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A Matter of Sources

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The approaches to documenting and archiving electroacoustic music and computer music include an array of diverse aims and interests which accompany different requests depending on the source material being archived. While already facing a vast variety of sources ranging from traditional scores to complex digital performance set-ups, a particular challenge is to navigate the gap between saving historical testimonies of a musical work and its performances on the one hand, and making information and technology sustainably accessible in order to enable new performances of the examined music on the other (Basic challenges are outlined e.g. by Serge Lemouton [Lemouton 2020]). Hereby, rapid (digital) technological developments cause an urge to create updates in order to provide access to the content resulting in a constant need of transfer, which then raises basic historical questions e.g. what to consider – and thus save – as historical testimonies of a musical work and its performance. In other words: digital technology always implies a temporality in its existence – an ascribed sense of future as well as a short-lived usability. For example, the first established set of digital sound processors that enabled real-time music signal processing, which were developed from the 1970s to the 1980s, were overtaken by new developments within approximately a decade [Lindemann et al. 1991]. All of these initial systems are now no longer in use. This example can be linked to a more general process: (digital) technological developments are per se meant to be designed as future-oriented, aiming to create new visions, solutions, and possibilities. Individually developed technologies, however, are often seen as smaller steps within a more comprehensive development process which (still) do not completely satisfy all aims (and therefore only last until revision). This strongly interferes with the mutual influence of technological developments and artistic works resulting in the challenge of a constantly, and often intendedly, changing state of source material especially on different (technical) levels. Approaches to documenting and archiving therefore have to evaluate between capturing a result, saving performance information and preserving content that enables establishing new performances of specific musical works.

Music embedding technology

Digital technologies form a central part of the existing sources for both electroacoustic music and computer music, and appear as a main characteristic in the definition of computer music. In the 2010s, Nicolas Collins, composer and researcher in the field of computer music, explicitly placed the technical aspects as the fundamental element, stating that "[c]omputer music could be most generally defined as *music that involves a computer at any stage of its life cycle*. This encompasses a very wide variety of musical activities, even if 'unplugged' acoustic music and electric (e.g. amplified) music without microprocessors are excluded" [Collins 2010: 1]. This implies that the use of a computer is necessary or essential for the music's genesis or performance. However, there is not necessarily any aesthetic direction framed.[1] The fact that Collins implicitly specifies the computer as "microprocessor" indicates that the term 'computer' itself may not always be precise enough to describe the respective technology. On the one hand, the term 'computer' serves as a synonym for both hardware-software combinations including digital processors and operations calculated on (micro-)processors; on the other hand, there exist both a broad range of technical specifications and a more or less precisely differentiated designation of substantial technologies within a composition and its work description, which may relate to 'computers', but may not be named as such [Akkermann 2021].

This challenge is mirrored most prominently in a discrepancy between the description of compositions (e.g., technology in/and instrumentation), their classification, and the technology that is actually used

in a specific performance. For example, at the Institut de Recherche et Coordination Acoustique/Musique IRCAM (Paris, France), a total of 929 performances of 559 identifiable mixed music[2] compositions and 62 performances of works without title are extractable from the institution's program notes and reports for the 1980s and 2000s.[3] Within the information on these performances, there are 58 different terms in use for describing the technology. This number can be reduced by merging terms like "tape" and "bande", or "computer" and "ordinateur" as well as synonymous terms in different languages such as French, English and German. It results a collection of 23 terms which are clearly dominated by naming seemingly individual technologies while at the same time strongly depending on the decade in which a musical work was composed. Besides the most mentioned instrument 'bande', which includes the use of technologies ranging from magnetic tape to digital fixed-media works, the term 'computer' remains the most used description, followed by 'synthesizer' and 'clavier électronique'. It is noticeable that the descriptions of the technologies range from very detailed statements, for example the name of a program used such as 'Max' or the name of a specific sound processor, to very generalising descriptions such as 'électronique'. Rather generalising descriptions are dominating; yet those are not necessarily matching with a historic classification of a work nor with the actual embedded technology and may even veil a specific set-up or stand against certain attempts of categorisation. This displays one more aspect of the challenge caused by the mutual relationship between technological development, the urge and interest of updating technology, the devices actually employed and the terminology in use concerning documenting and archiving the sources: as the keywords are not on the same systematic level, these terms – even though they are characterising the piece – may be misleading for documentation or classification systems. However, they are significant for understanding the position of the technology in a musical work in historical terms and they may provide significant information for finding or gathering a certain group of compositions.

