Between Technology and Creativity, Challenges and Opportunities for Music Technology in Higher Education

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Abstract

A presentation at Bath Spa College University in 2001 gave me the occasion to critically reflect on the existing Challenges and Opportunities of Music Technology within Higher Education today. To integrate an interdisciplinary field, such as Music Technology, into an academic discipline-segregated structure, such as that existing in our Universities, provides, in many ways, more challenges than opportunities: in research as well as teaching and administration.

Several working groups and workshops, such as the EC funded CIRCUS project (Content Integrated Research into Creative User Systems), the invited EPSRC Music Technology workshop as well as the invited EC "creativity and technology"3, have addressed relating issues of teaching not only music technology but other creative courses in HE. Although this is within a European context, and some comparisons to the German systems are made, most issues are possibly restricted to the British continent.

This report will present an overview of this situation, fed by these workshops and my personal and professional experiences working with or in various academic institutions. As I personally am very much aware of the much larger amount of experience of many individuals working in Britain within this field, I would welcome any views and comments from the whole of the music technology community, and would hope that this report could be seen as initiating the start of, in my opinion a necessary discourse in how we teach and how we set up frameworks to facilitate the learning of this interdisciplinary subject.

1. Between Technology and Creativity: Music Technology, an interdisciplinary new discipline?

The discipline of Music Technology, if it is such a thing as a "single" discipline, has already acquired a relatively long history. Seeing our students in Higher Education institutions as a part of this history shows how much we, as teachers and learning facilitators, still need to learn in order to teach this new academic discipline within our own institutions.

1.1. The fourth generation

Our students could be considered the "fourth generation" of music technologists. Oversimplified, the first generation of Music Technologists could be called the "Experimenters" of the 50s and 60s, where for the first time a critical mass of technologists and musicians looked at music and technology and tried to develop their own methods of combining aspects of previously different disciplines into one. In the danger of continuing this oversimplification, the second generation of the 70's and 80's built on the basis of the first generation, and with a fast developing commercialisation as well as academic endeavour in this area, with Centres emerging, the speed with which music technology was developed, produced and utilised in/around works of art accelerated. The third generation of the 90s and 00s was able to position first lecturers of music technology into academic institutions. Music technology was slowly becoming an academically viable discipline of education and research. For the first time a critical mass of individuals, who had studied more than one discipline and who had a background in more than one field, existed to push this area forward. The current generation of junior lecturers comes from this generation.

The fourth generation can be seen to be our current student body: students of interdisciplinary music technology degrees, such as BMus in Music Technology, or the BEng + Music as taught in the Universities in different variations. These are the first body of students who are studying music technology as one discipline or as one degree. These degree curricula are of a multi-disciplinary nature, but are still given as if they fit seamlessly into our traditional, discipline-based academic structure. Sometimes we, the lecturers, course developers and degree managers, forget that these are degrees which do not have a long standing tradition on which practices can be based, and that we are ourselves are still in the process of learning how to best facilitate the provision of these new degrees. The challenge exists concerning how best to integrate an interdisciplinary field into a disciplinary framework.

This challenge exists on all levels of academic endeavour: from the running of these courses and its administrative frameworks, to the teaching and facilitation of learning, the disciplines' pedagogies and specific vocabularies, and its research with its own particular methodologies.

1.2. Music Technology, defining an academic Discipline

To teach or facilitate the learning of music technology within HE, a corpus needs to be a defined: a
taxonomy of issues belonging to this subject, and a definition of the borders of this discipline.

Interdisciplinary subjects such as music technology are almost impossible to rigidly press into a specific corpus, which would result in the disadvantage of not allowing change or development. In addition to its current developing nature there are varying views of this discipline, which allow for a variety of academic degrees to emerge: the engineer’s point of view is facilitated by a "B.Eng. with Music", the Musician’s View possibly by a B.Mus. in Creative Music Technology, and so on. Nevertheless, if this discipline is to exist successfully within current HE institutions, there is a need for institutions to explicitly formulate teaching-content responsibilities according to faculties, departments or schools, and it requires those involved to lay down and quantify the amount of knowledge, i.e. create a corpus and thus define a discipline.

