are documented in big multimedia

¹²⁶ The names of the works are real (selected from catalogues of competitions and labels), but they are illustrative in this text.

¹²⁷ Compare with the Beatport offer: <http://mixes.beatport.com/mix/supernova-progressive-psy-trance-mix-2014/240483>

projects of EXPO from the 1950s to the 1970s, supported by the state. The ideas of multimedia futuristic spaces accessible to the public (and later interactive) with a sound system were attractive (K. Stockhausen, I. Xenakis, La Monte Young and others), which represented social vision of avant-garde artists and the change in understanding the work (from a close concept towards “design” and anesthetization of the environment).

In postmodern philosophy and present, most authors understand technologies in an instrumental and asymptomatic way, which allowed for the development towards miniaturization, mobility, high variability of functions and lowering the prices of new products. Technologies can serve to purely artistic or ecological specialization of new music¹²⁸, artists play with it more or they sometimes “let them play”, which has its pros and cons, as it was mentioned above. On the one hand, artists have potentially more opportunities and impulses (formats supporting new talents in music labels or new media like YouTube).¹²⁹ On the other hand, if artists want to have music as a traditional source of income (royalties and copyright protection), they also face pressure from the environment overflowing with limits, demands and numerous foreign competitors (mentioned below).

128 COHEN Neil Shaw (19th November 2015), *Why Landscape Music Is More Important than Ever*, in: http://www.newmusicbox.org/articles/why-landscape-music-is-more-important-than-ever/?utm_source=newsletter_156&utm_medium=email&utm_campaign=music-world-news

129 <https://www.youtube.com/yt/press/cs/statistics.html>

INTERPRETATION — REALIZATION

Interpretation and realization is yet another phase of music production existence. Speaking of the point of view we are interested in, we can divide it into:

- 1/ *stage performing* (part of performing arts), i.e. realization in front of the audience with participating performer;
- 2/ *studio production/recording and post-production*, which can be distinctive or a processed recording of a live stage performance.

ad STAGE PERFORMING/PRODUCTION

*Using sound technology (sound systems)*¹³⁰ has significantly changed music performance. It has contributed to a quantitative growth of creation and production (the popular one in particular), the development of style using electrophonic and electronic instruments, making of effects, electronics supported by a computer. New modes have been developed — mass open air festivals, huge concert shows, large format multimedia musicals.

In Europe *open air concerts/festivals* have their provable predecessors since the time of outdoor music celebrations in Italian Renaissance and European Baroque. At that time, outdoor events were more like smaller events scattered in space, or in special place (*salla terrena*). Outdoor music had entertaining and accompanying functions, so the surrounding noises were not perceived negatively; social entertainment played the leading role. The similar situation has applied to folklore (organizers of the traditional folklore festival in Strážnice locate several smaller events in the event space without an amplification due to the perception of style, yet it is sometimes misinterpreted as a sign of lack of professionalism).¹³¹

An open air mode of mass music events has developed since the music festival in Woodstock in 1969. This festival is perceived as a ground-breaking event¹³², which would be impossible to organize without high-performance amplifiers and a reproduction system.¹³³ The exceptional intensity of an out-

130 *How to Set Up Band Equipment: How to Set Up a Sound Board on Stage*, in: <https://www.youtube.com/watch?v=hvdgNrbAjU4>

131 Compare with: the statement of the NULK festival P. Kurfürst in the time-lapse documentary *Krajinou české hudby (2015)* made for the Year of Czech Music 2014, IDU/ČT.

132 https://simple.wikipedia.org/wiki/Woodstock_Festival

133 <http://outdoor-speaker-review.toptenreviews.com/>

door sound system corresponds with function (the decisive fact is when a lot of people listen to music) and spatial arrangement (high concentration of mass audiences, usually in big space in front of the stage). Multimedia large-format *musicals and shows* depend on high-quality sound systems and coordination with light design.

There are currently a lot of companies, professional websites or blogs providing sound systems, consulting and testing for an utilitarian selection of sound and multimedia sets (the *Muzikontakt* database in the Czech Republic has 510 companies).¹³⁴ The complex issues concerning specific features of sound systems include some traits that need to be highlighted speaking of long-term practical experience: the importance of auditory control of quality of sound recording (selection and distribution of microphones, distribution of sensors) because this factor cannot be sufficiently rectified by sound mixing and reproduction. The result of a sound system outdoors is influenced by a number of factors (weather, surrounding noises, number of people etc.), which cannot be really anticipated and assessed (see RISKS).¹³⁵

According to the statistic data of the EY agency from December 2014¹³⁶, open air festivals, concert shows and musicals rank among the most costly segments (tens of millions CZK in the Czech Republic) but at the same time, they are the most flourishing and economically fully utilized segment of performing arts, which also integrates digital technologies the most (from production, promotion, stage realization, media coverage to the way of selling and working with the audience).¹³⁷ Music festivals and concerts generate more than one third of all income in performing arts and it has been developing since 2010 despite an overall crisis and a drop in other segments. Visitor's rates of the biggest festivals in the world are up to 3.2 million view-

<http://www.alibaba.com/showroom/outdoor-concert-speakers.html>

BURTON Jon (March 2012): *Outdoor Sounds — Engineering Sound for Festival Events*, in: <http://www.soundonsound.com/sos/mar12/articles/outdoor-sounds.htm>

134 Only a small number of the company are of high-quality — they solve the problem in a complex way, in time, and are able to keep the quality during the event.

<http://www.muzikus.cz/muzikontakt-kategorie/sluzby-2/>

Microphone Buying Guide (9 December 2013), in The Hub, <http://thehub.musiciansfriend.com/audio-recording-buying-guides/buying-guide-microphones>

135 *Digital vs. Analog — Mixing* (no date), in: <http://www.mix-engineer.com/audio-philosophy/digital-vs-analog-mixing/>

136 *Creating Growth — Measuring Cultural and Creative Markets in the EU* (12/2014)

<http://www.creatingeurope.eu/en/wp-content/uploads/2014/11/study-full-en.pdf>

137 *Ibid.* p.49-52.

ers at one event, hundreds of thousands visitors at big festivals and tens of thousands listeners at medium-size festivals (Czech events included).¹³⁸ Production¹³⁹ and expensiveness of musicals are rising in the Czech Republic. Musical singers cannot do without voice amplification in most cases with production being based on sound and light effects.

BENEFITS/OPPORTUNITIES

- A/** *Spread of style and instrumental possibilities of interpretation in real time*¹⁴⁰ This kind of live performances is preferred by authors and performers, who are interested in anthropology, music gesticity, as well as extension of the potential of voice and instruments beyond the limits of normal sound and virtuosity, i.e. some kind of an ideal state of an organic merge of a human being and technology.
- B/** *New opportunities for professional performers*, such as their involvement in multimedia projects,
- C/** *the possibility of crossing the borders of standard music interpretation and presentation* (interactivity, multimediality, style fusions, frequent international cooperation with specialized communities),
- D/** *the growth of amateur production in the field of performing popular music*. The Czech database *Bandzone* currently (12/2015) registers 40,000 bands and about 260,000 works.¹⁴¹ It documents the interest in active performance of music (however, this factor has some cons as well).
- E/** *The possibility of self-education*, using karaoke, on-line course recordings (proved by a good and knowledgeable level of amateurs singing

138 More details in chapter AUDIENCE — CONSUMPTION.

139 <http://www.kulturniportal.cz/porady/zanr/muzikal/?gclid=CITI6v74uswCFEYK0wodQasPaA>. There are 18 various original and adapter musicals in the cultural program in Prague in May.

