



## **The Arts & Humanities, and the Sciences: Music and the Mediation of Inter-Disciplinary Tensions**

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### **Research in the Arts & Humanities - the historical context**

Over recent years, the conventional justifications for the value of arts & humanities research – that it builds cumulatively on the knowledge acquired through generations of scholarship, that it advances our understanding of particular subjects and topics, and that that knowledge and understanding have value in themselves – have become more difficult to sustain in an increasingly utilitarian and economically-driven academic environment. Even the argument that such research enhances our understanding of our histories, of ourselves, and of the human condition, have had ever-diminishing resonance in contemporary western societies whose governments are increasingly detached from the values that gave rise to such arguments, and that are focused on short-term goals that are predominantly economic.

In addition, the nature of research in the arts & humanities has been subject to increasingly rapid change, in part as a consequence of the change in values and in part as a consequence of a proliferation of possible methodologies. Some of these methodologies arise and are adopted as a result of new intellectual paradigms and commitments (such as, e.g., deconstructionism). Some emerge as disciplines re-define their objects of study and re-align themselves (as in the domain of musicology, where "empirical" or "applied" musicology has arisen from the confluence of historical and experimental research, and "new" musicology

arose from the assimilation of ethnomethodological and deconstructionist approaches into the field of historical and cultural musicology). And some emerge as a consequence of the availability of new research tools; the computer and the internet have transformed the ways in which topics that have been central to research in the arts & humanities can be investigated, interpreted and presented.

The change in the nature and the values of research in the arts & humanities has also been driven by changes in the nature of the broader academic context within which they are conducted. As Clark Kerr presciently suggested over fifty years ago in his book *The Uses of the University*, the research activities that happen within universities can no longer be thought of as sharing many common attributes or motivations, to the extent that he proposed replacing the term **university** with the term **multiversity**. While diverse research methods and ontological commitments were part of the idea of the modern university from the outset of their reimagining – largely in the German world – in the nineteenth century, the relative value accorded to the diverse disciplines that make up the contemporary university has changed radically over the last sixty years. The opportunities offered by the development of technology, the relationships between university research and the commercial world, and the increasing pressure to expand student numbers have all influenced the perceived value of different types of research, both within the university system and beyond it, in the public and governmental spheres.

As a consequence of these changes and pressures, the nature of graduate training in the arts & humanities has had to adapt. A focus on texts, sources, and the history and nature of ideas could serve as the central core for the training of earlier generations of arts & humanities graduates, and the structure of a doctoral programme could emerge from the exigencies of the subjects that it tackled. In the present day the nature of graduate training is shaped by a drive towards homogeneity of programme structure (impelled by sponsors and funding bodies), the need to accommodate to new and useful techniques, technologies and methodologies, and the imperative to justify the value of the research that is undertaken.

## The institutional contexts - value systems

I shall discuss these issues in the context of the present-day UK system, in which virtually all university funding derives from the government which is thus in a position to shape (and to seek continually to reshape) the ways in which universities provide opportunities for research and for research training. Changes introduced into the workings of the university funding system over the last twenty years in the UK are increasingly used in the restructuring of state-funded university systems in Commonwealth countries (e.g., Australia), and effects analogous to those caused by the changes in the UK system appear to be occurring in the US.

Some twenty-five years ago, the UK government instructed the body then responsible for funding research in UK universities to carry out a **research selectivity exercise**, ranking research in each department of each university and providing funding in accordance with the rankings. This exercise has since been carried out periodically, becoming increasingly prescriptive and demanding in the process. In the current exercise, now entitled the Research Excellence Framework (see <http://www.ref.ac.uk/>), each member of staff of each department must submit four items published in the period 2008-2013, each department must submit information about all research and research-related activity (including graduate training), research income, research environment, and provide proof that the research conducted in the department has had **impact** outside the academic world. All this material will then be ranked and funding to each department for the next five years will depend on the rankings given. There are evident difficulties and inequities associated with this system – quite apart from the intellectual incoherence that characterises its operation – that generate tension between institutions (which are now **competitors**) and that privilege particular types of research over others, but the UK academic community has gradually had to accommodate to this system over the last couple of decades.