Lists like Philipp Ackerman’s visualisation of the discipline, Richard Moore’s music technology pentagram and Stephen Travis Pope (ed.) classic detailed taxonomy help us to define what exactly should, needs, and could be taught within academic degrees of music technology. This discipline is a very fast moving field and its corpus may, for many years to come, be a moving target. Its interdisciplinary nature allows it to locate itself within new combinations of old disciplines, binding them together into a new opportunity of gathering insights to new knowledge, and providing the opportunities to feed back into the knowledge of traditional disciplines. The challenge lies in the successful integration of such an interdisciplinary subject as "Music Technology" within a discipline-based educational framework.

2. The challenge of Institutional Frameworks

Music Technology has traditionally been placed within Music Departments, especially in Britain, where the tradition of "computer music" became a strong influence in contemporary music, taking up the momentum where the German "Elektronische Musik" left off. Music in itself, of course, has had its place traditionally in Arts/Humanities Faculties, and in a few Universities, Music has been able to exist within its own Faculty.

2.1. Music Technology within the framework of Arts and Humanities

The academic discipline of "Music" within British Universities has the tradition of being a practice-based discipline. This characteristic is not shared with the majority of European countries, but has greatly contributed to Britain’s high attraction for overseas and European students, and has probably contributed to its successes in the music trade: Britain has a market share of 10 – 15% of the world trade of records. The notion of "learning by doing", with performance and composition being methods of attaining a higher level of understanding of music styles or music activities, has more in common with other vocational disciplines, such as design, practical arts and also the "lab-based approaches" found within engineering and computer science studies.

Thus, the fact that Music Departments in Britain generally tend to be located within the Humanities can provide a point of friction, where methodologies between the more historical and analytical disciplines clash with more vocationally driven disciplines. Especially in times when universities’ financial resources are stretched, the tendency to adopt the "German Approach" of Musicology at Universities vs ‘Music in Conservatories’, seems to be an acceptable solution. A very fractured understanding of the disciplines themselves can and will undoubtedly result, as will a very divided community of "theorists" and "practitioners". This is something which Britain has managed to avoid almost completely, to the success of its own music communities and academic endeavours. For such a new discipline as Music Technology, the fracture represented in the "German Approach" becomes critical, with "Theoretical" music technology ("Musikinformatik") being generally located within Universities under "Systematic Musicology" and Electro-acoustic Composition being located within conservatories.

This division, as existing in Germany, tends to have the effect that universities are left with the degree of musicology - not music - with its academic traditional historical, analytical and theoretical - but not practical and creative - approaches to the field; these approaches being well understood within the humanities. Music Technology, which is heavily driven by creative processes, tends to be ill-placed in this environment as it is solely used as another tool for analysis of music or analysis of musical activities.

The need for joining theory and practice in music education has been a classic requirement, explicitly discussed and mentioned throughout history, and can be traced as far back as the Greeks. (Strangely enough, as soon as a computer is involved in academic activities, most disciplines think it useful to utilize "learning by doing" methods, but this thinking does not transfer itself to other instruments of learning, such as musical in struments or composition.)

Practice-based disciplines, such as the British music degrees, are often located within a faculty in which not only the understanding of its practice-based approaches might be missing, but moreover, where financial constraints can force departments to adopt more conventional (and low-cost) approaches to its own discipline: contrary to the British tradition of practice-based music degrees. Consequently, the attraction that British degrees have on a European scale can be lost.

Within Britain it has finally become standard practice to accept musical activities, such as performance and composition, as valid outputs of research (see the newest "Research Assessment Exercise" (RAE) specifications), but nevertheless, institutions still tend to often mistake the method with the learning objective of practice-based aspects of this discipline:

As you would expect in conservatories, performance and composition is aimed towards delivering professional quality. However, in the degree courses often existing in universities, the involvement of performance and composition is also used as a tool to attain a higher level of understanding of the mate-
rial being dealt with. If this vital difference is not understood it can be difficult to justify the more costly activities of performance and composition within Universities, which often do not have the remit to train future performers and composers. The notion of "learning by doing" is conveniently forgotten in the light of cost-saving decision making processes. Not illogically, these issues are understood and accepted much more within engineering and computer science contexts than in the Humanities, furthering the difficult positioning of Music within an Arts and/or Humanities framework. Consequences of this can be seen in the phenomena of discussing the closing down of Music Departments in the light of Conservatories existing within the same city.