140 We may recently notice (in *Musica nova* competition, or other festivals and competitions) that there are more works in the category for a live instrument and electronics, which, due to the development in hardware and software, experimentally work with instrument options in solo and chamber performances (not like an enriched modification of an instrumental concert). The authors, who closely work with performers and have participated in *Musica Nova* in sound creation (in alphabetical order): Elvíra Garifzyanová (Russia), Tereza Hron (CR/Canada), Apostolos Korkokiou/Myrto Loufopoulos (Greece), Roderik de Man (NL), Joao Pedro Oliveira (Portugal), Carlos Perales (Spain) and others.

141 <http://bandzone.cz/>

in competitions like *Superstar*, self-learners, who learn to play instruments according to online tutorials and others),¹⁴²

F/ *the origin of new mass music formats*,¹⁴³ with a social function (the feeling of cohesion of the young generation) and high economic throughput,

G/ *concert tours supported by network services* (especially YouTube, Myspace, Facebook).¹⁴⁴

RISKS

A/ *Formal education does not satisfactorily incorporate special education of performers for music with the technological support and experiments* (there are more developed ones in the USA, Great Britain, France, Germany, Nordic countries). This fact is strongly perceived in the Czech Republic by contemporary music composers (there are few performers, who are interested and competent to practice music creatively), and in the unsatisfactory quality of most of the popular music performers.¹⁴⁵

B/ A big number of bands is not only a potential benefit, but also a risk. Only several of them would stack up to the audience without amplification and effects. It is only natural that it is not possible to saturate it with the interest of audience and media or an economic reward. A new opportunity created a *high excess of quantitative supply over demand* and contributes to an inaccurate angle of an exceptionally small interest of the public sector, media and audiences in this type of music. The quantitative excess of the supply or confusing advertising may *outshine high-quality art projects* in big cities in particular because the music discourse has flatten and the audience does not notice the advertisement for an event. A similar growth of the average is also in musicals, although very good musical actors have appeared in the Czech Republic in the past ten years.

142 *Woman Films Herself for Two years as She learns to Play Violin*, in: MailOnline, <http://www.dailymail.co.uk/video/femail/video-1240286/Woman-films-two-years-learns-play-violin.html>

143 It ranks among risks as well.

144 The tour of Adele is currently (12/2015) sold out. Her videos and more than 1 million views.

145 See professional discussions 2014-15 in the project *Cultural and Creative Industries Mapping*, ATI

C/ Problematic sound systems: although the professional database in the Czech Republic includes over 500 companies, we can find only a few top-quality companies speaking of quality and variability of equipment and know how in the world. There are two kinds of problems:

- a) frequently occurred *disproportionate amplification with distorted and unbalanced sound*. This fact is caused by frequent insufficient complex preparations, insufficient equipment, the lack of money producers have for optimization of the sound system, insufficient cooperation of local and external sound engineers.
- b) Frequent experience is also the *transfer of amplification habits from outdoor to indoor* in the extent that jeopardizes hearing with loudness, subwoofer humming (especially with some types of pop music — techno, electro, rock) even at prestigious festivals and platforms (MIDEM, for example).
- c) It has become a custom to *disproportionately install sound systems to concerts* that do not need it speaking of the size and style (blues, world music, country, folklore and others). This bad habit shows that it is a non-reflected manner and the fact that music practice has not fully absorbed technologies as a common utility means, which is not always suitable. In this case, comments on amateurism of presentation, in which amplification at the folklore festival is not used (see above), are evidence of stereotypical thinking.

D/ A steady growth of a mass character of open air festivals and star shows (hundreds of thousands of visitors in several days) is accompanied by ecological problems (noisiness, pollution or damage of environment), social risks (excitation of a large mass of people is sometimes accompanies by sudden hysteria or dangerous hustle etc.)¹⁴⁶

Probably due to economic reasons and rashly listed “visitor’s rate”, huge events are promoted by professional platforms and cultural policy like model events, although they are controversial in many aspects (see the comments of the EU studies, EFA competitions etc.)¹⁴⁷

146 Personal experience from street electro festivals in Paris, Berlin; hysteria hen pop stars visit MIDEM in Cannes and others.

147 See the study, link 124, EFA= *European Festival Association*. The first prize of the new EFFE competition went to the competition and festival *Ars electronica* in Linz with 3,000 competing composers (64 awards). See <http://www.effe.eu/effe-award>.

ad STUDIO PRODUCTION/RECORDING AND POSTPRODUCTION

There is currently a possibility to specialize in studio production, yet to be released efficiently. Studio production allows for creating projects sophisticated in sound, which are problematic for live performances — such as technical realization or players' abilities (the case of “studio bands”). The most of musicians combine live productions and studio albums. A special chapter is post-production, which concerns all recordings including acoustic music.

BENEFITS/OPPORTUNITIES

A/ *The possibility to create recordings sophisticated in sound; to improve the quality of recordings in postproduction*, to remove small intonation flaws, sound imbalance, unpleasant timbre, noises made during the recording. i.e. to merchandise recordings of bands, which would not stand the test speaking of quality, or to create an ideal state of perfectionism, which is unattainable in live classical music.

B/ Ongoing *innovations in record quality*; The record of sound can be judged from several points of view:

1/ the resolution¹⁴⁸

2/ the durability of the recording in time and losses during copying and transfer,

3/ fidelity, or generating nuances in style.

ad 1/ The aim is to preserve or improve the sound quality of the recording. In this point of view, the analog (continuous) recording is valuable. The digital recording “cuts” the sound wave into a chain of numeric characteristics with a variable density. It is discreet and it never reaches original quality when being converted to acoustic version. The consequence of this fact is interesting when speaking of how it affects a person (i.e. research the effect of how live sound or an analog recording differs from a digital recording).¹⁴⁹

Sound studios record in the quality of 24 bit/96 kHz now, but after a final mix, the record is usually compressed to lower quality (for a CD), i.e. 16 bit/44.1 kHz. The current trend is to store the highest pos-

148 *Comparison of Analog and Digital Recording*, in: https://en.wikipedia.org/wiki/Comparison_of_analog_and_digital_recording

149 SST= *Somatic Sound Therapy* <http://somaticsoundtherapy.com/somatic-sound-therapy/resonanz.php>

sible studio quality without compression (*High Resolution Audio*)¹⁵⁰, which is important for some types of music, which work with a wide specter including noises and with dynamic contrasts (electroacoustic music, sound production).¹⁵¹

ad 2/ The analog recording loses quality while being manipulated, in time or while being copied and transferred. The digital recording is more flexible and it does not lose quality while being manipulated, copied or transferred. Speaking of the international exchange such as EBU (European Broadcast Union), this is the reason why uncompressed digital formats of wav are used (in the resolution of minimum 16 bit/44.1.kHz, or 24 bit/48 kHz).

ad 3/ Recordings and postproductions should respect the sound ideal of the style (lighter timbres of traditional jazz and jazz between the wars, rock bass lines etc.).