The interplay of artistic creation and technological development in combination with a quite inconsistent technical description, as well as the fact that digital technologies require constant care and updates, leads to a complex state of source material which is heterogeneous not only in relation to the technologies embedded and the use of technology but also in the respective nomenclature. In consequence, keywords or titles of categories must be evaluated with regard to their inherent meaning as well as the domain/perspective from which the sources are examined.

Disciplinary perspectives

Sources of music works are both created and examined under different perspectives with varying interests and questions. This applies especially for music that embeds digital technology, as – besides artistic aims – establishing an environment, that enables e.g. the performance of a computer music composition, includes a lot of information and knowledge that is not directly bound to the music itself, such as audio technology for amplification (e.g. microphones, mixing desk and loudspeakers, which were explicitly excluded from the definition of computer music by Collins if only used for amplification) [Collins 2010] or the basic knowledge in computer science (e.g. programming skills), which is then not specified or described in the description of a music piece. This also accounts for technology that is supposed to be 'standard' (e.g. the specifications of a computer in use concerning processor, sound card and operating system) – information that is usually not bound to a specific tradition of transmission and often considered as rather 'general technical knowledge', although not necessarily for the composer.[4] At the same time, sources exist that are (for western music research) clearly connected to specific (western) music traditions such as music scores and notation systems, but also instruments and playing techniques as well as interpretational approaches.[5] For computer music also, musicologist Laura Zattra shows that a "standard framework of tasks, know-how and objectives" [Zattra 2017, 85] is establishing. This applies for both the initial artwork as well as its documentation and it goes hand in hand with a discipline-driven expectation of what kind of information can be found in the sources as well as the related (inherent) knowledge – and what might be missing.[6] For example, musicians approaching sources of a musical work usually ask for indications on how to play this music – a question that accounts for the first set of sources produced for a composition as well as for documentations of this piece.[7] In contrast, the aim from a musicological perspective can be a

systematisation of existing information to create a documentation or to examine existing sets of source materials looking for (historic) documents giving hints concerning the genesis of a piece or its (initial/former) appearance.[8] A technical perspective, however, may put the practical information of a piece's performance into focus, whereas from a computational perspective, the implementation to a specific hardware and the realisation of practical artistic ideas may be the central interest [Akkermann 2022b: 80ff].

A closer look at the sources hence unveils that the various aims need different sets of source materials, which points back to two very basic questions: What information has to be provided to meet the different questions and interests? And hence: What is considered as 'the artwork'? In terms of documenting and archiving, this results in the respective questions: What is considered to be archived as 'the musical work'? And how is it possible to provide the information that allows to achieve the respective archiving goal? This complex relationship is enhanced by the fact that (historic) musicological research is often consulted to develop the basis for preservation processes. This means that a major focus is set on retracing information about the genesis and former performances of a composition, which may not necessarily also include the information required for establishing new performances when it comes to technology and its implementation.

Hence, the aim of archiving can be to preserve the existing sources which may produce a set of source material that differ from the one deriving from the aim of finding possibilities for sound fixation, or the interest in providing information that enable re-performances. The aims of archiving therefore are directly linked to the questions researchers or musicians want to address, the sources and the contained information they expect, and consequently also influence the development of selection criteria for the sources to be archived.

Temporality

Technology undergoes changes in various ways. For example, materials of media carriers such as tape change over time – because of temperature, the way they are stored but also when played a lot, causing transformations of tempo, duration, or also the audible result – or the hardware, in terms of carrier of the (digital) content, can change through aging processes of single components. Fundamental approaches to preservation strategies based on transferring the content from tape or other physical media carriers to the digital domain have been already developed from archival as well as practical perspectives including archival protocols, transfer strategies, and software tools.[9] Hereby, a content that has been considered 'fixed' on instable physical material becomes a transformable digital data set.