For Music Technology as a discipline often situated within Music Departments or Music Faculties, several additional issues present themselves. The practice-based elements of its academic activities are understood, as described above, however the methodologies for research into music technology are very different from music, and as such can be very difficult to understand if coming from a point of view used to traditional music research approaches.

Music Technology research methods have always been closely related to, and adopted from, the science-based disciplines such as engineering and computer science. Characteristics of this research include:

- "creative pull" projects and basic and experimental research
- emphasis on teamwork and collaborative projects and more opportunities for large scale projects
- more possibilities for industry-bridging activities for universities commercialisation aims and industrial collaboration
- multi-institutional R&D projects and involvement in technology developments with international consequences, such as standards development, basic research, long-term research
- involvement in a wider diversity of funding schemes, the ability to draw on a wider variety of funding bodies and the ability to attract more industry sponsorship

These approaches do not necessarily remain only within research areas, but as can be expected and desired, feed back into teaching, utilising teaching methods such as:

- large and paired team projects,
- creative productions which include technical development
- industry relevant assignments and industry placement,
- industry funded/supported projects
- etc.

As a result, difficulties can occur when needing to assess research and teaching within one set of criteria, such as for RAE (Research Assessment Exercise) and QAA (Quality Assurance Agency).

Lastly, but possibly one of the biggest challenges existing for Music Technology today, is that the introduction of music technology into many music departments has created, what has been called a "Trojan Horse" complex. The rising interest of music technology has been met by a general decline of financial support for arts-based subjects in the last decade or so. This means that Music Technology within a Music department can be seen as resource-hungry: a costly but very popular activity - further fed by the music industry's need for specialists in this area. This results in a situation in which many Music Departments have had to decrease the size of their total teaching body, but increase the number of staff active in music technology. With the ratio of "music technology staff to musicology staff" rising, inner-departmental long-term strategies might not be able to be set without conflicting interests and tensions arising from having to distribute the limited amount funding.

2.2. The Trials of Institutional Frameworks

Taking Glasgow University as an example, Music in the University is located within the Humanities/Arts Faculty. As most of the Music Technology courses are under heavy constraints due to a limited number of available staff and available resources, quota or entry restrictions are in force for the majority of modules. Quotas and restrictions can pose difficulties for educational objectives. Certain technological skills should actually be taught in the first years in order to act as supporting tools for further activities within the music department. However, due to the need for keeping numbers lower than the existing interest, such skills are only able to be taught to a fraction of the students, or only to honours students, contrary to educational aims.

In most of these interdisciplinary course activities, music technology acts as glue drawing different disciplines together, such as Psychology and Music, Engineering and Music, Computing and Music, Education and Music and Physics and Music. But this is not without problems. For instance a general tendency is currently evident of a nationwide decrease of students coming into the Electrical Engineering courses, and departments have problems of attracting students into their pure Engineering degree courses. The more attractive courses seem to be Applied Engineering and similar degrees with a multi-disciplinary element, such as Multimedia, IT, Business Studies, and audio, video or in fact, music.