C/ It is possible to have a *home studio*¹⁵² of an average quality with relatively small costs.

E/ Labels (e.g. *Universal*), *media* (TV), *new community media* (YouTube) offer opportunities to take care of shooting stars — e.g. UMG *Hledáme talenty*¹⁵³, multinational TV format *Superstar*, YouTube strategic programs and workshops in YouTube production studios in LA, NY, London, Tokyo (10,000 projects as of March 2015).¹⁵⁴

RISKS

A/ *The problem of storage capacity for archiving the recordings in high resolution in media* (i.e. in Czech Radio or Czech Television). Working materials are deleted with this justification and they lose much content, which was not suitable for the “specific purpose” but could be used for other purposes.

150 *High-resolution Audio*, in: https://en.wikipedia.org/wiki/High-resolution_audio
PAUL Ian (2.4.2014) *Is High-Resolution Audio Really As Good As It Sounds?*, in: <http://www.techhive.com/article/2138484/is-high-resolution-audio-really-as-good-as-it-sounds.html>

151 ELSEA Peter (2013) *The Art and Technique of Electroacoustic Music*, A-R Ed. Inc. Middleton, Wisconsin

152 FRANZ David (2004) *Recording and Producing in the Home Studio. A Complete Guide*, Berklee Press

153 <http://umusic.cz/hledame-talenty-1/>

154 <https://www.youtube.com/yt/press/lt/statistics.html>

B/ *The issue of transcription of older recordings to new media:* the transcription requires workforce, means for transcription and a right choice of the most suitable media with respect to evaluation of advantages and risks (reliability, durability, dependence on other technical devices, which can become outdated and unavailable etc).

C/ *Inadequate studio recordings and postproduction concerning style and genre.* Many musicians, who are charismatic during the live performance, are “anaesthetized” by studio modifications and “improvement” of authentic live performance, which is essential for some styles in particular (folklore, world music, traditional jazz...). The distribution of microphones does not sometimes correspond with the style.

This fact is more of a rule rather than an exception and is tolerated (also by musicians, who often offer the recording as being a “better” one or of the same quality), which is probably connected with studio routine work (or a preference of a certain type of studio sound) and the shift of discourse about music from aesthetic-axiological topics towards marketing topics (see above), i.e. musicians expect certain preferences from the audience and they want to satisfy them.

D/ *The service of the sound studios* has spread in the Czech Republic and worldwide. However, their *quality differs*. In the Czech Republic, *Muzikontakt* currently keeps a record of 234 recording and postproduction studios. In fact, there are more of them, although only a small number of them do a fine job, speaking of their equipment, know-how and accuracy. Money is usually the reason why people work on their recordings for shorter time than desirable (2×4 hours per album). More successful Czech bands are trying to work in more prestigious foreign studios (studios with experience with Anglo-Saxon popmusic in the USA or Great Britain — e.g. *Metropolis studio*¹⁵⁵). The problem does not concern the Czech Republic only, we may compare yearly samplers of various countries at international platforms MIDEM, WOMEX, EUROSONIC and others. In classical music, the situation is better regarding the tradition of recording quality.

155 <http://www.thisismetropolis.com>

VALE Maida Recording (2011): *Studios in England*, Books Llc., <https://books.google.cz/books?id=syicSQAACAAJ&dq=studio+Metropolis&hl=cs&sa=X&ved=0ahUKEwuijPaep7vMAhVDthQKHfsRCl0Q6AEINTAB>

E/ High costs of studio recordings, mainly classical orchestra and opera production: in classical music, high-quality sound direction and sound mastering carry on the good tradition. The issue of the past few years is growing expenses when making recordings with prestigious ensembles (purchase of copyright, royalties, rental fee for bigger studios). After 2000, live recordings, or older and remastered archival recordings, are released (Supraphon is a good example). Some ensembles try to solve this problem with the purchase own their technologies and recordings (e.g. *Berliner Philharmoniker*, *Czech National Symphony Orchestra*). Private labels (*Arco Diva*) or universities (*AMU*) got their own studios to save money and monitor the quality better.

TECHNOLOGIES OF SPREADING MUSIC

This segment of the music sector has contributed to its change the most.

Spread of music is influenced by three parameters linked to technologies:

- 1/ *offered recording quality* and its stability during playback (streaming) and the offer of metadata (i.e. data about the composition),
- 2/ *easy control* of the recording playback (user-friendly manipulation), reliability and service, availability/mobility, compatibility with other devices and programs,
- 3/ *monetization*, i.e. bearable pricing of using the new ways of spreading and distribution for authors, agents and end customer.

Some inventions contribute to improving the quality of the offer of the contents or sound, others deal with a user-friendly comfort.

HISTORICAL BACKGROUND

The development of the recording industry was supported by the standardization of LPs, electrification of recording (*Bell Laboratories*) and recording playback in the 1920s. The LPs were standardized in 1952.

The listening quality was improved as the stereo recordings have spread since 1957. They required a new way of recording, adjustment of a pick-up and adequate Hi-Fi devices.¹⁵⁶ As early as the 1960s, they dominated the market and undoubtedly influenced the mass liking for the new wave of pop music. The magnetic multi-track recording was a breakthrough in production in particular (see above). The audio cassette (*Philips* company since 1963) had an exceptional importance for spreading after the vinyl was discovered. The invention, including the follow-up players, was much smaller and more mobile, therefore it contributed to spreading as well (listening in cars, outdoors). The cassette boom came after 1979, when the *Sony* company produced a walkman. In 1986, the sale of cassettes exceeded the sale

¹⁵⁶ Czechoslovakia had some interesting inventions and patents; a patent for LP material with an antistatic surface and improved strength from Loděnice u Prahy, in ČERMÁK Jiří (2011) *Historie GZ z pohledu vinylové desky*, Gramofonek, p. 4; Jiří Landa's AU/RA gramophone without the pick-up.

of LPs three times¹⁵⁷. It emerged that recording industry campaigns, which question new inventions, keep repeating it when the sale of dominant media drops. In the 1980s, the American association of recording industry started a campaign called “*Home Taping is Killing Music.*” Yet another situation keeps repeating: things convenient for the consumer eventually win out and industry looks for new innovations, which could improve a trade balance. Copying to empty cassettes sped up motivation for the commercial use of digital recordings.

