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(Re-)Performing Early Mixed Music from the 1980s at Ircam: Pierre Boulez's *Dialogue de l'ombre double*
(Ré-)Exécuter les anciennes musiques mixtes des années 1980 de l'Ircam : *Dialogue de l'ombre double* de Pierre Boulez

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Résumé de l'article

Dans les années 1980, l'exécution de la musique mixte nécessitait un équipement technique lourd et coûteux, qui était généralement lié à des institutions. Par conséquent, la création de ces oeuvres était également liée à des structures techniques, des ressources en personnel, des installations, ainsi qu'à l'évolution technologique. Aujourd'hui, la réexécution de ces oeuvres fait face à plusieurs défis. En raison de l'évolution rapide de la technologie, l'exécution de ces pièces est en changement constant, et leur documentation repose en partie sur une tradition orale d'échange d'informations. La carrière de telles oeuvres est donc plus fortement liée aux acteurs institutionnels que ce qui est généralement le cas. Partant de l'exemple du *Dialogue de l'ombre double* (1976/1981-1984) de Pierre Boulez, la situation des réexécutions des compositions en musique mixte à l'Ircam dans les années 2000 est décrite dans le but de donner un aperçu des tendances générales.

(Re-)Performing Early Mixed Music from the 1980s at Ircam: Pierre Boulez's *Dialogue de l'ombre double*

Miriam Akkermann

Preface

In the 1970s, it was almost impossible to work on computer music or use expensive audio technology without being connected to an institution, university, or sponsoring company. Access to digital processors was particularly limited. Granting access to technical equipment is not a commission as such, but it can create similar effects, in the sense that a specific framework and performance situation is determined by the material resources necessary in the composition process. Pierre Boulez's score for *Dialogue de l'ombre double* was first published in 1976, but the official premiere, using Ircam technological and human resources, took place in 1985. This piece was not commissioned by Ircam, but the fact that it was produced at this institution fundamentally affected its subsequent career. In a case such as this, where access to technology is strongly bound to the facilities in question, this type of access can be seen as a form of commission. The composer is granted a residency, officially or not, which provides access to particular technological resources which are then showcased in the resulting piece or pieces.

Point of Departure

In February 1981, the first conference titled "*Le compositeur et l'ordinateur*" was organized at the Institut de Recherche et Coordination Acoustique/ Musique (Ircam). Tod Machover, composer and, at that time, Director of Musical Research at Ircam, stated in his introduction that he saw music to be the first art form to widely use the computer to find ways to benefit from

1. Machover, 1981, p. 1.

2. Couprie, 2011, online.

3. Born, 1995, p. 180.

4. *Ibid.*, p. 183.

5. *Ibid.*, p. 185f.

6. Favreau, Gerzso, and Potacsek, 1984. Important predecessors were the 4B (1977) and the 4C (1978, available 1979).

the creativity of this powerful tool. The relationship between music and the computer not only opened up new possibilities but also led to new, complex challenges.[1] One of these was the development of suitable set-ups for musical use, another was the general handling of technology in compositions as well as in performances. On the technical side, the move from mini- to micro-computers was successful. At the same time, Digital Sound Processors (DSP) were constructed, providing enough power to use them in real-time, in musical performances in concert situations. These developments paved the way for so-called 'mixed music'—music that includes analog as well as electronic elements.[2]

The Situation at Ircam in the Early 1980s

In these early days of mixed music, the technological work-environment was constantly under construction. At Ircam, "it was hoped, then, that computer music could enrich the quality of sound materials by its capacity […] to simulate 'any imaginable sound' as well as completely new timbres."[3] Following Georgina Born, the aim in 1984 at Ircam was to move beyond existing computer music compositions by using the latest technological inventions, but also to implement characteristics of traditional music instruments, such as real-time response and ease of use.[4] The main technological projects in the period Born studied were the development of a new programming language, CHANT/FORMES, with a completely new structure with which the user was able to adapt the program to suit her/his own needs, and the development of the 4X, initially intended to be the "most powerful real-time digital synthesizer."[5] Presented in 1981 by Giuseppe DiGiugno and Alain Chauveau, the 4X was the last and most powerful digital sound processor of Ircam's 4-N sound processor series, which had been in development since the mid-1970s. This processor made it possible to handle, in real-time, a large number of oscillators in sound generation.[6] The Ircam was predominantly funded by government grants and not allowed to make profits from their research or production results. The 4X, however, was one of the developments that gained commercial interest. Born observed that despite the conflict between the developers and the management team of the 4X, the technology was sold to Dassault/Sogitec, a company involved in aircraft manufacturing. In exchange for the prototype, Ircam received a license fee and four 4X, which were needed for the premiere of Boulez's composition *Répons* (1982). Additionally, the developers hoped that the 4X would enter the music market as a commercial music synthesizer. Dassault/Sogitec, however, never produced it commercially, and the 4X "remained an exclusive and prestigious 'tool' that