Engineering Departments tend to be departments with large research incomes, and with a relatively low undergraduate staff/student ratio: in effect the opposite of the Arts and Humanities Faculties in general, with a high number of students but a low research income. The normal income gained from Under Graduate teaching in faculties such as Engineering may not be able to balance the cost of staff, and numbers may have to be balanced across faculties which have a higher income from undergraduate teaching, for instance the Arts/Humanities. As these Faculties themselves have their own strategic plan concerning undergraduate expansions which might not include expansion of faculty-external degrees (such as the multidisciplinary degrees between Engineering and Music), and similarly, as Music Departments are constantly in the position of needing to balance the demand for musicology, compositional activities and music technology activities, expansion into music technology cannot be done without considering the balance of sub-disciplines within Music.
and the balance of resources across departments within Faculties. Thus an expansion of, or building upon, the multidisciplinary-cross-faculty degrees can be difficult; in above example, although it would be logical from the Engineering Faculty's point of view, it is not of direct interest and might be contrary to the long-term strategic plans of an Arts Faculty, and possibly that of a Music Department itself.

This absence of the flexibility to expand into a successful area creates a deadlock situation in which Engineering Departments (or other departments applying their subject and technologies to music) can only create their own interdisciplinary courses, not able to collaborate with other Departments dealing in this discipline. A big potential for teaching and research is missed.

The above problems can be seen to be reflected, with some negative consequences, within the Music Department at Glasgow University in the last few years as possibly other Departments in the country.

As may be expected, this can lead to a strained and tension-fruited environment within a highly attractive and in-demand discipline, causing general discontentment. The potential in staff and resources in such an environment lies dormant: all this in an area which, in industry is the second largest in Britain, and which has one of the highest commercial, research and teaching potentials. For a discipline such as Music Technology to find itself in such a framework is detrimental to its own development as a discipline and undoubtedly detrimental to all those involved.

Only a very supportive Faculty or/and Department, might be able to compensate for the deficiencies that this type of structure in an institutional framework can create, generating a direct conflict of interests which seems difficult, if not impossible, to be resolved.

3. The opportunities within institutional frameworks - Education and Research

Having covered some of the basic problematic issues of music technology within traditional Higher Education institutional frameworks, one could attempt to formalise a range of possible solutions. To place a discipline - which has both creativity and technology as its central driving forces - into a larger institution will probably provide a constant challenge. Larger institutional frameworks will always have the need for stable and permanent long-term structures in order to work efficiently, whereas creative disciplines, in general, stand opposed to institutionalised frameworks, and technology-driven disciplines tend to move too fast to stay efficiently stable for larger HE sectors. This has always been a problem, especially when it comes to equipment funding allocation.

Other institutions have tried solutions such as:

• the regrouping of disciplines to make faculties smaller and create smaller groupings of more similar disciplines. "Schools" seems to be fashionable these days, but the regrouping from faculties into schools can logically only be of benefit if the schools themselves replace the faculty structure, and not impose yet another layer of bureaucracy
• the creation of Music Faculties

• the creation of Centres of Study

The creation of centres is obviously an interesting type of solution as it offers many possibilities that other frameworks are not able to supply: a) a centre might be made up of individuals from different departments with an interdisciplinary aim or objective, b) a centre might include external organisations, such as companies and creative and cultural organisations, exploiting possibilities of project-placement, industrial visits, visiting lectures, etc or c) a centre might interact with a number of departments and faculties with a higher level of independence and not restricted to departmental or faculty strategic plans.

"Vertical centres", or centres which include organisations outside of the university as well as different departments from within, offer many types of collaboration. Collaboration which not only provides a fantastic basis for developing the research field of music technology, but can also provide the overall need for formalisation of university-industry bridging, as emphasized by the EC in its newest 6th framework (See chapter 4.2.). Having adequate bridging is positive for students and staff in many areas of HE activities, but is vital for industry to exploit the newest developments in a field.

As with the above difficulties it can be seen that there are more opportunities for research than teaching in our traditional HE framework, it becomes clear that there is a high importance placed on research feeding back into Undergraduate and Postgraduate teaching. In addition to this, in a fast moving field such as music technology, research becomes vital in order to stay close to state-of-the-art developments, as the status quo is moving much faster than in traditional Arts/Humanities disciplines. This calls for a higher interaction between future technologies and the students’ curriculum. If centres are able to include teaching provision into their remit, then there is a higher amount and diversity of interaction between teaching and research, profiting the students in their acquiring of knowledge in this fast moving field.