CDs did not have major importance speaking of the spread of music. The first CD (*Sony* and *Philips* companies) appeared on the market in 1982. They enhanced user’s comfort and purity of the recording. Low costs for production increased it and contributed to the decrease of the demand of dramaturgy and postproduction arrangement of recordings. Cutting the costs for production was not reflected in the price, however. The market with CDs stagnated due to the implementation of optic drives to PCs and burning programs for copying. This case showed that an adequate protection tool is not legal restrictions but technological provisions using protective algorithms against copying. The protection is aimed at a common user as a knowledgeable user can circumvent it. This stagnation has contributed to a retro-wave of vinyl popularity.¹⁵⁸

THE PRESENT — IMPORTANT DISCOVERIES FOR THE SPREAD OF MUSIC

I. SOUND FILES COMPRESSION FORMATS

Seen from the hindsight, one of the revolutionary inventions for the increase of music spreading is *compressed format*¹⁵⁹ for digital recording: *mp3*¹⁶⁰ (an algorithm defined by the MPEG — *Motion Picture Experts Group*). The first

157 ELBOROUGH Travis (2009), *The Long-Player Goodbye*, London, Hodder&Stoughton, 464 pp.

158 The GZ Media company in Loděnice is currently the biggest producer of vinyls in the world (with the expansit to Canada, China). The traditional SEV hi-fi gramophone producer in Litovel prospers as well. They follow traditional production in specific localities.

159 HTG Explains: *What Are the Differences Between All Those Audio Formats?* (18th January 2011), in: <http://www.howtogeek.com/howto/40465/htg-explains-what-are-the-differences-between-all-those-audio-formats/>
Comparison of Audio Coding Formats, in: https://en.wikipedia.org/wiki/Comparison_of_audio_coding_formats

160 MP3, in: <https://en.wikipedia.org/wiki/MP3>

version was developed in 1991–1993 and was based on a psychoacoustic model of reduction of redundant and inaudible parts of a sound recording. The mp3 format had a breakthrough together with the start of the *Napster* service (see below) and the online shop *Amazon mp3* (since 2007, the first shop that offered music without the DRM protection as well,¹⁶¹ therefore it contributed to mp3 popularity). The motivation to develop these compressed formats was small capacity of memory media in new devices (the first portable MP3 player called *Up player* by *Audio Highway* in 1996 was designed as an army transmitter and had a capacity of several songs).

Other compressed formats developed very quickly. They were later motivated by easy sale and a quick exchange of music data on the internet. Compressed formats used in spreading less frequently are innovated *mp3Pro*, *mp3HD*, OGG, AAC (can be played only with iTunes, iPod), RA/RM/RMA (in internet radios), WMA (a Microsoft product with a higher compression than mp3) and others.

Due to the capacity of storage space and data transfer, we may use formats without lossless compression: the most frequently used and popular format is *FLAC* (the lossless format, which can be used in all main operation systems, used by the *Supraphonline* service, the compression is about 60 %), *ALAC*, *M4A* (used by iTunes and iPod by Apple), *WMA* (the format in *Windows Media Player*).

II. MEMORY MEDIA AND PLAYERS

In 1998, Compaq developed its first hard disk. In 1999, the first *Personal Jukebox* (PJB-100) had a ground-breaking advertised capacity of 4.8 GB, i.e. 1,200 works (instead of 5–6 songs in previous devices). In 2001, Apple Computer company presented its first-generation *iPod* with a 5 GB disc. The subsequent innovations are quick and aim at miniaturization, compatibility and flexibility. In 2001, *iPod* had a flash memory. Since 2002, it is possible to play the video.

Current hardware players can be divided into players based on a flash technology (flash and memory cards, digital jukeboxes with HDD), CD/DVD players, USB memory cards and network audio players (they are connected by the wi-fi network, see below).

¹⁶¹ *Digital Rights Management* (DRM) was one of the technical methods how the copyright holders were trying to control copying. The lack of user friendliness led to the search for different options. The second big store without DRM was *iTunes* (see below).

III. MUSIC IN THE NETWORK — INTERNET

Music on the internet is an essential breakthrough speaking of music spreading. The main ways of spreading music on the internet are *sharing, downloading and streaming*. The youngest generation with its internet and mobile application has introduced a different ways of behavior in the music sector. Given the fact they are technological innovations, it is not possible to do away with them using a legal action.

In 1999, the 18-year-old student Shawn Fanning set up the *peer-to-peer service Napster*. It allowed copying and distribution of music mp3s in the interconnected society of users and thus circumvents the existing chain of the distribution of music industry. The service was sued by performers and the

RIAA (Recording Industry Association of America) was fined in order to liquidate it.¹⁶² Professionals' attitude was ambivalent — the author of Napster was seen by millions of users as a visionary. The service also helped spread the mp3 format. Majors were trying to agree upon fees and share in profit but their attitude was too rigid at that time. According to the vice-president of the Berklee College (focused on innovative processes in music industry and one of the MIDEM partners) Dave Kusek “*traditional majors lost millions of dollars due to obsolete strategies and bad management.*”¹⁶³ The P2P service is still illegal but the “fight” against it is done through education and an offer of relatively nice services, which are subject to the charge.

The P2P application eventually stirred up the development of *download services*, although the impulse to contribute came from a different party than the majors. It was necessary to create a big offer of catalogues, which would be accessible on the internet to download for a reasonable price. These services developed at the same time like the spread and speed growth on the internet and compressed formats (see above). In 2003, the *iTunes Store* was established and quickly developed into one of the biggest stores with music. The store uses the eponymous program as a media player and it pairs with a portable multimedia player *iPod* (since 2001, for music since 2003, see above) and later *iPad* (since r. 2010).¹⁶⁴

162 *Napster*, in: <https://en.wikipedia.org/wiki/Napster>

In more general terms: DASWAMI Neil, GARCIA-MOLINA Hector, YANG Beverly (no date): *Open Problems in Data-Sharing Peer-to-Peer Systems*, Stanford University, USA, in: <http://ilpubs.stanford.edu:8090/581/1/2003-1.pdf>

163 TŘEŠŇÁK Petr (2007) *Kam se řítí hudba*, in *Respekt* No. 47, p. 38.

164 In 2007 over 110 million iPod players were sold, compare with: KUKAČKOVÁ Jana (2008) *Průmysl populární hudby v období rozvoje internetu. Problematika stahování a sdílení hudby*, Brno, FF MU, p. 34

The IFPI (International Federation of Phonographical Industry) started to follow the new digital branch in 2003 as *iTunes* was set up and quickly developed. In 2007, it registered over 500 legal music shops with 6 million songs in 40 countries. The development of services depended on providing the majors catalogues under conditions acceptable for both parties.