could be used only at Ircam. It therefore added maximum prestige to the few pieces"[7] that used it. In the Ircam database Brahms, only six compositions are mentioned which used the 4X. Presumably there were more, but the way the technology is described is not coherent as the processor was only part of the whole electronic system. The first mention of a composition using the 4X is Pierre Boulez's *Répons*, followed by two works commissioned by Les Amis du Centre Georges-Pompidou and the Association des amis du Centre Georges-Pompidou (Denis Cohen, *Jeux* [1983-1989] and Philippe Manoury, *Neptune* [1991]), and two by Ircam (Emmanuel Nunes, *Lichtung I*[8] [1988-1991] and Ichiro Nodaïra, *Quatorze écarts vers le défi* [1990-1991]). Additionally, Karlheinz Stockhausen used the 4X to create *Kathinkas Gesang* in 1985, which is part of *Samstag aus Licht*.

As in the 4X system,[9] sound processors were mainly used in hybrid systems in which they were programmed and controlled by host computers. Control of the 4X was handled by developers and programmers, as direct access to the system required good programming skills. Consequently, the more advanced the technology was, the more difficult it was to use it. Laura Zattra states in her research that composers in the 1970s already had the possibility to work at Ircam on their compositions with the support of assistants who provided the capability to use the technology, programs, and sound effects. These were typically researchers, programmers, or composers themselves, and they helped not only with the direct use of the technology, but also suggested technical solutions in case the composer did not know how to achieve certain effects, and transferred the artistic ideas into computer programs which could be used for the final performance of the composition.[10] These collaborators were called Musical Assistants, Computer music designers, or, at Ircam, RIMs ("*Réalisateurs en informatique musicale*")[11]. Zattra described the position of the RIM as "*le plus proche collaborateur d'un compositeur accueilli en résidence dans un laboratoire de recherche.*"[12] Composers and RIMs work together on the composer's idea, and they therefore have to find ways to express and share their ideas and knowledge. On the one hand, the composer has to explain her/his artistic ideas or imagined sounds and wishes, on the other, the programmer or technician has to find an adequate solution, and can also propose technical features or sound options that might be unknown to the composer. The sociologist Pierre-Michel Menger therefore described working on a mixed music composition as "*création comme action collective: le compositeur, l'ingénieur et le tuteur.*"[13] During the period in question, this collaboration was bound to very practical issues: complex and highly specialized techno-logical equipment and several specialists with access to suitable spaces and

7. Born, 1995, p. 111.

8. The dates for *Lichtung I* are inconsistent: in Brahms, it is dated 1988-1991 without 4X (<http://brahms.ircam.fr/works/work/10856>, accessed March 22, 2016), while on the CD *IRCAM: Les années 90*, it is dated 1992 and with the use of the 4X. *Lichtung II*, also described as a composition with live electronics from 1995-1996, was commissioned by Françoise and Jean-Philippe Billarant (<http://brahms.ircam.fr/works/work/10857>, accessed March 22, 2016).

9. This system was "*un périphérique d'ordinateur spécialisé dans le traitement du signal en temps réel. Ce système comporte jusqu'à huit plaques universelles de traitement du signal (4U), une carte interface avec le calculateur hôte et une carte de contrôle*" (Favreau, 1985, p. 21).

10. Zattra, 2013, online.

11. Zattra, 2012, online.

12. Zattra, 2013, online.

13. Menger, 1989, p. 129, cited by *Ibid*.

14. *E.g. Résonance* (1981) by York Höller (<http://brahms.ircam.fr/works/work/9156>, accessed February 23, 2016).

15. *E.g. Mortuos plango, vivo voco* (1980) by Jonathan Harvey (<http://brahms.ircam.fr/works/work/9030>, accessed February 23, 2016).

16. These numbers are from a research survey of Ircam program notes from 1979 to 1981 and 1999 to 2010, as well as the database Brahms from 1981 to 1999, conducted by the author.