The roots of this system of ranking research and distributing funding according to ranking are twofold: in the application of doctrines derived from management studies; and in the pragmatic political need to find a mechanism for distributing funds (while avoiding responsibility for the consequences of the operation of that

mechanism). From management studies comes the idea of Performance Indicators that can be quantified, an approach that makes sense in a business environment, that promises to provide an objective correlate of performance and hence a quality control mechanism for identifying good and bad performance. The idea adapts poorly to the heterogeneous world of academia, however, as there is no objective correlate of research excellence that can be applied across all the diverse disciplines and methods of the multiversity. The value of the notion of Performance Indicators to the funding body – the government – is that it provides a means of distributing a limited amount of public funding between UK universities. It has also enabled past governments to enlarge the Higher Education sector in the UK by increasing public access to those institutions while limiting expenditure.

The binding of research ranking to funding in the UK has imposed a peculiar – but probably increasingly internationally common – set of pressures on arts & humanities research, pressures that amplify those that arise from general societal dynamics. Economic value can be clearly demonstrated in science and technology (STEM) subjects (as can impact). Hence STEM subjects, and the ways in which these work, in terms of research procedures involving collaborative work, integrated graduate training programmes, defined research outcomes, and, particularly, potential for commercial application, have come to set standards whereby all university research tends to be judged.

How can one justify the value of research – and research training – in the arts & humanities if the bottom line – the criterion for acceptability – is economic? The arts & humanities produce **output** that is largely non-commercial, but a case can be made that creative arts – music, film, literature, gaming, dance, and graphic, plastic and conceptual arts – constitute a significant economic driver for the economy. This is undoubtedly the case; in 2008, the UK Department for Culture, Media and Sport reported that the creative industries employed 2 million people in Britain and contributed £60 billion to the economy each year, 7.3 percent of UK GDP. It has proven difficult to provide any coherent evidence for an effective role of the university sector in driving creative economic output, but at least the data enables universities to argue that the creative arts have value in terms that are recognised by the government. This does not, however, provide much relief

for those arts & humanities fields that are not classifiable as creative arts. Moving away from an agenda that is over-determined by governmental funding requirements and the weight that is thereby granted to research processes of the types found in the STEM subjects, the issue of what can and should underpin the distinctive nature and value of research in the arts & humanities requires to be addressed.

### **Research ontologies**

I would suggest that at a first approximation it is heuristically helpful to distinguish research that is concerned with the establishment or exploration of general causes and theories from that, which deals with the human, and the particular. Several different frameworks exist that can accommodate and illuminate this type of distinction, amongst them those proposed by Popper, by Bruner and by Hacking. Popper suggests

... that there are three (or perhaps more) interacting levels or regions or worlds: the world 1 of physical things, or events, or states, or processes, including animal bodies and brains; the world 2 of mental states; and the world 3 that consists of the products of the human mind, especially of works of art and scientific theories (Popper, 1978, p. 351).

For Popper, all elements of all worlds are susceptible to scientific exploration and explanation, though those of world 1 are likely to be more so than those of world 3.

Popper's distinctions shed little light on how the domain of the sciences relates to the social world, and it is on this issue that Hacking, in *The Social Construction of What?* (1999), focuses. Hacking makes a useful distinction between what he terms indifferent kinds and interactive kinds. Indifferent kinds are those that are likely to be the subject or result of scientific research, having identities that, while they are dependent on their mode of discovery and their relationships with each other, are unaffected by social action or debate. Interactive kinds are those that arise by virtue of social interaction and cultural process. Hence, for Hacking, the human genome would be an indifferent kind, though clearly its implications and uses can be interactive kinds. Thus Hacking's indifferent and interactive kinds may interpenetrate, indifferent kinds acquiring an interactive identity by virtue of the ways in which they become incorporated into the subjectivities of individuals and expressed in their interactions with others.