However, native digital content does not necessarily change itself, but it is changed by its changing environment: the digital content may appear differently *because* it did not change in parallel to its environment [Vidolin and Canazza 2010: 292]. This means that it is necessary to change the original content in order to maintain the initial functionality. The range of the adjustments depend on the technology (environment) and the content itself [Straebel 2008] At the same time, a new question appears which has already been discussed – with a similar attempt – by media scholar and curator Corina MacDonald. She asks (for the exhibition context) to what extent it is acceptable to change an artwork in order to recreate an impression for the audience that is comparable to the initial presentation. How does this relate to the intention to present the artwork in a form that is as similar as possible to the initial presentation – even if this changes the impression for the audience? [See MacDonald 2009 chapter 2.1 and 4.1]. For technology-based music, the question is if technology should be kept in the original form even if this means that it is no longer working or processable (e.g. code); or if the sources should be constantly updated in order to maintain the operability whilst taking into account that this changes the initial content. While many approaches aim in the latter direction,[10] this also implies another challenge: a constant increase of sources. In terms of state of source material, this means that with each update, new content is added which may (practically) replace the previous version(s).

The need of digital hardware and software to be continuously adjusted – changed – in order to remain accessible and functional causes two major consequences: the source material grows by agglomeration

of new content created by potential new authors [see e.g. Akkermann 2020], and each documentation of a (new) performance becomes a snapshot of the state of a composition at a specific time which possibly overwrites other sources.[11] This does not only influence the notion of stability of sources, but it also offers a new layer in the discussion about 'original' sources/state of source material and opens a new perspective on the role of archiving. As has been already discussed with focus on the role of the process of documentation by archival scholar and curator Suzanne Briet [Briet 1951], the process of creating and selecting the documents which enter the archives becomes a powerful gatekeeper for both the retrospective appearance and the possible future understanding of the artistic idea, as well as related performative issues. How a composition's initial shape is depicted – the way it seems it should sound or be performed – relies, then, on a combination of successive sources which are shaped by a selection and configuration based on both the aim of archiving and the interpretation of previous sources.

This becomes especially clear when considering that each newly introduced technology is also accompanied with new specific performance techniques which are – again – often bound to a specific device. Or, as computational information scholar Sergio Canazza and composer Alvise Vidolin put it already in 2001:

"An aspect often neglected concerns the preservation of knowledge about the performance praxis, both on traditional and electronic instruments. If a new instrument imposes a new performance technique, also a new musical language could stimulate a mutation in the way to play instruments already encoded." [Vidolin and Canazza 2010: 293]

Documenting technology also means documenting instrumentation and hence thinking about how to preserve knowledge of performance aspects. With respect to Briet, this requires a dedicated documentation, especially as this aspect incorporates an unsolved discussion: How to grasp the knowledge on performance practice which can hardly be formalised, even for traditional western music genres. For music that incorporates new technologies, this adds to the multiple challenges and often leads to solution-oriented processes building on technical aids and the latest existing sources. It appears a self-consistent re-feeding loop of archiving aims, interpretation of already existing sources, creation of updates and/or new versions, documentation and selection processes and source agglomeration. Hereby, on the one hand, versions seemingly try to keep the audio result quite similar to possible predecessors (which may also align with the idea of 'tape' music being 'fixed') while on the other hand code transfer and technology change are not much questioned concerning potential changes to a composition (which may derive from the practical need of updates). In any case, it is important to consider that the archived sources can influence the way a composition is retrospectively perceived, and that the state of source material also influences how it is assumed that a piece has been intended – and hence, how it can be re-performed today or in the near future.

These interrelated processes are mirrored in the terms used in the description of the compositions as well as in the descriptions of the compositions' performances. In the case of the performance information studied for the 1980s and 2000s at IRCAM, it can be seen for example, that the self-description or self-categorisation comprises a rather basic description and gives little information about the technologies actually used. The only exception is the 4X, the sound processor developed at IRCAM, which is named explicitly as a technical component [Akkermann 2015]. It does not, however, indicate any performance-related aspects. Furthermore, it appears that the information concerning the technologies embedded in compositions and their performances differ significantly between the description in the program notes and the entries found in the Sidney database. Instead of specifying the technologies, as occurs in the database (?) documentation, the terms used in the very first description of a composition continue to be used in the description of the performances, even if the terms no longer refer to the same technology as in use of the very first performance [Akkermann 2018]. These inaccuracies can lead to misconceptions both about source content and (possibly unintentional) selection, since each categorisation enshrines an implicit view of the sources.

