Musings on computer music perennity

by Kevin Dahan

Introduction

It should come as no surprise that, at more than sixty years of age, the computer music field starts to ponder its legacy: what started almost as a 'challenge' (Chasalow, 1998) is now a well-established academic practice which has had a profound impact over the whole music and entertainment industries. More often than not, breakthroughs in our field were initially established through pursuing musical or aesthetical, rather than purely technical, goals: this is especially the case in 'early' computer music. Clearly, it is now time to reflect on the numerous techniques (many of which make the foundations of current music software) that have been initiated over the years. Perhaps one of the best ways of examining these is through in-depth multimodal analyses of computer music works: this approach would constitute an initial effort towards a critical evaluation of computer music history. However, for a long time, composers, researchers and institutions did not have the means to store anything beyond the output of the computing process, losing essential information on the means of production. On top of that, the deterioration of media on which these compositions were recorded and stored is a known issue which has been acknowledged and partially addressed since the 1990s (Bauman, Diener and Mathews, 1991; Goebel, 2001; Battier, 2004). Since the mid-2000s, more initiatives emerged to safekeep early computer music masterpieces using reengineering techniques, often prompted by the rediscovery of compositional sources (Zattra, 2015): unfortunately, while important sources may still exist somewhere in one form or another, extensive documentation is quite hard to come by. Currently, there are initiatives to document, archive, preserve and present important computer music works being set up in many research centers worldwide. This article posits that understanding the history of our field and critically evaluating its findings from a musical perspective will guide preservation efforts more effectively. It is also through the integration of technological advances made in data science and machine learning that long-term preservation

of computer music will be a reality. Hence, this article proposes a three-step approach to computer music preservation: frame computer music theory, consider its ecosystem, and assimilate newer technologies.

Computer music technologies

Digital technology has this innate quality of potentially being extremely malleable, leading to novel and singular properties in artifacts created through its means. In computer music, the most obvious examples are of course digital synthesis techniques (Smith, 1991), which are central to the computer music composition process. From additive to granular synthesis, and from waveguide to adversarial neural audio synthesis, numerous algorithms were used in compositions to strikingly different end results (FM synthesis, for example, is especially flexible with regard to the wide range of possible sounds achievable with a single algorithm). However, it is interesting to note that, since the initial efforts of Jean-Claude Risset (Risset, 1969), there has been no work undertaken to establish an expanded catalogue that would provide baseline 'recipes' using the multiple synthesis algorithms developed thereafter. Likewise, there has been little effort to establish a working typology with the musician in mind: rather, the referencing of these techniques is primarily done through technical descriptions, which may prove problematic (and lead to confusion) for the non-technically proficient music analyst, or for future generations, for which the technological environment will be largely different. It is already the case: the concept of non-real-time sound synthesis – let alone that of time-sharing on mainframe computers… – is remote to many current students.

Framing computer music theory

This constitutes the first step we need to take towards computer music preservation: (re-)invest in establishing a working musical framework of computer music theory, which would take precedence over and guide technological developments. This is, essentially, going back to the roots of computer music to reevaluate what has been produced in terms of techniques, notably over the past thirty years of computer music: this, incidentally, corresponds to the densification of personal computing, which saw

composers and researchers move away from mainframes to personal, then mobile, computers.

Computer music ecosystems

Another possible approach is to consider computer music production process as ecosystems, which needs to be preserved. Instead of examining, cataloguing and labelling the musical artifacts created through technologies – which is what music analysts mostly do – the focus switches back to the production chain. An initial impulse would be to consider storing the production means of the composition process (e.g. hardware and software), but then we would be losing these technologies altogether. An interesting alternative to this 'cold' storage is to develop emulation of working environments, while we still have access to sufficient documentation. This has been done, for example, for the Samson Box (Schottstaedt and McNabb, 2012; Loy, 2013), which however needs binary .SAM files to work. This exemplifies the ecosystemic approach that has to be followed when considering preservation of computer music: it is simply not sufficient to safekeep and store previous technologies, it has to be preserved in working order, along with surrounding documentation and data. From there, two ways are possible, each requiring a different skillset:
a) adaptation, where a computer music work is 'transcribed' to a new environment, and
b) virtualization, where the environment is emulated. Both approaches' aim is the reconstruction of the original work (Dahan, 2007), but with different means and results. In both cases, extensive data and documentation are needed, and access to the original (and working) creative environment would tremendously help the efforts.

Consider computer music ecosystem

This constitutes the second step: to achieve effective computer music preservation, we need to consider the whole ecosystem in which music research takes (or took) place: production means (including, but not limited to, computers, controllers, operating systems, software), products (e.g. tests, compositions), but also by-products (e.g. documentation, sketches). Of course, an established framework of available techniques, both at the time of the original creation and at the

time of the recreation, is needed, highlighting the importance of a properly framed computer music theory.

Conclusion: towards computer music perennity?

We all have witnessed that the many technological mutations experienced over the last seventy years did not provide a large amount of direct protection to computer music works: hardware were abandoned, software evolved, data misplaced, and as a result, compositions and musical works have been lost. However, we are now living in an age of mature digital technology: the resources, techniques, and more importantly, the perspective we have gained on digital obsolescence, allow us to contemplate the preservation of our field less as an emergency and more as a focused, selective, and informed exercise. Obviously, urgent actions are still needed: data sources need to be found, recovered and transferred to better media for medium term purposes. However, there is some time to plan and develop strategies for the long-term preservation – perennity – of computer music.

Integrate newer technologies

This constitutes the third step: to integrate the latest technological developments and make use of them in the process of preservation. Since an established framework and sufficient multi-modal data would be available, it will make sense to use machine learning techniques to develop appropriate storage approaches, to design functional virtualized environments, or to achieve reconstructions. Ultimately, it could help bridge the gap between musical perception and computing techniques by – circularly – enhancing and refining both the theoretical framework and associated techniques.

And perhaps, along the path of preserving its legacy, it would paradoxically help us discover new ways of achieving what computer music is about: expressing inherently human emotions and feelings through machines and algorithms.

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