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Technological Innovations in Contemporary Music

PIERRE-MICHEL MENGER

INTRODUCTION

THE subject of my paper is the use of new technologies in serious musical creation. Although I cannot develop the comparison with popular music and its mass market, one will understand implicitly the importance of the fact that 'all of my story' is set within the institutions and environment located on the edge of the market. My aim is not to show why diverse technologies that have appeared in the last 40 years have been exploited by composers, but rather how innovations such as electroacoustic and computer music were able to 'succeed'. I employ the word 'success' in the organizational sense: it is the lasting formation of new segments of musical creation and the mobilization of composers, of partners from the scientific world, and of the technical and financial resources for establishing these new segments.

If the two types of musical production I shall consider – electroacoustic music and computer music – can be strongly distinguished, it is because they neither appeared nor developed in the same contexts, nor did they require the same technical or human resources. And the respective roles played by creation, properly speaking, and the research work of scientific invention are very different. I believe that one might also differentiate them geographically: electroacoustic creation was dominant in Europe up until the late 1970s; the research in the field of computer music developed very early on in the United States. Of course, one might cite examples that contradict this pattern but the main tendency corresponds, I believe, to the presentation that I propose.

What in fact interest me are the factors that shape each of these separate activities, i.e. the socio-economic, technical and organizational factors. I shall therefore examine these two sorts of activity successively, and then I shall show how one has sought to reconcile the merits of each, using the example of the French centre for musical research IRCAM (Institut de Recherche et de Coordination Acoustique/Musique).

THE TWO SEPARATE WAYS OF TECHNOLOGICAL INNOVATION IN CONTEMPORARY MUSIC

(1) Electroacoustics on the edge of the serious music world

It is quite symbolic that in Europe the activities of electroacoustic creation were born within French and German public broadcasting companies. For such organizations had the two characteristics necessary for

the development of this type of musical innovation and experimentation: the technical resources, of course, and the practice of patronage supporting serious musical creation.

The socio-economic studies on the music market and its development in the twentieth century (Peacock and Weir, 1975; Ehrlich, 1985) have underscored the importance and the ambivalence of the role of radio. On the one hand, I hardly need to emphasize that radio has had a considerable influence on the quantitative growth of consumption and on the segmentation of the demand, both thanks to radio's means of production and because of its ties with the recording industry. As it has been the main and the most influential musical medium, the radio has amplified the effects of the double opposition that has so profoundly marked the musical world for the last 40 years - the opposition between serious and popular music, and then the increasing divergence within serious music itself between the consumption of past repertoires, continuously broadened by the rediscovery of unknown or ignored works and performing skills, and the production of contemporary music.

On the other hand, it is the public broadcasting companies with their monopolistic position and public financing that have invented public patronage favouring serious music: they created the first full-time employed orchestras financed by public funds; they developed programmes largely and exclusively devoted to serious music; and they were the first institutions to commission works systematically. It should also be noted that for some time broadcasting companies supplied composers of serious music with the greatest part of their incomes in performing rights royalties (Menger, 1983).

In France, the radio provided a place for the inventors of concrete music, Pierre Schaeffer and his group, to carry out their first experiments in electroacoustic music; what began as clandestine patronage soon became official when the Service de la Recherche was created. The German Westdeutscher Rundfunk in Cologne played a similar role in the invention of electronic music, while the RAI in Italy with its Studio di Fonologia in Milan offered a setting for Berio's work.

The electroacoustic creation called upon already-existing equipment (that could be found at the radio in the recording or broadcasting studios) which was then appropriated. Concrete music appeared as a perfect testimony to radiophonic art, for the main techniques employed were tape recordings and sound mixers exactly like those used for sound effects in radio plays. The act of creation consisted of distorting, transforming and combining the sounds and noises, in short, of depriving them of their function as background sound. This process corresponds to a well-known definition of autonomous and pure art. There are no complicated technical problems in this sort of creation: one learns to use the machines on the spot, the skills are taught by example, and the composers quickly learn how to manage on their own - there is no need for numerous technical personnel.