17. Colas, n.d., online.

18. The number of performances is taken from the programs provided at Ircam. The absolute number of performances can differ slightly due to the fact that some tour programs did not mention the exact schedule but only the concert dates and all the compositions which were performed.

enough time and money for their collaboration. This type of collaboration was therefore strongly connected to supporting institutions, and became a common work form at Ircam, among other institutions.

Early Mixed Music Compositions at Ircam

When working through the documentation of compositions produced or performed at Ircam in the late 1970s and 1980s, it becomes clear that the terms used to describe the technology involved were as broad as the technology that was used. Alongside works with *"ensemble et bande"*[14] in the title, or more precisely *"sons concrets traités par ordinateur,"*[15] the terms *"électronique"* or *"sons de synthèse"* could imply different ways of using computer processes for the creation of a piece, e.g., spatialization, real-time sound processing, or prepared tapes with live controlled volume levels during the performance. It is also not clear what was meant by "computer," "live electronics," and "electronics" in the subtitles and descriptions of compositions of the time. This may derive from the fact that many different experiments took place using various set-ups, combinations of technology, and programming languages. In addition, the technologies were updated and changed during the production period and also between single performances of the composition, whereas program notes and work descriptions sometimes were printed when the piece was commissioned, or when the performance was scheduled, meaning possibly some months before the performance. This lack of standardization is reflected in a number of pieces performed at Ircam or on Ircam tours which included electronics or amplification.

From season 1979-1980 to season 1990-1991, approximately 125 compositions were created at Ircam. Within these 10 years, only eight of these were played more than once—in Paris or on tour.[16] Despite the small number of pieces that were re-performed in this period, some compositions reached exceptionally high numbers of performances throughout the years. One example is the composition *Dialogue de l'ombre double* by Pierre Boulez for clarinet and tape, which was created at Ircam and premiered in 1985 in Florence, Italy.[17] With approximately 37 performances, this piece is the most performed mixed music composition from Ircam between 1985 and 2010. In comparison, the composition with the second highest number of performances was Boulez's most publicly successful composition, *Répons,* for six soloists, chamber ensemble, electronic sounds and live electronics, which was performed twenty times, followed by *Jupiter* (1987—Ircam commission) for flute and live electronics by Philippe Manoury, with 15 performances.[18] Another interesting fact is that the number of performances of *Dialogue de*

l'ombre double increased over the decades, whereas *Répons* was most performed in the 2000s and *Jupiter* in the 1980s. Some explanations for this may be traced to the layout and the situation of these works.

Dialogue de l'ombre double

Referencing Paul Claudel's theatre play "Le Soulier de satin"[19] with its title, Boulez's piece for clarinet and tape consists of 13 parts, which are a dialogue between the live solo clarinet, "*clarinette première*," (six parts) and playback of a single-track tape (seven parts) distributed among six loudspeakers, called the "*clarinette double*," which acts as the shadow of the soloist.[20] A first version of this work was published by Panopus in 1976. The copy of this score in the Ircam library has an indication, presumably written by the librarian who catalogued the work, stating that the document is from 1984.[21] It may have served for the rehearsals when preparing the version premiered by Alain Damiens on October 28, 1985 in Italy. The score referencing this performance was published in 1989 by Universal and was dedicated to Luciano Berio for his 60th birthday, which took place in 1985.[22] It includes much of the knowledge that may have been gained from the performance in 1985, as it gives indications on the use of spatialization and sound effects with cue numbers and also includes graphics that show the intended levels for each speaker.[23] Three years later, in 1992, another version was published by Universal, this time consisting of three elements: the technical description, the version with Roman numerals, and a version with Arabic numbers, each containing the score with technical indications as well as the 13 single parts.[24] Additionally, there is a tape with the *clarinette double* part that can be rented from Ircam.

In his analysis, Andrew Gerzso, who was then Boulez's technical assistant (RIM)[25], gives elaborate insight into Boulez's artistic ideas, how they were transferred into the composition, and how the technical parts should be set up and used to achieve a decent interpretation. Technical and practical issues take up a major part of his description, but he also includes comments and anecdotes.[26] He especially takes pains to clarify the connection between the work's genesis, the inherent compositional ideas, and the performance of the piece. This may derive from Gerzso's position as the RIM who worked with Boulez on this piece, and who therefore had primary knowledge on the genesis of the piece and the technologies used. In order to be able to perform this piece in line with the initial idea, information on ideas and technology must be available with the piece.[27]

At this point, the very special collaboration between composer and RIM becomes clear: even though these compositions involved highly technical

19. Written in 1924, this theatre play is structured in Spanish theater style in four "*journées*" and tells the story of the impossible love between Doña Prouhèze and Don Rodrigue de Manacor (cf. Société Paul Claudel, n.d., online).