Hence, a clear distinction cannot be drawn between those subjects that are properly addressed by the sciences as opposed to the arts & humanities, but at least at the limits of Hacking's duality – clearly indifferent kinds, and plainly interactive kinds – different research methods must be applied.

Bruner's 1986 book, *Actual Minds, Possible Worlds* relocates the issue of scientific and other modes of knowing into the mental domain, proposing a distinction between what he terms paradigmatic and narrative modes of thought. This distinction roughly maps onto the separation between the sciences and humanistic methods of enquiry and explanation. The paradigmatic, for Bruner,

...deals in general causes, and in their establishment, and makes use of procedures to establish verifiable reference and to test for empirical truth [while the narrative] ... deals in human or human-like intention and action and the vicissitudes and consequences that mark their course (Bruner 1986, p. 13).

Again, this distinction is not wholly clear-cut – particularly in respect of aspects of human mental life – but it does mark out fairly distinct territories for scientific and humanistic research, perhaps most clearly where he suggests that:

Science attempts to make a world that remains invariant across human intentions and human plights... On the other hand, the humanist deals principally with the world as it changes with the position and stance of the viewer (Bruner 1986, p. 50).

It is notable that all attempts within the philosophy of science to demarcate the boundaries of "proper" science have foundered when scientific research is considered as a practice in the social world. Perhaps the most successful is that of Lakatos (1970), who proposes that scientific knowledge should be regarded as coming to consist of core and auxiliary theories, with core theories being resistant to change while auxiliary theories are more amenable to falsification. Yet even Lakatos does not deal satisfactorily with the notion, which his teacher Popper accepted, that there is no such thing as **science**, only **the sciences**; the specific methods and ontological commitments of one science can be indescribable in terms of another science. Hence, Lakatos ultimately fails to provide an adequate account of what makes the sciences **scientific** and what debars artistic and humanistic approaches from being so.

To conclude this section with yet another heuristic, my own preferred solution to the issue of what constitutes the sciences rather than other ways of knowing is to suggest that the sciences have methods and ontological commitments that are mutually commensurable (see Lakoff, 1987, p. 322). While the methods and ontologies of any science "A" are **understandable** in the light of those of any science "B", those of science "A" are unlikely to be able to be **expressed in terms of, or reduced to**, those of, science "B" (and vice versa). Hence, one can postulate a plurality of sciences, but the theories, methods and objects of each science are mutually comprehensible in ways that do not hold between the sciences and other modes of knowing. In other words, the sciences are relatable to each other because their premises, working methods and theories can be understood from the perspective of each science; the premises, working methods and theories of the arts & humanities seem, from the perspective of any science, to be of quite another kind.

### **Research epistemologies**

Perhaps rather than seeking to draw an essential distinction between the sciences and the arts & humanities, examination of their actual practices should shed light on what distinguishes them. Historically, research in the arts & humanities and that in the sciences involves seemingly quite different practices and validation mechanisms. Humanistic approaches entail scholarship that explicitly attends to the authority of pre-existing scholarly study, reinforcing or challenging interpretations on the basis of new materials and new theories which stand or fall on the basis of acceptance of their validity in the scholarly community. From a perspective that regards the sciences as social practices, the same types of procedures seem to apply. However, the role of authority or validity of knowledge in the sciences can be interpreted as externalised and generalized through the peer-review process, whereas the legitimacy of knowledge in humanistic approaches can be viewed as more reliant on reputation, connoisseurship and direct influence.

The arts & humanities tackle the culturally and historically particular, interpreting their evidence in the light of understandings of how individuals and societies have made, make, and remake their worlds. The understandings that emerge may be bound to particular cases and situations, but they can illuminate these