Groups of composers are built around these means of creation. I will use the case of France to demonstrate the steps towards institutionalization of these groups and their so-called centres for musical research.

These were first of all parasitical organisms that were formed and developed at the heart of the host institutions: I have mentioned the radio but other groups have been formed in conservatories and cultural organizations. Then, as the state support for musical creation is augmented, these groups are freed or recognized as autonomous entities within the host organism. Institutional autonomy means many things. In order to sustain and develop themselves and to acquire legitimacy, and to come out of the isolation in which the technology used confines them, the groups must produce not only works but also the demand for their works. They must also attract apprentice composers, by inventing networks of special formation, and create openings on the musical labour market. In short, they must build the institutional apparatus of a separate segment of cultural activity, an 'art world', to use the concept of the well-known interactionist sociologist Howard Becker (1982).

The technology employed allows them to bypass several categories of intermediaries, in particular performers and music publishers, that is, the sorts of mediators whose professional interests might be in conflict with those of living composers when the divergence between serious musical creation and consumption is too great. But this advantage has an important handicap: the marginalization of electroacoustic music within the music world. It is not distributed under the same conditions as instrumental or orchestral music; it is not included on the same programmes in concerts; its composers form a world apart, away from the world of serious musical composition. Since composers of concrete music are often self-taught and do not write instrumental music, they were, and still are, considered as amateurs or 'do-it-yourselfers', *bricoleurs*, as the director of IRCAM, Pierre Boulez, used to say. Certain of the composers, like a part of their public, are often closer to pop music and its most sophisticated forms, or to jazz, than to 'highbrow' music. They also produce music for ballet, theatre, publicity, radio, cinema and even for fireworks or 'son et lumière' shows - in short, all the genres rejected or looked down upon by 'serious' composers.

One of the advantages of building a group is the power to perform several functions in order to establish institutional autonomy and legitimize funding by the State and local authorities - a power depending on certain forms of the division of labour. Apart from the production of works for concerts and incidental music, its functions also include diverse kinds of teaching and initiation to the practice of electroacoustics, the organization of concerts and festivals, the occasional conference, and the production of books, records and radio programmes, in other words, an integrated enterprise that produces and distributes goods and services. These are the means of establishing links with the environment in order to attempt to overcome the handicap of marginality and autarchy.

Here it should be stressed that these are groups which above all attract musicians who want to make their careers as composers; in some ways, these groups merely extend to the dimensions of a small collectivity the principle of what sociologists call role versatility, as described by Denison Nash (1970). It is the means by which a composer earns a living - working at the same time as a composer and a performer, or professor, or

critic, or publisher, or cultural administrator, etc. By joining these resources of role versatility together and organizing a division of labour among themselves, the group members might, in a certain manner, lower the barriers of entry into musical creation and distribution with the aid of a technology which permits the substitution of capital (machines) for labour (the intermediaries of distribution). This is obviously crucial for that art, as for all the performing arts which are traditionally highly labour-intensive.

The substitution of capital for labour is also what characterizes the emergence and the multiplication of pop music groups. The decisive difference rests in the fact that the pop groups operate at the heart of the market: they can do without the traditional intermediaries, but they do not have to build the substitute of an institutional apparatus.

(2) Computer music: its organizational and environmental features

I have now arrived at the second use of technology in musical creation, computer music. From an economical and institutional point of view, it is the universities and certain industrial research laboratories that played the role of market shelters for this computer research. Think of the United States as the pioneer and leader in this field. As we know, musical creation is well established over there in the universities (Pasler, 1987) – this is one of the main organizational differences between them and the European musical system. Furthermore, the links between university and industry (and between university and industrial research centres) are much stronger in the USA, for example in the sectors in full expansion such as computer science and micro-electronics. These two host environments and the patronage of certain foundations created by industrial corporations provided the main support for the musical research work. The size of these host environments is important: the volume and dynamic of the new technologies industry and the scope of the university world were such that they were able to create a true trend of technical and scientific innovation even in a field as marginal as musical research.