20. Gerzso, n.d., online.

21. Boulez, 1976. This contains two versions of the work, one with Arabic and one with Roman numbering. There is no indication in Ircam's database that this first version was performed before 1985, nor is the performance from 1985 indicated as a premiere.

22. Boulez, 1989.

23. *Ibid.*

24. Boulez, 1992. For a more detailed analysis see also Tissier, 2011.

25. Gerzso is listed as such in the Ircam database Brahms as well as in the program notes (Colas, n.d., and Ircam, 1988a, online).

26. Gerzso, n.d., online.

27. Gerzso's analysis was published online on Brahms without date and is freely accessible. It was presumably done around 2000, as all audio examples are dated to 1998, and Gerzso also uploaded "Realization Instructions" for *Dialogue de l'ombre double* on the Ircam database Sidney (see FN 40) in 2000.

set-ups, which were documented in various ways, the workflow during the compositions' genesis and the practical, technical issues were based mainly on oral arrangements. These have rarely been summed up retrospectively for purposes of documentation. The knowledge to perform a piece was published in the form of a score, but a significant amount of information was kept by the RIM who was involved in the process. Looking through the program notes at Ircam, it becomes clear that the RIM usually stayed with the pieces on which he had worked. The RIM would not only set up the performance, but also had the knowledge necessary to rehearse with new soloists, and to keep tabs on the interpretation when updating or modifying the technology used. This kind of oral tradition was also sometimes maintained when handing over a piece from one RIM to another. Therefore, it was not necessary to provide detailed performance information for *Dialogue de l'ombre double* in written form, as long as Gerzso or a fellow Ircam collaborator stayed with the piece in the position of RIM. Moreover, this knowledge was easily accessible as long as it was performed at or by Ircam, where Gerzso still works, now as director of the Education and Cultural Outreach department.[28]

The accessibility of this information also influences the career of a piece. After the premiere in Florence, a performance in Avignon in 1988 followed, as well as one at Ircam in Paris on October 19 the same year, and another one at Ircam on October 7, 1989.[29] The number of performances increased with each decade: in the 1990s seven performances took place, in the 2000s twenty-six. In addition to the version for clarinet, this count also includes performances of the 1995 version for bassoon, as well as the version for saxophone from 2001. The number of performances of the versions not for clarinet is quite small: for the bassoon version there is only one performance which can be proved, and only three performances with saxophone are documented.[30] Between 1985 and 2010, Ircam took this work on tour in Italy, Portugal, Switzerland, USA, and Monaco.[31] It is therefore the most performed mixed music work from Ircam in the period under review. All of these performances were done by Ircam staff, most of them played by clarinetist Alain Damiens with Gerzso in charge as RIM. In the 2000s, there was only one performance where another RIM, Gregoire Lorieux, was assigned.

Re-Performances in the 21st Century

Despite the fact that very few compositions created at Ircam in the 1980s have been re-performed in the 21st century, *Dialogue de l'ombre double* was performed by far the most between 2000 and 2010. The fact that the piece was composed by Boulez certainly helped in this respect. In the 1980s

28. Ircam, n.d., online. Gerzso stayed with this piece even more than the soloist Alain Damiens, as Boulez rearranged it for saxophone and bassoon, and it was played by the clarinetists Alain Billard (who, like Damiens, was a member of the Ensemble intercontemporain), Philippe Berrod, Jérôme Comte, Jussef Eisa, as well as the saxophonists Vincent David and Miha Rogina, and the bassoonist Pascal Gallois, among others.

29. Ircam, 1988b, and Ircam, 1988c, online.

30. Established by or at Ircam, Pascal Gallois played the bassoon version on November 3rd, 1995, the performances with saxophone took place on June 6, 2001, November 28, 2001 (Vincent David), and July 20, 2007 (Miha Rogina). All performances were with Andrew Gerzso as RIM.