Interactions of research and teaching can occur and can be supported in many ways and on many different scales:

• Research Projects, PhD students and research staff can feed into the curriculum
• Assignments/Projects can be influenced or formulated by research/industry/external factors
• Industry/Organisation student placements in summer or for final year projects
• Industry/Organisation/individual visiting for lectures in a specific topic
• Larger student projects based on collaboration with external organisations/industry bodies

3.1. Bridging the Gap

As mentioned above, research within HE institutions provides, to a high extent, the freedom within institutional practices that undergraduate teaching may not be able to provide. Considering the potential of this subject, it would be in the interest of institu-
tions to support such research, as it is highly commercial viable in many areas and means that industry-bridging should actually be very easy, although it is not often done. Research within music technology, can not only be applied to the second largest industry in Britain: record sales, but offers integration into the telecommunication industry, broadcasting industry, culture industry, the education industry and related areas such as film-making and other creative industries.

Although this potential is relatively obvious, there has been a problem of university-industry bridging in the past. Simplified, but nevertheless true, music technology research seems to have been channelled primarily into two directions:

- either music technology research outcomes, if coming from music departments, have traditionally been channelled mainly into culture, into compositions and performances
- or music technology research outcomes, if coming from the engineering departments, has been channelled mainly into the telecommunications industry.

There seems to be a hurdle of transferring outcomes from academic research into industry: non-profit cultural or profit-based industry. Universities in general seem to be become more and more detached from industry, which has been noted and addressed by the European Funding Programs. This gap is characterised by a surplus of technology, left without being integrated into products or systems. It follows that one of the main aims in the 6th framework of the EC is "technology integration" in order to "force" the needed university-industry bridging for technologies to become a society's tools.

Within the music/audio industry, this can be said to be true, especially if comparing to the video/visual industry. This area seems to have bridged the gap from research to products much faster, for instance in animation/effects techniques, despite it being younger than the music industry.

Within music there are areas which tend to pick-up innovative technologies very fast, such as synthesiser technology, but these seem to be far and few if looking at the whole area of audio/music related industry.

3.1.1. Music Departments and industry collaboration: There is probably a number of interconnecting reasons for this gap between industry and research to occur, but one answer could be the location of music technology within frameworks which are not used to handling industry-bridging activities. As the visual/video technologies have traditionally been located within the computer science departments in Britain (and Europe), the developed technologies and research outcomes were well placed in a framework used to marketing their own results and providing the needed interaction between industry and university.

For music technology, the traditional positioning within music departments resulted in the developments of more artistic goals, not having the aim of commercialisation of technologies, nor having the experience or tradition of industry collaboration. For the cultural products this had a very beneficial effect, and one could say that music technology centres have created a large number of tools for composition which no other creative digital discipline can match in quantity, quality or diversity. Nevertheless, this also created some unnecessary gap between industry and university research.

Based on the above reasons, some centres have opted to be placed wholly or partly in the science departments (engineering or computer science), and have done so very successfully. But the ideal would presumably be a centre "in the centre of these subjects", as the drive for technology innovation can only be supported in a major way by artistic creative considerations as well as industry-relevant ones.

3.1.2. The Size of Music Technology Centres The location of centres within smaller departments is another issue to consider. Smaller centres and smaller departments are often disadvantaged in large institutionalised frameworks, summarised through:
- not having a critical mass of research active staff
- not having a critical mass of administrative and technical support

Both of which have an adverse effect on music technology research, and some strategic decision will always be necessary in order to compensate the disadvantages that a small size may bring.

4. The New Funding Diversity for Music Technology

There is a new funding diversity for music technology, especially in Britain. Most of the science-based as well as the arts-based funding councils accept some or the majority of music technology research as valid research, and allow it to be funded within its own remit. Although there is a danger of interdisciplinary subjects "falling between chairs", usually interdisciplinary centres can exploit this diversity more than uni-disciplinary ones. Some of these funding bodies, as described in more detail below, even address specific themes around the area of music technology, such as "creative pull", "creative productions" and "music technology".