Apple iTunes came to the Czech Republic in 2011 with the price of 0.99 EUR/single, 9.99 EUR per album — the price was lower than a CD with a similar kind of music by foreign stars. It made it a strong competitor with the youngest generation and those interested in foreign pop music. In the same year, the allegedly Czech service *MusicJet* with the catalogue of 30 million tracks was established and intentionally displaced the very first service of this kind in the Czech Republic www.i-legalne.cz¹⁶⁵. In 2012, it was French *Deezer* with the catalogue of 35 million tracks a *Bontonline.cz* managed by Bontonland. In 2013, *Supraonline* with the catalogue of 30 thousand albums and 500 thousand tracks started, *Google Play Naplno*, which offers a cloud storage as well¹⁶⁶. The last service of this kind in the Czech Republic is *Apple Music* with radio *Beats 1* with relatively low fees and the *TIDAL* service, which is successful due to a good streaming sound quality,¹⁶⁷ and high royalties. The service is co-owned by 16 top pop artists (rapper Jay-Z, Madonna, Rihanna, Beyoncé, Usher and others), who provide exclusivity to the brand.

The Orchard company is important for spreading of classical music and videos (since 1997 for an independent creative industry). Their client for the distribution in the USA is also Czech label *Arco diva*.¹⁶⁸ According to the IFPI report in 2015, there are more than 400 registered music services in the world. They provide 43 million tracks and the value of this part of the sector is 6,9 billion USD.¹⁶⁹

Speaking of the sound quality of offered music, the traditional mp3 format with a high bitrate of 320 kbit/s is used. *GooglePlay* offers the support of the wireless *FLAC* format, but when storing it to the cloud, music is converted to mp3. *Spotify* and Czech *MusicJet* use *OGG*, *iTunes Radio* uses the *ACC* format.

165 85 % *MusicJet* is owned by the Czech company *Bald Brothers*, *Universal Music*, *OSA*, *Supraphon* have 5 %.

166 *Cloud Computing*, in: https://cs.wikipedia.org/wiki/Cloud_computing
Cloud services are the most quickly developing services in the sector.

167 Studio quality of 44/2 kHz/16 bit with a bitrate of 1.4 Mb/s.

168 <http://www.arcodiva.cz/cz/vydavatelstvi/distribuce/>

169 Digital Music Report 2015, IFPI, p. 22.

IV. VIDEOSTREAMING

Another essential step in spreading came with music videos streaming. If the MTV channel started the demand for audiovisual presentation of pop as a standard format, an internet service, which would satisfy the needs, had to appear. In 2003, the network *MySpace — a Place for Friends* with free registration originated. Music groups discovered this virtual space as a network for their presentation. The speed of the market with innovations in this segment is proved by the development connected with *YouTube*, which was introduced to the market in 2005 as the first free streaming audiovisual service. *Google* bought it in a year and a half for 1.6 billion dollars. In 2015, YouTube was the second most frequently visited community internet website with two billion accesses a day. According to YouTube's own statistics, the generation of people 18–49 years old watch YouTube daily, the website works in 88 countries. Speaking of copyright, YouTube paid more than 1 billion USD to copyright users in October 2014.¹⁷⁰ It is still a free service for end viewers.¹⁷¹

Music videos are important due to their ratings. The *Vevo* (video hosting service) project originated as a joint venture of YouTube (i.e. *Google*) in 2009 and two majors — *Sony Music Entertainment*, *Universal Music Group* and *Abu Dhabi Media* (NYC) in 2009 in order to present production of the labels on a new channel called “*See Music Play*”. Progress of this platform is confirmed by data from their Facebook page (7 billion views per month, 100 thousand HD videos from the majors exclusive offer, it is possible to watch live concerts or use the on demand regime).¹⁷²

Music streaming is currently on the increase, yet the main issues are legal protection, balanced monetization and technical problems. Due to the use of the flash technology, the “music stream freezes”. Software players have issues as well. *Spotify* uses P2P, which lowers the costs for operation but it can bring some other problems (with operation, law).

170 *YouTube*, in: <https://en.wikipedia.org/wiki/YouTube>
<https://www.youtube.com/yt/press/statistics.html>

171 Revenues come from advertising — like in other community and mobile network, and private media. In the Czech Republic, OSA and YouTube made a contract in 2009 to make sure authors get paid from this channel as well (more information — see below, chapter CONSUMPTION — AUDIENCE).

172 https://www.facebook.com/VEVO/info/?tab=page_info

V. MUSIC IN MOBILE NETWORKS AND WIFI

Another significant landmarks in music spreading was *the mobile operators engagement in spreading and selling music* since 2004. The obstacle was the prices of mobile phones with required operation systems, memory capacity and a poor quality of sound at the beginning. In 2005, the MIDEM platform saw the new “music rings” in mobiles, which seemed to be as a marginal oddity by many professionals. However, the development of mobile phones sped up, so the majors started to change their attitude from confrontation and reactive behavior (when negotiating with download services) towards proactive behavior because mobile operators offered a well-elaborated system of charging the users.

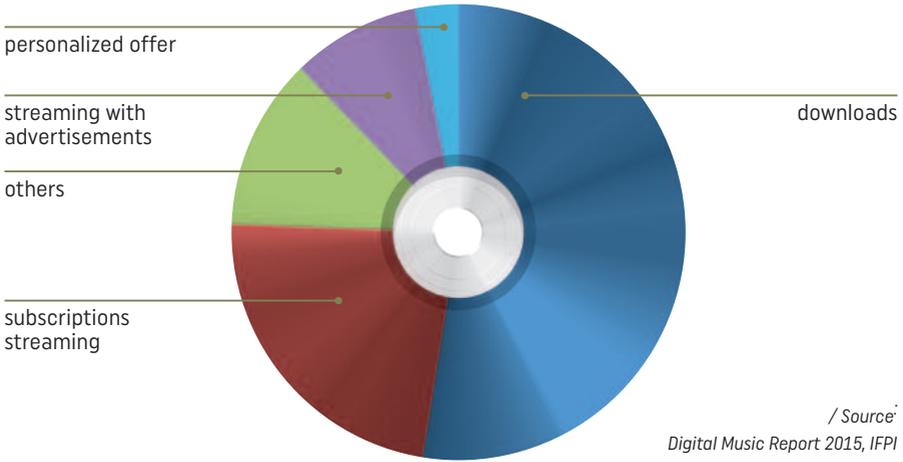
In 2005, *T-Mobile* used its position on the market and was the first one to make contracts about the conditions of providing the catalogues with the majors (*Sony, Universal and Warner Music*). Then it created its own music format, which was necessary due to the current technical parameters of the phone. Other operators followed. Nowadays the capacity of mobile phones memory allows for storing and playing common compressed formats; moreover, this practice stimulated the massive onset of the streaming service, which is, in fact, a kind of a second and user-friendly return to the principle of music radio and television.

Currently, *Android* smartphones are the most supported ones (with the offer of *Spotify, Google Play Music, Deezer, MusicJet, Rdio*). The persisting problem for streaming of music in mobile phones is low data limits. When it is used up, streaming “freezes” and the load of the mobile network plays an important role as well. The Czech market currently hosts three big operators — *T Mobile, Vodafone, O2* — which offer partner music services for financially acceptable conditions but they do not increase data limits for the given price, according to research.¹⁷³

Wireless computer networks, especially *WI-FI*, are good for music spreading (since 2002).¹⁷⁴ For public services providers (hotels, public transport — even city public transport, this service is an added value, which raises the standard of services and user’s convenience.