31. These numbers have been extracted from a research survey (see FN 16) of Ircam program notes from 1985 and 2010 as well as the Brahms database. Some concerts are listed only in one source material, therefore the numbers are the sum of all performances that have been found with single dates.

and 1990s, it was often played in combination with other Boulez pieces, such as *Répons* or *…explosante-fixe…* (1991). This combination vanished before the 2000s. From that point on, the work was most often played in concert with other works, while *…explosante-fixe…* seemed to catch up to *Dialogue de l'ombre double* in popularity. From 2010-2012, Ircam had more performances of *…explosante-fixe…* (approx. 5) than of *Dialogue de l'ombre double* (approx. 3). This was not the only change taking place.

"Once upon a time—not too long ago—digital audio recording, synthesis, processing, and playback were the privilege of laboratory specialists. Today they are nearly as commonplace as television."[32] With these words, Curtis Roads starts his overview to part one of his book *The Computer Music Tutorial*. They accurately describe the performance of mixed music today. Technologies used in the 1980s are now outdated, the original hardware-software combinations are often no longer accessible and the original systems may not be compatible with recent ones. On the other hand, recent computer technologies facilitate many formerly complicated and time-consuming processes. These new technologies may create problems of compatibility, but they also clearly open up new opportunities and performance possibilities for some compositions. For example, in the case of a work that was technically advanced at the time of its premiere, it may now be easy to adapt it and create a new user-friendly version.

Technical developments also influenced the career of *Dialogue de l'ombre double*. With the easily accessible, powerful computer, and the real-time programming languages that were developed in the late 1990s, it is now possible to create set-ups based on technical descriptions, without necessarily requiring technical help from Ircam.

At Ircam, the first time a new RIM for *Dialogue de l'ombre double* was mentioned was in 2007.[33] The close connection between a RIM and a given work had started to diminish already. With the change from old hardware-bound programs to new programming languages, the technology and its control of the music became increasingly accessible. This may have been one factor that led to changes in the position of the RIM. Programming and sound engineering slowly came to be seen as being on par with the more "artistic" side of the process. Technicians are no longer simply assistants to the composer, nor is the creation of a technical set-up permanently bound to special computer or sound processing systems which can only be controlled by specialists. A composer can directly engage with the electronics and therefore control the performance, as user-friendly music programming languages have been created. At the same time, these programs allow programmers to easily re-create

32. Roads, 1996, p. 3.

33. At the Atelier concert Boulez-Jodlowski on June 20, 2007, *Dialogue de l'ombre double* was performed by Miha Rogina, saxophone, and Gregoire Lorieux, RIM (Ircam, 2007).

musical systems on the basis of simple information. Yet, the methods and accuracy of programming can have a strong influence on the generated sounds. This means that, even when it may become technically possible to re-create a performance, there are still a lot of specific details that can only be carried out with special knowledge, in order to create a (historically) suitable re-performance. The expertise of RIMs is no longer primarily their programming or sound engineering skills, but a combination of this and knowledge regarding the desired aesthetics and musical ideas.

The interpretation at Ircam of *Dialogue de l'ombre double* has hardly changed over the years, even though the piece has been performed often and the technology constantly updated. After 2001, there were no changes in the composition by Boulez and the performances seemed very close to the 1980s version, although it would have been possible to make improvements in the sound recording quality of the *clarinette double*, for example.[34] One reason for this might be loyalty to Boulez and an awareness of his imagined sound.

One of the performances of *Dialogue de l'ombre double* that took place more or less autonomously from Ircam happened on the 25th of April, 2006, in Stuttgart. Richard Dudas, a composer and programmer who worked as an instructor for software workshops at Ircam from 1996 to 1998, presented Boulez's work for clarinet as a practical example of the use of MAX at the end of his MAX MSP/Jitter[35] workshop at the Forum Neues Musiktheater. The sound engineer was Magali Deschamps, who was an intern at Ircam in 2002. Peter Furniss played the live clarinet and also recorded all the *clarinette double* sections.[36] Dudas states that they created the whole set-up themselves, but they also were in contact with staff from Ircam who had already been involved in performances of this work.[37] After having successfully performed the piece in Stuttgart, Dudas and Furniss brought the piece to Seoul, performing the Asian premiere on November 11, 2008 in Seoul at Hanyang University.[38] This last performance took place completely independently from Ircam.

Outlook

With recent technologies, it has become increasingly easy to perform compositions which were previously bound to institutions and special knowledge for decades. These possibilities have also created challenges, such as finding technical and artistic information on works that were created in a close relationship between technology and a compositional idea, and deciding on a suitable transfer of technologies.