Sources of archiving

Thinking about archiving computer music presents not only the challenge of looking backwards, but it also requires a complex debate concerning current sources, as archiving aims impact on the nature of the sources as well as the way we think about 'preservation' and 're-performance' of a musical piece. In parallel, archives foster the illusion of the possibility to keep a time-independent status quo, which is in strong discrepancy with the technology. While tapes, recordings, or other media reconstructions provide the illusion of the possibility of re-experiencing a performance, digital technology promises future-proof and forward-looking concepts beyond the limitations of time. Despite – or maybe because of – their temporality, being document of its time and time-based evidence at the same time, they are both pivotal points and actuators of the transformation of, as well as a landmark for, an 'original' compositional idea. As seen above, this again applies to both timelines, the reading of the past and the implications on a possible future of a musical work. An inherent but rather invisible challenge, particularly for the use of digital technologies, is that practical decisions and everyday handling are commonly not documented. This partly results from the fact that there is no time allocated to document it and partly it is considered unnecessary as the actions are – as comparable to average performance practices not being assigned in scores – considered 'common knowledge' and examined in terms of 'tacit knowledge' or 'practical knowledge' (see e.g. Donin and Traube 2016).

It becomes more and more clear that different archiving aims require different archiving processes, each implicitly or explicitly influenced by the disciplines involved, which in turn apply different expertise and methods to the sourcesresulting in differing selection processes – which again relates to the sources themselves. Archiving music including digital technologies shows the challenges that come along with these interrelated processes. This may help to increase sensitivity concerning the possibilities archived sources offer in terms of their interpretation as well as concerning the process of documentation which shapes the state of source material, and may also enable new approaches with respect to existing sources which can open up new perspectives on the documented and archived works.

Early and fundamental steps have been made in all involved disciplines, but a remaining challenge is to bring all of these approaches and research results together in order to be able to make informed decisions on strategies that match the individual needs, and oversee consequences that result from the strong interdependencies of the sources. This would not only help to develop matching strategies for sustainable archiving, but it would also allow the connection of involved actors, provide benefits from specialisation on specific documentation or archival aims (e.g. of smaller collections) and prevent what Canazza and Vidolin has described as a "precarious passive conservation of the cultural heritage" [Vidolin and Canazza 2001: 289].

[1] Martin Supper refers in his definition to "a music that cannot be created without the use of computers" (Supper 2001: 48) Computer music composition is described as algorithmic composition, framing a line of tradition coming from serial music, whereas there is not such a hint in Collins' descriptions.

[2] Mixed music is defined in the most broad sense as music that includes acoustic and electronic elements [Couprie 2020] see also the publication of conference contributions [Bonardi et al. 2017].

[3] The research included program notes from the seasons 1979/80 to 1990/1991 and 1999/2000 to 2010/11 from the IRCAM media library, as well as from performance documentation in the IRCAM databases Brahms and Sidney and was processed in 2015 and 2020 in Paris and online by M. Akkermann [Akkermann 2022a].

[4] Laura Zattra describes the new tasks and knowledge bound to 'technical staff' along the titles/designations for the people developing and operating the technologies at IRCAM [Zattra 2013].

[5] See for example Köpp and Seedorf 2020, Chapter 2: Sources.

[6] Archival study scholar Guillaume Boutard and music scholar Fabrice Marandola developed for example a methodology for the documentation of mixed music works including also interviews with participating agents, namely composers, performers, computer music designer, and sound engineers in order to include

also the context of the creative process [Boutard and Marandola 2014; with reference to Donin and Theureau 2007].

[7] See e.g. Berweck 2012.

[8] See e.g. Zattra 2022.

[9] See especially the works of Federica Bressan and Sergio Canazza: Bressan and Canazza 2013; Bressan et al. 2015; Bouche et al. 2017; Fantozzi et al. 2017.

[10] See also e.g. Bonardi and Barthélemy 2008.

[11] An approach for systematizing versions at IRCAM was developed by Lemouton and Goldszmidt 2016.

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