173 The test of the volume of transmitted data in services, e.g: MACÍCH Jiří ml. (23. 1. 2014) *Pět služeb na streaming hudby: jakou nabízejí kvalitu a kolik spolknou dat*, in LUPA <http://www.lupa.cz/clanky/pet-sluzeb-na-streaming-hudby-jakou-nabizeji-kvalitu-a-jak-zatizi-fup/>

174 <https://cs.wikipedia.org/wiki/Wi-Fi>



Commentary: The fastest growing segment (from the above-mentioned) is subscription with the year-on-year growth of 39 % (41 million users), the segment of streaming with advertisements (used by the younger generation) has the year-on-year growth of 38.6 %. Downloads (i.e. purchase) slightly decreases by 8 % as well as a personalized offer in mobile phones (-17,9%), which is probably considered too “obtrusive”.

According to the IFPI report in 2015, there is an increase in revenues from digital sales by 3,2 %, total revenues from digital sales is 6.7 billion USD, total revenues are 15 billion USD (the total volume is roughly identical with 2014).

The most dynamic part is streaming with the year-on-year increase of 45.2 %. Streaming is now 19 % of total sale (compared with 14 % in 2014). 68 million people uses subscription with advertisements (compared with 41 million people in 2014). Download remains an important service with 20 % of total revenues, but the overall drop is by 10.5 % compared with the previous year. People use it to download full albums (with the value of about 1.4 billion USD). Revenues from execution rights are growing by 4 % year-on-year (2.1 billion USD) and they are the most consistently growing part of revenues. They now account for 14 % of total incomes compared with 10 % in 2011.

Physical sales are dropping, yet the dynamics of the decrease is slowing down (by 4.5 % year-on-year, it the previous years by 8.5 and 10.6 %).

An important step forward was made in December 2015, when the European Commission published its Communication Towards a modern, more

European copyright framework. While acknowledging that music and other creative content and online services are both important for economic growth and jobs in Europe, the paper clearly identifies the "value gap" as a problem. The Commission plans to make its first proposals on how to deal with the "value gap" public in 2016.¹⁷⁵

BENEFITS/OPPORTUNITIES

- A/** *An enormous growth in the amount of potentially available music* (mostly pop music) in a short period of time. *Repertoire globalization* is a benefit and a risk. New services keep taking account of the national repertoire and indie catalogues. *The principle of mutual cooperation of B2B, B2C* therefore strengthens.
- B/** After 2014, *availability of "studio technical quality" Hi-Res* is being thematized as well as *service personalization*, i.e. using programs for finding out and the offer of repertoire according to customer's preferences (see below).
- C/** *There is an enormous development of the YouTube platform (Vevo) even for mobile networks.*
- D/** *Offered services become more available* (see WI-FI services, music in smartphones, they are *more compatible*, i.e. less depended on an operation system, specific players and others).
- E/** *A digital market "triggered" of music industry crisis but it also contributes to its stabilization. The music market ranks among the most progressive ones regarding technology*¹⁷⁶. Speaking of flexibility, influence and innovation implementation, *Universal*, ¹⁷⁷ *Deezer* a *Spotify* are evaluated by the European agency in the above-mentioned study. Majors gradually adapted to new technologies, see the *Vevo* platforms (see the dates about consumption below).

European agency in the above-mentioned study. Majors gradually adapted to new technologies, see the *Vevo* platforms (see the dates about consumption below).

175 <http://www.ifpi.org/news/IFPI-GLOBAL-MUSIC-REPORT-2016>

176 EY (Dec. 2014) *Creating Growth. Measuring Cultural and Creative Markets in the EU*, p.13.

177 In the Czech Republic, the classical label *Universal Music* seems to be as the most flexible one regarding dramaturgy, marketing and cooperation with digital services. It also supports young talents (*Hledáme nové talenty*).

RISKS

- A/** *The market is still unbalanced.* The offer of services exceeds the demand and the prices are driven down to the minimum. New ways of reliable pricing (subscription, lump sum payments from wholesale customers and others — see CONSUMPTION—AUDIENCE) are being searched for.
- B/** *Authors, performers and labels get only small income from new digital services.* It is state that an artist gets about 20,000 CZK for 1 million views at YouTube¹⁷⁸, the international average per one play is 0.4 pence (about 0.20 CZK) per one track in digital services (OSA lists about 0.033 CZK for an author).
- Additional information: the author in the Czech Republic gets about 1 CZK for one played song on the radio and 45 % from the income from a released recording.¹⁷⁹ Thus, new media are more like promotion for albums (CD) and concert activities. In general, the system supports established stars, who can reach up to one billion views and downloads¹⁸⁰. It is unfavorable for indies and those who are at the start.
- C/** *Technologies (Wi-Fi and streaming) are not fully settled speaking of user's comfort.*

Radiation risks (electro-smog) are also evaluated for WI-FI.

178 Current *YouTube* statistics quotes positive 50% year-on-year growth in partners' income.

179 <http://www.lupa.cz/clanky/streaming-hudby-pocita-se-na-halere-muzikantum-ale-presto-pomaha/>

MP (6 May 2015) *Za písničku v rádiu koruna. OSA obdarovala autory nejštedřeji v historii*, http://ekonomika.idnes.cz/svaz-rozdelil-penize-autorum-d2o-/ekonomika.aspx?c=A150506_164759_ekonomika_map1

Streaming Music Payments: How Much Do Artists Really Receive? (19th August 2013) in: <https://www.theguardian.com/technology/2013/aug/19/zoe-keating-spotify-streaming-royalties>

SPOHR Wolfgang (29.7.2015) *German Publishers and Music Authors Call for Equal Streaming Pay*, in: <http://www.billboard.com/articles/business/6648419/german-publishers-music-authors-equal-streaming-pay>

180 <https://www.youtube.com/watch?v=6O4Fr0IGCu8>

CONSUMPTION – AUDIENCE

Regarding the excess of the offer of new services over demand, the care about the consumer/audiences has become essential for music production. The P2P service and the development of community internet networks have shown that the youngest generation essential for pop music can also be creative and react quickly. This speed is increased by the principle of networking and current capacity of these networks (in its statistic data, *YouTube*¹⁸¹ lists more than one billion viewers, which is about one third of internet users). *YouTube for mobile devices* approaches more people between 18 and 49 years of age than other networks. Therefore it is necessary to offer service that wins the group and prevents the gain leak.

Producers and labels accepted this “game” and sophisticated the B2B processes in order to distribute the risks and compensated potential losses (the biggest merged international enterprise in media in currently *Vivendi* with about 60 thousand employees and the turnover of 50 billion EUR, which includes labels (the biggest one — *UMG*) and media; another example of a reactive corporation is joint venture *Vevo* established by Google and labels; every network users also knows about the links among *Google*, *Facebook*, *Twitter* and others).