During the last six months there have been a number of workshops organised by funding bodies and funding councils with the goal of acquiring feedback from the research community about the needs and requirements for funding within specific areas. These workshops provided valuable information about where the funding bodies are moving, and how the funding tools will be changing according to the changing face of economic, industrial and educational factors. Two of these workshops are used as example to demonstrate the changing face of funding for music technology within Britain and Europe.

Using EPSRC and the EC as the sole examples obviously means omitting one of the major funding councils for the creative activities, the Arts and Humanities Research Board. It, in itself, has not been in existence for very long and thus does not have the need to redefine its remit. The AHBB was set up to specifically cater for the needs of creative, cultural and humanities-relevant research. To the author's knowledge, no research community workshop has been organised, however the fact that the AHBB is the funding council closest in its remit to creative, performative and compositional research activities...
within music technology, makes it the most widely known: at least within the creative and artistic user communities. Although issues surrounding the positioning of technology-development within creative projects are unspecified within the AHRR and easily discarded as being within the remit of more science-based funding councils, the AHRR has shown an immense interest in supporting creative productions, with or without a technological basis.

4.1. EPSRC - Engineering and Physical Sciences Research Council

EPSRC is the Engineering and Physical Sciences Research Council, and it is the largest of the seven Research Councils within Britain. In February 2001 it held a two day workshop on the “Funding of Music Technology within EPSRC” (Harrogate, Feb. 2001)⁵. Fifty individuals from various academic institutions were invited, representing an attempt to have experts covering most areas within music technology.

Nigel Birch, who co-ordinated the workshop as a representative of EPSRC, mentioned in his introductory talk the problems which a funding body such as EPSRC presently faces:

- a rising number of music technology funding applications, representing few and small pieces of a large puzzle
- growing problems of bridging universities and industry (and marketing)
- a lack of enough projects with the emphasis on technology integration, resulting in a surplus of technologies which are not utilised by industry or are not distributed to user communities

With these problems in mind the workshop concentrated on the following aims:

- to map the discipline of music technology (from the EPSRC point of view)
- to identify enabling technologies and secondary technologies
- to identify priority research areas
- to identify capable funding tools

The results of this workshop were extremely interesting. A detailed “knowledge map” of the research field of music technology was provided, which, unlike existing taxonomies, concentrated on the development of technologies as a starting point. This allowed a good overview of the research scope, and the addition of specifying primary and secondary technologies (enabling technologies and technologies based on enabling technologies) resulted in realising priority areas as well as re-search “holes” in which technology outcomes are missing: hindering further progress in a specific research area.

For EPSRC, this contextual map of priority areas is meant to have a sort of “roadmap” effect for further funding strategies.

One of the direct results of this workshop was that EPSRC will allow the development of technology based on creativity support as a valid research activity within their funding remit, as long as technology development makes up 51% of the overall activity. Also, the notion of accepting the potential in experimental approaches (serendipity, accidental inventions, exploratory approaches, basic research) was also accepted and will be supported by EPSRC in the future.

The notion of creative pull was mentioned in that “the use of technology by artists can push the technology development”⁶. Other conclusions, amongst many others were: the need to integrate or support the integration the research community into the formation of standards, outcomes of research should be evaluated on artistic as well as technical merit, specific areas of interdisciplinarity need development and support in their collaborative efforts (ex.: cognitive sciences and music, social sciences and music technology, etc.), language barriers between scientists and artists still need to be overcome, etc.

In terms of funding tools, it was announced that traditional project funding would be continued, but supported by “Networks of Excellence”. These networks would be of a distributed nature, unlike the French model of centralised physically located centres of excellence. Support would be in the form of administration, travel, working group meetings and events.

4.2. The European Commission

Similar to the EPSRC meeting, the European Commission invited to a workshop at the FhG Darmstadt in May 2001 called: “Technology platforms for cultural and artistic creative expression”. In its inviting letters the commission stated that:

“The discussions will be used to help us establish future priorities in this area, which could be supported within the framework of our IST Programme as part of a new Cross Programme Action (CPA) to be introduced in the IST Work Programme of 2002.⁷”

Representatives presented the problems in which the EC find itself, which, although within a more general remit of creativity and cultural activities, are similar in nature to EPSRC.