instances in ways that irrevocably change our appreciation of them. Conversely, science aims to establish and explore general causes and theories. In the course of doing so, it simplifies. In any scientific study, what is being explored constitutes an operational abstraction from a real-world domain. The extent to which conclusions drawn from the manipulations carried out on that operational abstraction can generalise back to the real-world domain is dependent on the degree to which the operational abstraction adequately represents the real-world domain (or elements of it). The criteria that allow such generalisations can, more-or-less, be specified for sciences – notably physics, and its technological counterpart, engineering – that seek to account for and to explain Hacking's **indifferent kinds**. But when the sciences are applied in the exploration of aspects of human experience – when they focus on topics that have typically been the preserve of humanistic scholarship, Hacking's **interactive kinds** – the criteria that allow generalisation to the real-world domain of human life from the operational abstractions on which scientific methods rely become more and more difficult to identify and to apply. Despite these difficulties, science is applied to understand human social and mental life, and the problem of assessing the validity of the generalisations that the human sciences draw from their findings (a problem that is acute in the scientific study of music) is one that has continually to be addressed within scientific practice.

While the methods and the research foci of the sciences and the arts & humanities have a long history of difference, many of their concerns and practices are being recognised as sharing common features. In very recent times, the emergence of the internet has accelerated a convergence in research practices as researchers increasingly seek the context for their research – whether primary documentation or data, or previously published papers – on the web. The ways in which such sources (particularly published research) are presented and are made accessible are tailored to the requirements and the demands of the sciences, yet these tools are often the only means by which humanistic scholars can retrieve the materials on which their research depends. The alternative tools available to the humanistic scholar are all too often, as Jensen (2007) notes, driven by the commercial imperatives of the web giants such as Google, with, as he states (p. 300) "authority conferred mostly by applause and popularity" rather than by reputation and influence.



## **The Centre for Music & Science**

The Centre for Music & Science (CMS) in Cambridge was established in 2003 in a purpose-built wing of the University's Faculty of Music, comprising a sound-isolated studio (with control and recording rooms), a computer room, a research room, a machine room, and office and storage space. Its establishment was aided by being able to build on existing strengths, particularly already-existing expertise in the Music Faculty in a new research area – music and science – straddling arts and sciences, a research area under-represented in UK universities. It has benefited from being embedded in an institution with an excellent international reputation that has consistently performed well in the governmental research selectivity exercises referred to above, and that has attracted a high level of government funding for research. The CMS was established in order: (i) to provide facilities for conducting scientific experiments on aspects of music, (ii) to provide a base for researchers in the Music Faculty working in the area of music & science, particularly graduate students, and (iii) to provide facilities to support collaboration with researchers in other departments in the university and in other institutions.

The CMS houses dedicated resources supporting technology-intensive research and teaching in music that is fundamentally collaborative and inter-disciplinary, linking music with psychology, phonetics, linguistics, acoustics, computer science and neuroscience, as well as other human sciences such as biological anthropology and archaeology. Since its foundation it has attracted a yearly average of eight PhD and two or three MPhil students, and provides a base for collaborative doctoral and post-doctoral research with other departments in Cambridge and in outside institutions. Collaborative projects have involved CU researchers in Engineering, Computing, Psychology, and Archaeology, as well as visiting researchers from US, European and Australian institutions. While the chief specialism of the centre is music cognition, its research is inherently cross-disciplinary embracing cognitive, computational, psychoacoustical, phonetic-linguistic, evolutionary and archaeological approaches to music. It has organised international conferences and workshops, and since its inception in 2003, CMS research has been represented in the form of over one hundred articles in peer-reviewed journals and conference proceedings, some thirty book chapters, and

three edited volumes (published by Cambridge University Press and Oxford University Press).

Current experimental research in the CMS explores:

- cognitive structures and processes implicated in the experience of musical pitch and rhythm;
- properties influencing the experience of emotion when listening to music;
- influences of body movement and music on attitudes and pro-social behaviour;
- common cognitive and motoric processes underlying speech-language and music;
- the role of culture in shaping musical perceptions and cognitions;
- perceptual correlates of instrumental timbre
- computational models of musical processing;
- experimental (reconstructive) archaeology, exploring the extent to which inferences can be drawn from use-wear concerning use of stone "tools" as sound-producing objects ("Lithoacoustics").