Certain centres could get a real technological overcapacity, because they had succeeded in convincing firms to offer them very powerful computers without having to provide any immediate compensation in return. Obviously, the relations between industry and musical research were reinforced when it was seen that research work on sound and music could, directly or indirectly, have considerable applications in the fields that are economically or even militarily essential. Here I can mention in particular voice synthesis, flight simulation and work on artificial intelligence. The relations are also transformed when the market is progressively constituted in order to exploit and commercialize the musical equipment created by research in computer music science. The best-known case is the synthesizer and, in particular, the FM digital synthesis invented in the musical research centre at Stanford University and industrialized with considerable success by Yamaha. The progress of microcomputer systems today generates a lot of applications to music that are increasingly used in the field of pop music and music for film and television, and compete now with large computer systems in serious composition.

As opposed to electroacoustic music, which recruits its practitioners almost exclusively from composers and secondarily among the professionals from sound-related areas (sound engineers, radio producers, recording technicians, etc.), computer music research has mobilized a more varied personnel – scientists, engineers, computer scientists, who are generally also amateur musicians – as well as students of diverse scientific disciplines linked to musical research (data processing, physics, acoustics, but also psychology and today cognitive sciences).

In general, the composers are neither in the majority, nor the chief members of these centres. The personnel is more mobile, and has no direct projects of creation, though music is regarded both as art and as a complex field which presents a challenge to the scientific and technical world. Think of artificial intelligence today: as early as 1957, Herbert Simon asserted that in order to demonstrate its power and its maturity, computer science research must be able to create, among other things, programs generating musical works of ‘a certain aesthetic value’ (Turkle, 1984).

All of these characteristics of computer music and its development explain not only its dynamics as a field of research but also the fact that the production of works should not be the most important priority nor the main criterion of the validity of these works. And when they produce works, these researchers have little in common with a European definition of aesthetic and technical experimentation led by avant-garde ideology. For, generally speaking, musical creation in the USA is much more diverse and eclectic, and could not be dominated by a univocal and hegemonic conception of innovation.

RESEARCH WITHIN MUSICAL CREATION: HOW UNCERTAINTY AFFECTS THE COMPOSER'S CORE ACTIVITY

The institutional challenge we will now examine is that of the conciliation of these two logics of activity: is it possible to let the steady production of works exploiting new and rather sophisticated technological means, on the one hand, and permanent scientific and technical research into these devices of production, into acoustical and psycho-acoustical phenomena, and into the mental process of composition, on the other hand, coincide or at least coexist in the same institution? And if so, at what cost? By all accounts this was Boulez's ambition in creating IRCAM in Paris in 1977: to construct an institution that emulated in one respect the research carried out in American universities and that would also be a leading institution at the core of the contemporary musical world and no longer on the fringe of serious creation. (For a detailed analysis, see Menger, 1987.)

What are the characteristics of IRCAM? Economically, the creation of IRCAM corresponds to a change in the scale of public support for artistic creation and also to an impressive movement of the concentration of financial and cultural power in the hands of one creator and his team. I will quote a few figures so that it may be understood how IRCAM is the child both of an old centralizing tradition in France and of the increasing power of the Welfare State within the cultural domain. For here it is a

question of creative activities that are socially so much in the minority that they could not exist under the rule of the market. IRCAM represents in a way the most monumental symbol of the emergence of an art that is official and yet neither popular nor conservative.

At the beginning, the French State spent about 120 million francs (£12 million) to construct and equip IRCAM. The Institute receives roughly 25 million francs a year for running costs; added to this are the investment credits for renewing equipment and other operations. I shall now give three points of comparison:

- (1) The French State allocates all other subsidized research centres and groups a total of 22 million francs – therefore IRCAM receives more than all the other groups together.
- (2) The funds that the State devotes to this sector of activity – around 50 million francs per year – equals just about the total royalties paid to the entirety of French composers (living and dead) for the use of their works in all forms in France and in the world. So you can understand the extent to which the State acts against the market trends in order to support this type of creation.
- (3) Finally, the public funds for commissions to composers do not exceed two million francs per year. With musical research one is therefore in the presence of a new means of intervention by the Welfare State, aimed at socializing the creative risk.