The last two funding frameworks (4th and 5th framework) resulted in a surplus of technologies which have not been integrated into industry or distributed to the user of the “information society”, as specified in the current framework. This surplus of technology is generally seen as an unexploited resource, and its integration needs to be supported, specifically within the SME industries.

Another problematic area is that the last, fifth, framework found itself swamped by projects concentrating on art preservation, and although the calls specified cultural and artistically creative productions, most applications and successful projects were of a preservative and archiving nature. The EC sees this as a potential hazard meaning that, at some point, no new works of art - specifically digital art - will be created, making technology innovation solely for the purpose of preservation of traditional art and cultural objects.

Within these two major problems the workshop aim was set to:

- Survey existing activities + identify major technology shortcomings
• Identify key issues to be addressed within 5 to 10 years from now
• Identify key players and, if needed, the additional actors
• Develop a strategy for the articulation of such an action with respect to the 6th Framework Programme, currently in preparation

The one-day workshop formulated on that day surprisingly refreshing results for creative & technology research:
• Creative Productions will be emphasised and part of Framework 6
• Acceptance of the concept of Creative Pull (see next chapter)
• Emphasis on Generic platform for creative processes, available to a wider user community

Nevertheless this refreshing attitude is only partly reflected in the official report with a lot of un-useful and too general and trivial statements (such as "audio should not be forgotten...", "emphasis on natural interfaces...", "content is key...", "focus on end user...", etc) and only some useful conclusive recommendations. Amongst them are that:
• technology needs to be resistant in time and space in order for artist to take them up in a critical mass
• the access threshold of artists into R&D projects should be lowered
• importance of proper education and training in this area was stressed
• danger of EU projects being to market oriented
• standards involvement of the artistic and cultural community

Considering funding tools, the stress on medium-to-long-term exploratory action was mentioned, as was emphasised the creation of networking centres of excellence, and prioritisation of integrative projects with a large amount of technology integration.

This one day workshop, although very interesting, did have some, form the CIRCUS point of view (see below in next section), questionable outcomes, which seems to demonstrate a still lingering tendency towards technology push instead of creative pull as in the workshop "some argued that a technology push is needed since traditional techniques will not provide enough motivation to innovate" and that "creative work and deliverables/milestones do not go well go together - But it was felt that the artist community can also respect deadlines".

Although the apprehension of some towards these results, it was understood by all that this meeting represented only a first attempt to begin to understand, thus this report was to be understood only as an initiating of a process rather than final recommendations, in general the continued discussions of the integration of the creative-pull aspects of project development was accepted, how it will be supported within new funding frameworks still leaves to be looked at.

For areas such as music technology, in which serendipity, creative and exploratory approaches may lead to something new and innovative, the acceptance of "creative pull" processes is a "sigh of relief" regarding having to phrase project proposals with outcomes already known: a notion going against many kind of approaches for basic research as well as creative processes. The support for networks of excellence again implies support for individual creative users which, until now, were not able to participate within research projects as they were not bound to academic institutions. This left a large creative potential unexplored. The notion of acceptance of creative pull (further described in the next section) will free the creative user or artist from the role of service-provider to that of an individual whose expertise needs to be involved form the design to the implementation stage.

4.3. CIRCUS working group - Content Integrated Research into Creative User Systems

CIRCUS is a working group funded under the last calls of the fourth framework of the European commission. It started in October 1998 and will run until October 2001, in the last weeks of which a conference on the issues of creativity and technology will be held in Glasgow.

Its aim is to advise the EC on the integration of content and technology in terms of creative pull vs technology push. It aimed to gain a fuller understanding of the relationships between content, medium and technology in user contexts ranging from data creators to data users, from entertainment through education to fundamental research.

This group of ca 50 active individuals, representing ca 16 different European institutions involved in creative productions, including artists, film-makers, designers, musicians, composers and authors, has identified major issues and problems which will need to be addressed by the next funding frameworks in order to exploit the potential of creative production to the fullest.