In parallel with this experimental work, theoretical work has focused on how tensions between scientific and hermeneutic approaches to understanding music might be understood within frameworks derived from evolutionary theory. This has led to a concern with understanding music as an interactive medium, resulting in experimental studies exploring the ways in which engagement with others in music-making can influence the cognitive and affective performance of participants. From this work has emerged a research focus on the exploration of the commonalities and differences between music and language, taking particular account of biological and evolutionary perspectives and of cultural factors [for further information see <http://cms.mus.cam.ac.uk>].

The principal impact of the Centre's activities has necessarily been in the academic domain, where the impact of its work has extended well beyond the domain of academic music studies; it has highlighted the significance of music, and of the broader domain of human communication, as an important and consequential area for research within a range of disciplines, from archaeology through anthropology to psychology and linguistics. The Centre's work has also been represented in wide-ranging contexts explicitly concerned with public engagement with science, as well as being extensively disseminated in the media, including internet, print, radio and television.

### **CMS research - problems and solutions**

The three key features of research and research training in the CMS are:

1. inter-disciplinarity
2. collaboration
3. encouragement of individual, original, research interests

To start by considering the role of inter-disciplinarity: the tensions between humanistic and scientific conceptions of and approaches to understanding music are worked out in everyday practice in the CMS. Music, to paraphrase Allan Merriam (1964), must be understood as sound and concept manifested in behaviour: music is sound, but to accept that sound *as* music, a culturally-determined and consensual concept of what constitutes musical sound is required – and, of course, the production of the musical sound requires behaviour. Humanistic approaches to music – for example, historical – of necessity focus on the conceptual domain as represented in the historical record, and on behaviour so long as this can be inferred from that record. In such approaches music as sound typically plays a role in terms of the scholar's responses to sound and their inferences as to the role that those sounds have played in respect of the concepts and behaviours manifested in the historical record. In the scientific domain, all three levels – sound, concept and behaviour – necessarily must be taken into account, hence all levels of Merriam's definition must be acknowledged and addressed within research in the CMS. For example, while the apparent focus in psychological experiments on listening to music are on the observable behaviours of experimental participants in response to the musical sounds prepared by the experimenter, the design of the experiments

must take into account the concepts that are hypothesised to underlie the ways that a participant may hear the musical sounds, and the goals of the experiment must be to elucidate the ways that those concepts are manifested in the participants' behaviours.

This requires experimenters – whether staff or graduate student – to be highly aware of the ways in which sound, concept and behaviour may be conceptualised and investigated through experiment. They – we – must be acutely sensitive to the extent to which the framework of any particular experiment – which involves manipulation of variables that constitute operational abstractions from the real-world domain of music – adequately reflects the real-world problem that is being tackled, and hence the extent to which the findings of the experiment may be used to make generalisation about that real-world domain. This awareness is established and maintained through constant interaction between CMS members, in terms of critiquing each other's experiments, debating methods and definitions, and constantly seeking to clarify the terms in which experiments are framed. In part this is achieved through regular seminars with staff and students in which CMS members may present their research to each other or in which the group reads and critiques important new papers in the various fields that fall within the ambit of the CMS. It is also maintained through the everyday informal interactions between CMS members; the physical spaces in the CMS serve as workspaces where all members not only conduct their research but interact with each other daily, and it may be that more significant discussions have occurred over coffee than have happened as a consequence of planned seminars!

In effect, doing science on music requires the scientist to be a musician, a musicologist as well as a scientist. One must strive to attain the perspective of the humanistic scholar and practitioner so as to evaluate the explanatory adequacy of any experimental design or finding, while maintaining the rigour that is required to control the structure and materials employed in the experiment so as to be able to make appropriate inferences on the basis of the statistical patterns observable in its results. Bruner's paradigmatic mode must be coupled to his narrative mode, Hacking's indifferent kinds must be allowed to take on the role of interactive kinds, and the logic of falsificationism must be allowed to work itself out in the process of analysing and evaluating

experimental designs and results. This is asking a lot of graduate students – yet they rise happily to the challenge as they grasp the benefits of taking a broad and integrated view of their inter-disciplinary discipline.