The new role for the programmer or technician in mixed music performances allows them to provide artistic input, but also requires new abilities,

34. There is an old recording of the *clarinette double* part by Damiens which can still be rented from Ircam. In 2003, David Wessel, Ali Momeni and others established a performance for the Ojai festival in Southern California, using this recording and the Ircam max patch. The soloist was Lorin Leeve (Dudas, 2016; Holland, 2003).

35. "MAX" is a graphical music-programming language which was initially developed at Ircam at the end of the 1980s and was officially presented in 1990. A commercial version was developed in 1997, which is distributed by Cycling'74. In 2003, Jitter was created for video processing (Akkermann, 2014, p. 335).

36. Dudas and Furniss, 2015.

37. *Ibid*. Dudas, Furniss, and Deschamps recorded a complete new version of the *clarinette double*, but they worked on a modified max patch from Ircam and had guidance from Frank Rossi, who worked at the Ircam production department, both for information about the live mixing and balance in performance, as well as for the sound engineering and atmosphere/reverb on the pre-recorded "double" parts (volume, reverb and lighting cues) (Dudas, 2016).

38. Hanyang University, 2008.

such as knowledge on the background of the composer or a work. This is part of the new self-image held by electronic musicians. In 2013, the first Electroacoustic Repertoire Workshop for young sound engineers, computer music designers, and composers was held at Ircam. The goal was to demonstrate mixed music performance practice to future professionals. It also included the question of how old mixed music compositions could be programmed in current programming languages and re-performed today. The workshops took place during the Manifeste Academy, alongside workshops for young professional composers and musicians.[39] This interest in strategies for performing older mixed music compositions also influenced the number of re-performances: in the 2010s, the quantity of performances of various Ircam mixed music compositions from the 1980s and early 1990s significantly increased. Interestingly, the fact that a work was not re-performed within the decade of origin does not necessarily mean that it was not performed in the 21st century. The criteria for re-performance are now more bound to practical reasons. Hence, the focus was on small chamber music works with good technical descriptions and more easily programmable sound effects. With these performances, new MAX patches and performance documents were created. To keep this newly created information accessible for future performances at Ircam, patches and documentation can be archived in the Ircam internal database Sidney.[40] This database reflects the increasing number of performances and the use of continuously updated and changed program versions, and also makes new challenges for historic approaches visible: for example, patches are signed with the save date and not the date of creation, and several patches or documents are inserted after the performances, including retrospective changes. In some cases, the patches were created as a transcription of an original patch purely for archival purposes and not for performances. These patches may not work, as they have never been tested. However, it is not mandatory to use these patches or to archive them in the database.

For *Dialogue de l'ombre double*, there are six versions in Sidney, one from 2000 and five between 2010 and 2013. Taking this as a reference, the number of performances seems to have decreased compared to the 2000s. However, new versions have appeared, which were not created at Ircam, and therefore are not collected within this database. This is also true for performances which were seemingly done with Boulez's agreement, for example the transcription of *Dialogue de l'ombre double* by Erik Boosgraaf for recorder and electronics in 2014.[41]

Today, technologies are more developed and information on early mixed music compositions is accessible. This certainly has had a positive influence

39. Ircam, 2013, online.

40. The Ircam internal database Sidney gathers information on performances of compositions held at Ircam, with technical documentation of performances and MAX patches.

41. Cf. Boosgraaf, n.d., online. A different version was presented by Alvise Vidolin in 2005. He did a performance of *Dialogue de l'ombre double* in which he made the reverb effect of the recorded clarinet via convolution instead of using a real grand piano (cf. Vidolin, 2005).

on the number and quality of the performances of these pieces, and has led to several opportunities: musicians can choose works they are interested in playing, and new roles are available for computer music designers and sound engineers. Institutions, however, face new challenges, as they lose their primary position as spaces with unique technical equipment, which also changes the criteria guiding the creation, (re-)performance, and the career of works. In the 1980s, when technology was difficult to access, the facilities offered by an institution to a composer could be as relevant to the creation of a work as a commission. This changed with the development of small, powerful computers and musical (real-time) programming languages. Since composers can now access the necessary technology at home, providing facilities is no longer necessarily akin to a commission. Providing knowledge on performances, however, becomes more and more important, as institutions like the Ircam are still very important as production and, especially, as performance spaces. Knowledge on how to re-perform mixed-music compositions and the curatorial decisions of this institution itself heavily influence the career of a work, whether or not it was an official, paid commission.

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