In the centre of these problems stands the challenge of content, medium and technology: the needed balance of "Creative Pull" vs "Technology Push". The concept of creative pull has more complex implications of:

• integrating the creative user from the start of a application developing process, instead of attaching him as a service or as an end user
• providing frameworks for letting the interaction between creativity and the development of technology happen throughout all phases of project development
• providing production methodologies or business models to cope with situation in which creativity pulls the development of technology along with the inherent dilemma best described as "building the camera while making the film"
• providing the framework in which individuals artists can participate in research projects, without the need of their belonging to academic institutions.

CIRCUS has found that some of the detrimental effects of the lack of creativity pull within digital art can be seen in the fact that 90% of artists are still using traditional tools. In addition to that, production from digital tools seems not to support creative processes, but rather to provide a template way of thinking and producing: more appropriate for mass pro-
duction than works of individual art. Within our current creative environment of digital art production artists, surprisingly, still manage to be creative, but it is the opinion of CIRCUS that this is not because of the tools but despite the tools.

Issues which need to be addressed before this situation can change are:

- The lack of the creative user with creativity seen as a service, to be able to be brought in, rather than integrated into, a process
- Current Systems have not proven to be adequately permanent. Digital Art needs to be resistance in time and space, for at least 20 years in order to be considered for use by the critical mass of artists.
- There needs to be a balance between funding Art Creation (Tools development) and Art Preservation/Consumption
- There needs to be support for style development, (Manner, Expression) and similar processes in digital creative productions.

Within these main points, CIRCUS has published a list of its research themes that can be used as a more or less comprehensive list of issues needing to be addressed by future research.15

5. Conclusion

The experience with other interdisciplinary working groups in this area has confirmed that the challenges and opportunities described and stated in this paper are not specific to Music Technology in Britain, but could and possibly should be tried against other countries and other interdisciplinary technology based subject areas within the "digital arts". It may seem that Music Technology is a prime example for the opportunities and challenges faced in Higher Education today, not only because the authors background is within this area, but also because Music Technology has a longer history and a more established place within institutional frameworks today. For decades a community and culture has already been formed, and we can already distinguish the consequences of outside forces, such as funding or educational structures, within this community and its culture. From a more general perspective, these insights should be able to be used to compare and discuss the integration of the other "digital arts" within the HE sector. More specifically for Music Technology, we are still in an era where due to its interdisciplinary nature, its integration within institutions with discipline-specific structures is still undoubtedly difficult, and one solution lies within the formulated "Vertical Centres for Teaching and Research". Lying detached from the discipline-specific departments or faculties, they can draw on the expertise held within various internal and external organisations and different fields, and can build upon the interaction of these disciplines to create a successful and highly promising future for music technology research and study.

I would hope that this paper could be seen as the start of a discussion in terms of the "bigger picture", a discourse in how educational frameworks would need to be set up to support interdisciplinary education and research, how funding bodies would be able to support this development, as well as providing insights how these two influence each other and their relating communities. As Universities are in the centre and the basis for all academic and industry activities, they will have to provide the framework in which music technology research and education in general preside. But if the internal conflicts existing in many institutions persist due to inherent structural problems of the framework, they will always prove to be a stumbling block for this new subject area, slowing progress, halting development and resisting necessary change. An academic discourse on these issues can only lead to improvement.

Footnotes

3 EC - European Commission - Workshop, FhG Darmstadt, May 2001: "Technology platforms for cultural and artistic creative expression"
7 Figures taken from the British Government's Department of Culture, Media and Sport, http://www.culture.gov.uk/creative/index.html Last accessed 21/06/01.
8 See documentation of the 5th and 6th EC Research Funding Frameworks
10 See EPSRC REPORT: Music and IT, p.1.
11 Letter of invitation to the workshop at the FhG Darmstadt in May 2001 called: "Technology platforms for cultural and artistic creative expression"
13 ibidem
14 Phrase coined by Dr. John Patterson, University of Glasgow, in the beginning of the CIRCUS working group, 1998.