The EU program for the support of creative and cultural sectors *Creative Europe* for 2014–2020 with the capacity of 1,462 billion EU aims at using new technologies and “audience development.”¹⁸² *From this point of view, projects with high attendance or a number of views are evaluated to be the top.*

The festivals with highest attendances in Europe are *Donauinselfest* in Austria with 3.2 million visitors in 2013, *Przystanek Woodstock* in Poland — 550 thousand in 2012, *Sziget* in Hungary — 385 thousand in 2012, *Paléo* in Switzerland — 230 thousand in 2013, *Exit* in Serbia — 285 thousand in 2012. In the Czech Republic, open-air festivals have lower attendance: *United Islands of Prague* — 60 thousand, *Hradycz* — 60 thousand, *Colours of Ostrava* — 40 thousand, *Rock for People* — 30 thousand, *Sázavafest* — 20 thousand, *Finlandia Mácháč* — 10 thousand). Electronic festivals that use technologies for sound system installations and sound making are properly registered. The most of bigger festivals of this kind is in Europe (306), in the USA (42) and Canada (34). The attendance is tens or hundreds of thousands (one of

181 <https://www.youtube.com/yt/press/cs/statistics.html>

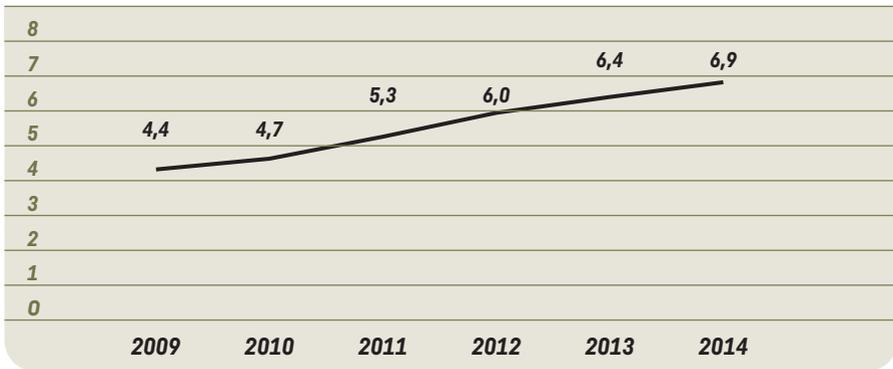
182 <http://ec.europa.eu/programmes/creative-europe/>

the recommended ones is also *Magnetic Festival* in the Czech Republic — 10 thousand visitors).¹⁸³

Dynamics of the music market with the link to new digital technologies can be followed in the annual reports of the IFPI, protective organizations and statistical studies ordered by professional platforms (like *Creating Growth* by the EY agency).

According to the IFPI record from 2015, the income from physical and digital sales equaled in 2014 (46 % each). In 2015, digital sales are 45 % of overall income but physical sales are only 39 %, the rest is the income from performing rights and synchronization. The growth is slower in countries, which introduced digital services first. On the other hand, the slump in physical sales is slowing down because CDs and vinyls have found their places on the market (the albums of established stars are sold on CDs and vinyls, people evaluate sound quality, cover, metadata). CDs and vinyls are either collector's items or presents nowadays. Sales of CDs show the popularity of Czech repertoire in more countries (also in the Czech Republic)¹⁸⁴. Digital downloads and streaming are utility forms as global stars dominate the top overviews.¹⁸⁵

GLOBAL INCOMES FROM THE DIGITAL MUSIC SECTOR (in billions of USD)



/ Source: Digital Music Report 2015, IFPI p. 6 /? Digital Music Report 2016

183 http://www.electronic-festivals.com/event/map_and_list_of_upcoming_electronic_festivals_world_wide?field_visitors_value=2

184 <http://www.ifpicr.cz/hitparada/index.php?http=R>

185 The research of musical preferences can be controlled by more complicated models, see: RENTFLOW Peter J., GOLBERG Lewis R., LEVITIN Danel J. (2011) *The Struktura of Musical Preferences: A Five-Factor Model* <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3138530/>, but the purchase or the rate of video viewing has a behavioral character independent of utterances, which can be confusing.

IFPI also lists the survey ordered with 13 biggest music market for 2014¹⁸⁶. Consumers list:

INTEREST OF INTERNET USERS IN THE MUSIC SECTOR (in %)

YouTube – watching music videos	84 %
iTunes – paid download	68 %
Spotify	62 %
Amazon – mp3	57 %
Vevo – Music / music videos	41 %
Deezer	28 %

/ Source: IFPI.org (Original source: Ipsos Media CT)

THE OUTLINE OF 10 MOST POPULAR SINGERS IN THE WORLD IN 2014¹⁸⁷

1. TAYLOR SWIFT	6. MICHAEL JACKSON
2. ONE DIRECTION	7. PINK FLOYD
3. ED SHEERAN	8. SAM SMITH
4. COLDPLAY	9. KATY PERRY
5. AC/DC	10. BEYONCÉ

/ Source: Digital Music Report 2015, IFPI p. 11

Commentary: The top chart evaluates the outputs of physical sales and digital services (downloads and streaming) and viewer ratings on YouTube and Vevo video platforms.

The best-selling albums in 2014 reach about 10 million copies (album *Frozen* / sampler of more artists), the second best-selling was Taylor Swift’s 1989 (6 million), the third best-selling was Ed Sheeran’s *X* (4.4 million).¹⁸⁸ The sale of top singles in digital services reaches 13.9 million on the first place (Pharell Williams’s *Happy*) or Katy Perry’s *Dark Horse*, which is probably the most frequently watched single of this time (1.21 views on YouTube¹⁸⁹). This fact refers to the above-mentioned fact that visual image and video

186 The year 2015 has not been listed yet.

187 After 2015, we can find 10 TOP male and female singers without the methodology:
<http://www.allbesttop10.com/top-10-most-popular-male-singers/>
<http://www.allbesttop10.com/top-10-popular-female-singers/>

188 Another top in Digital Music Report on p. 12.

189 <https://www.youtube.com/watch?v=OKSOMA3QBU0>

(started by Michael Jackson and Madonna) play an exceptional role in popularity.

The big boom related to services for audiences is now experienced by *applications for mobile phones* (it is an important part of presentations of *Innovation Factory* on the MIDEM platform), which offers various kinds of services to the whole chain of the music sector.¹⁹⁰ Notifications for events with favorite artists, booking and sales systems, games with potential discounts, well-functioning players with functions for selections, searching and others are useful for the audience as well.

OPPORTUNITIES/BENEFITS

- A/** *Production being interested in audiences, the origin of various new formats*, space, offers with technologies usage,
- B/** *lowering the degree of unlawful behavior on the music market* regarding the youngest generation (according to the reports by IFPI and protective organizations),
- C/** *a wide spectrum of free software and applications offer* improves the functions of commercial products.