Here I do not pretend to explain the genesis and mechanisms of the State's musical policy. It will just be mentioned that among the reasons why the funds were so large is that, after having financed the creation of IRCAM, the State has sought to re-establish some of the balance between IRCAM and other institutions. (In 1980, the subsidy for IRCAM's running costs was four or five times superior to the total received by other existing centres.) There is therefore an endogenous mechanism of increasing public intervention.

A second socio-economic characteristic should be underscored: the musical creation at IRCAM is not limited to electroacoustics (as is the case in many of the other centres), but it combines sound elements produced by machines in a studio, or programmes of transformation in real time of what is played by instrumentalists, with the presence of musicians playing a score. This was one of the obvious conditions of bringing the activities of experimental creation in from the fringes; but there is no substitution of capital for labour except for the fact that the music produced here, like almost all contemporary music today, is written for restricted groups of instrumentalists. It should be remembered that Pierre Boulez obtained, on his return to France in 1975, both the creation of IRCAM and the creation of the Ensemble InterContemporain, an orchestra of 30 musicians specializing in twentieth-century music and very closely tied to IRCAM: in fact the two institutions form a real conglomerate.

IRCAM's management of its human resources also shows the extent to which the two logics – research and creation – seek coexistence. The official image of IRCAM is first that of an institute in which one finds high-level engineers and scientific researchers on one side and permanently employed composers on the other; and here I am not referring to those

composers who are invited to create one specific work. Among the Institute's staff of 59 salaried employees, there are only seven engineers, eight researchers and three assistant composers. However, there are 23 administrative and office workers, 13 technicians and a directional staff of six.

This dividing up of human resources discloses the organizational cost of an enterprise that must perform multiple functions in order to be situated both at the highest level in its sector and at the centre of the musical system: to carry out research, produce works, organize concerts, seek industrialization of the prototypes built by the engineers, welcome and assist guest composers, publish a journal, teach musical computer science and train composers to use the machines. All of these functions guarantee public visibility for the Institute and long- and short-term profits, but are expensive to organize and coordinate.

In fact, the Institute would not really function or produce anything substantial if it did not employ a temporary support personnel – paid or volunteer. Between 50 and 80 additional persons, from casual searchers to students, interns, grant-holders and volunteers, work in the key sectors: acoustical research, technical and computer projects and the musical application of research results. This staff is very mobile, and quickly renewed through recruits from Parisian and foreign universities. One finds in particular many young American researchers who have come to spend several months in France and to whom IRCAM owes many of its innovations. This part of the personnel relates IRCAM to the American centres implanted in universities. This staff's mobility, essential to the dynamism of research, has its advantages – it allows the Institute to be constantly fed with new ideas, with information as to what is going on elsewhere, and supplies it with a motivated personnel. However, it also has its drawbacks: because of the tendency to multiply the research projects and push them in the direction of innovation without stopping to evaluate or perfect the findings, there is a difficulty in exploiting the research in the process of creation.

I would like to generalize the observation by examining the problems posed at IRCAM when producing works. (I am leaving aside the symmetrical point of the real dynamic of the research in this institution that must above all produce works, concerts, machines that run and travel, etc.) Despite, or rather precisely because of, the size of its available resources, IRCAM produces few works. One might say that this is proof of its great strictness or demand for quality – a sort of heroic asceticism. I would like rather to insist on the dimension of uncertainty that affects the composer's work.

The technologies and scientific knowledge that the composer is invited to consider are by definition unstable. They evolve at the same time under the pressure of the engineers and researchers within the Institute (it is their role) and under the pressure of the computer and micro-electronic industries. IRCAM is founded on ever-renewing and more powerful technology and on the immediate application of fundamental results to the creative work. It is easy to understand why a composer might have difficulty in working with equipment that is constantly evolving, and in

exploiting results which are endlessly diversifying. If the rule is that aesthetic innovation is intrinsically linked to technical progress and knowledge of sound phenomena, then the standardization of the devices acts as a brake, and technical obsolescence becomes an obsessive fear.

The non-standardization has created many difficult problems, that is to say, quite expensive problems, to resolve. I shall cite a few. If the machine plays the role of super-instrument used in a concert to make sound transformations in real time, will the work survive once the machine has been replaced by another that is more powerful? The cost of performing this kind of work prevents it from having a real career – to circulate a work such as Boulez did with his *Répons* was just as much an economic as a technical feat. It is not certain that the cost of production and distribution in the future will be lowered as quickly as it has been augmented with the progress of technology.

In order to use a complex technology the composers must train themselves and acquire at least a minimum of familiarity that would allow the creative intuition to play its role. This familiarization takes time and the competence acquired is not everlasting – the systems change in each centre and then within each centre of research there are a number of different systems. There is also the competition and race for technological originality. Empirical study shows that there are not many composers who are willing to acquire a complete special training. The investment in time is great, the profit uncertain and the time of the apprenticeship is not easily compatible with the composer's professional obligations and the imperatives of his artistic career – except in the case of very young composers and again only within certain limits. There is also the paradox of collective action (Olson, 1966) that characterizes this period of pioneers: each composer might prefer to leave attempts at technological adventure to others, in the hope of profiting from results whose expenses he did not have to carry. From then on, the pioneers risk being few in number, they will cost much more for each engagement and the profits will be more uncertain.

In order to surmount the difficulties of using the available computer systems, IRCAM supplies each guest composer with one or several assistants who are either young composers or engineers. The organization of the production of a work then becomes complicated: it is an entire line of collaboration that must function for each project, with the division of tasks that are more or less formal. What is even more interesting to observe is the relation between the composer and the assistant. There is a true dilemma here that weighs on cooperation: the success of the collaboration depends on the full and entire cooperation of the assistant. It is in the interest of the composer, but is it in the interest of the assistant? For the more total the collaboration is, the more the problem of the sharing of benefits and gains increases: it suffices to observe that it is obviously the composer who signs the work and receives the public benefits of it. Thus the management of the cooperation by the institution is particularly delicate.

In the customary situations of artistic creation, all those who take part in the production and distribution of a work coordinate their activities on

the basis of conventions. (I employ the concept of convention in the sense intended by the philosopher David Lewis, 1969, and the sociologist Howard Becker, 1982.) They do not have to look for specific solutions each time. The existence of conventions allows individuals who were not present at the beginning to carry out the required tasks. A convention also guides the creator, allowing him to anticipate the results of choices that he might make throughout the time spent working on the *oeuvre*: conventions are all part of all the decision-making process that more or less consciously orientates the creative activity.

Here the situation is very different: a number of ordinary conventions have been suspended, which affects the entire network of artistic cooperation. The sound material is not a limited and standardized ensemble of itemized possibilities. On the contrary, the very powerful devices are prototypes, the necessary skills are not taught outside the institution, and teamwork is required. The division of labour between the composer and his partners no longer intervenes only once the written work has to be played, but it is at the very core of the creative process, with all the uncertainties linked to the necessary cooperation with the assistants.

Under such conditions, the production of a work is certainly not a renewable exploit each time, but a more complex and risky process, where the composer has more difficulty than usual in anticipating the results.

CONCLUSION

In order to simplify, I have adopted a chronological point of view several times, by showing how an art considered as a collective action changes. However, it is obvious that the two types of activity I have distinguished coexist: one of the objects of the aesthetic conflicts provoked by technological progress is to know to what extent the first activity is now obsolete or simplistic and the second really innovative. This debate can be found, in somewhat different terms, in the opposition between popular and serious music in their relationship with new technologies. In popular music, the technological progress has contributed considerably towards broadening the market, speeding up innovation, multiplying the number of groups of creative artists, lowering the barriers to entry in the production and diminishing the need for a set of very specific musical skills. In serious composition, the meeting between aesthetic originality and technological progress is assumed to lead to fundamental changes on a long-term basis. But this change involves a strong increase in the costs of the production and performance of works, a drop in artistic productivity and a lopsided allocation of public support. This situation is extreme, one that only a centralized Welfare State can managed to keep in a precarious balance.

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