RISKS

- A/** *Obtrusion in the content and format for the youngest generation* (childishness, over-ornamentation, sexism) in shows and recordings,
- B/** *focusing of the youngest generation on virtual reality*, star system,
- C/** *too strong emphasis on supporting events, branding* (merchandising, promo events, guided tours, peeks into singers' privacy and others),
- D/** *the insufficient impact of psycho-social research on practice* (the research of mass culture, fetishes, values that are presented)¹⁹¹. Most research

190 Applications for Android: the player *Poweramp Music Player* has an equalizer, it supports many formats, the *N7player* player with multitouch controls, *JetAudio* with strong bass, *Om-nich Player*, which filters the selection of performers, albums. It creates playlists, has an equalizer ETA. Many applications are offered for free.

191 One of the respectable authors dealing with mass communication A. BADURU, or PRIMACK Brian et al. (2008) *Degrading and Non-Degrading Sex in Popular Music: A Content Analysis*, in *Health Rep.*, No. 123, p. 593-600, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2496932/>; MAUCH Matthias a kol. (2015) *The Evolution of Popular Music: OSA 1960-2010*, The Royal Society Publishing, <http://rsos.royalsocietypublishing.org/content/2/5/150081>

are produced due to a commercial order by producers and professional platforms, and should serve for improving consumption.

EDUCATION

The system of education is currently divided into *formal and informal*.

Formal education is linked to accreditation, acknowledgement of qualifications based on a graduation document. Informal education has two levels — level of courses, workshops out of official system and spontaneous natural process of learning since early childhood.

Speaking of music, teaching information and communication technologies is a priority in most of the countries; however, its implementation in music education. The current *European Agenda for Music* (2012) followed the agenda from the UNESCO meeting in Seoul called *Goals for the Development of Art Education*, UNESCO 5/2010 and the *European Agenda for Culture*, 6/2010¹⁹². It explicitly includes the ICT education as part of *audiences development* and communication, not in the field of production.¹⁹³ The equipment of schools of all levels and kinds of computers, internet and basic general software is a standard of more developed countries. However, equipment with special software for art education is not a standard. The problem is investments into software and adequate education of teachers. Foreign countries (UK, USA, France, north Europe, Germany and others) develop the external cooperation model of “*creative partnership*”¹⁹⁴ with artists: it is a project education in cooperation with other organizations, which are capable of getting project funds and provide qualified stuff (an education program of *Berliner Philharmoniker*, *Society for Creativity in Education* in the Czech Republic), or individual artists, who can guide children to attain creative results. Another problem is evaluation of artists, who are suitable for education within the formals system, especially in the Czech Republic as there are formalized requirements for qualification.¹⁹⁵

192 LAURET Jean-Marc, MARIE Francois (June 2010) *European Agenda for Culture. Working Group on Developing Synergies With Education, Especially Arts Education. Final Report*.

193 COENIX Stef (2014-15) *A European Agenda for Music*, in *Sounds in Europe*, No.10, p. 17.

194 https://en.wikipedia.org/wiki/Creative_Partnerships
<http://www.crea-edu.cz/>

195 *The Society for Creativity in Education* created a project *Self-assessing Competence Framework for Artists and Other Professionals in Creative Practice*, which could serve this purpose. http://www.crea-edu.cz/sites/default/files/sebehodnotici_kompetencni_ramec.pdf. It not a certified methodology, however. Yet the principle of self-assessment suits the field and is a common tool of quality management in organizations (state administrativ — CAF).

The formal education system deals with a useful implementation of technologies in education all over the world. Speaking of the formal education at the middle/higher level, *Berklee College of Music*¹⁹⁶ ranks among exceptionally progressive schools in methods of education for creative practice. Due to these reasons, *Berklee* in Valencia is a long-term partner of the MIDEM platform. The Czech Republic discusses the issue on the methodical website *rvp.cz* managed by the Ministry of Education, and deals with experience and advice regarding implementation of framework education programs. Using computers in education is also discussed by the *Association of Basic Music Schools in the Czech Republic*. A project by the *Portedo*, o.p.s. is being prepared and it should provide the support for its members using the European funds.

The most progressive field of education with the support of technologies can be found in the segment of informal education: there are *a lot of on-line tutorials, courses, presentations of private institutes* on YouTube.¹⁹⁷ In the Czech Republic, the results in this field (composition with the support of technologies) are followed by the *Institute for Modern Music* in the project *České ucho/Czech Year* (since 2014)¹⁹⁸ in cooperation with the *Music Section of the Arts and Theatre Institute v* in the courses for children and the youth (9–18 years of age).¹⁹⁹ The graduates show quick and good results and other basic schools show their interest as well. However, the practice of informal education in the Czech Republic still has the constant problem of sufficient continuous funds for independent subjects.

OPPORTUNITIES/BENEFITS

- A/** *Art education and education for user's competences for new technologies is part of formal education in the most countries.*
- B/** *Young people's interest in art supported by new technologies is big.*

196 <https://www.youtube.com/watch?v=M7woVKKjLhc>

197 <https://technmusiced.wordpress.com/about/http://mustech.net/>
<https://www.youtube.com/watch?v=9MkSAJYnO3Y>
<https://www.youtube.com/watch?v=rexxum-urLY>
<https://www.youtube.com/watch?v=M7woVKKjLhc>

198 The project *České ucho/Czech Year* is based on the training of hearing, identification and description of sounds, recording, petting to know the software and composing a short piece ("bonsai"). The last phase is the competition evaluated by an international jury at the prestigious international competition with awards <http://ucho.sitespecificart.cz/>

199 <https://www.facebook.com/institutmodernihudby/>

- C** / *We can find a sufficient number of available projects in informal education.*
- D** / *We can find some “good practice” examples in this segment in the Czech Republic.*

RISKS

- A** / *Formal education experiences troubles to efficiently interconnect art and technological education, although it is part of education strategies. There are financial (investments) and staff (a sufficient number of competent and creative teachers) problems. The structural funds in the Czech Republic do not cover this field, however.*
- B** / *The more general problem is funding the projects of independent organizations in the education segment.*
- C** / *In the Czech Republic, there is a problem of an efficient interconnection of formal and informal models (legal, job, financial and operational barriers).*

CONCLUSION

Education is a precondition for music production and perception. Technologies seemingly facilitated (laicized and sophisticated) production, spreading and perception (consumption). They are an impressive tool we have to handle wisely. They are not an independent goal and every segment has benefits and risks of using new technologies.

Public space is currently overloaded with electrified music being a background. A number of creators rely on amplified sound semi-finished products, which is a manifestation of the fact that modern technologies have been in production for such a short time that we cannot perceive them asymptotically as a tool. Omnipresence of electro and sound smog, the improvement of impressiveness and a real depth of application of virtual reality places the issues of ecology, hygiene and axiology. Quality of cultural environment is part of non-reflected informal education. The good practice of music education shows us that the youngest generation is capable of cultivating their abilities very quickly and, in the end, to limit the influx of poor and valueless production.

The final recommendation of this study is to pay professional and practical attention to education in all fields (education of authors, performers, production and audiences), which contributes to a good overview, direction and co-creation of changing audiences and the media sector.

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