The value of collaboration in the work of the CMS has been highlighted and refined through frequent and heterogeneous collaborations with researchers in other disciplines, e.g., linguistics, engineering, psychoacoustics, computer science, materials science, or archaeology. Each collaborator brings different problems and solutions to the table. For example, collaborators in engineering typically bring with them an intensely numerical approach in which criteria for judging the success of research is founded in the application of quantitative methods. In our experience engineers have often been reluctant to accept that dealing adequately with music can entail adopting aspects of hermeneutic approaches, but our most fruitful collaborations – for example, a three year project exploring the perceptual correlates of violin acoustics, conducted between the CMS, the Faculty of Engineering and the Auditory Perception Group in the Department of Psychology – have quite literally been mind-changing. Our collaborators in Engineering now happily refer in their work to concepts from musicology, while CMS members now have intuitive recourse to engineering concepts. Collaboration, at least as we have experienced it in the CMS, has been a series of reciprocal learning experiences, enriching and enhancing the rigour of the work that takes place in the Centre while helping researchers in other disciplines to use and to value humanistic scholarship.

At Cambridge, we have the advantage of being able to select from large pool of applicants for graduate study. Many students apply "just because it's Cambridge", but our principal criterion for admission is academic excellence and potential for developing original research. A secondary – but highly significant – criterion for admission to graduate study is that the applicant must have a personality that we feel fits with the ethos and values of the Centre. The CMS is crewed by a fairly small group and the high frequency of everyday professional interactions, together with our stress on collaborative working, requires that CMS members get on with each other both intellectually and personally.

The work of the Centre, while largely focused around the research interests of staff members, is non-directive; we actively encourage CMS members,

particularly graduate students, to develop their own original and individual research interests. While students are obviously attracted to work in the CMS because they are interested in its existing research areas, we are happy to allow their own research paths to take shape in broad alignment with those already existing in the Centre, and lay emphasis on the need for students to develop their own intellectual commitments and research directions. This makes for a stimulating and sometimes combative research environment, but one that ensures that each CMS member feels a sense of ownership of and responsibility for CMS activities. At times, students' research interests may lead them into areas that are outside the expertise of staff members; again, we are happy to allow this to happen so long as we can be sure that expert advice can be found elsewhere – often in other departments of the University, as it contributes to the learning experience not only of our students but also to ourselves, the staff members.

We run a Music & Science strand within our Faculty's one-year Master's programme, as well as our doctoral programme. We conceive of all our teaching and training as being integrated, from advanced undergraduate to doctoral levels, with graduate students free to audit and participate not only in their own dedicated programmes but also in the advanced undergraduate classes, where these are likely to be of value to them. In addition, Cambridge University allows students to participate in any course across the University where this is consonant with course logistics (student numbers and facilities), and we encourage our graduates to take full advantage of access to specialist training. Doctoral students are also encouraged to teach undergraduates in small groups, which not only enhances their career development but also provides them with the opportunity to build confidence in their abilities to communicate effectively. Moreover, we ensure that graduates focus part of their energies on disseminating their own research findings, at conferences and in journal publications.

Finally, public outreach has come to constitute a significant strand of CMS staff and student activity. The Music Faculty has a dedicated Outreach Officer, whose remit is to broaden access to music and music study at Cambridge through educational and artistic activities, drawing on the strengths of staff and students in performance and public presentations and events. These can take many forms: devising courses on music to be taught in schools in underprivileged areas

of the UK; organising public events and concerts in "non-traditional" environments, such as public car-parks; holding open days, where the public can engage with CMS activities, can learn about scientific approaches to music, and can participate in experiments; and devising shows for young school-children to introduce them to ways of doing music and thinking about music that their schools can then build on in their own musical activities.

## **Conclusions**

The CMS exists within a particular institutional and intellectual context. We benefit from being embedded in an internationally recognised and financially stable institution that consistently attracts high levels of government funding for research; we suffer, as do all university departments that have a primary focus in the arts & humanities, from the insecurities that arise from erratic and sometimes misguided governmental attitudes and policies towards the arts & humanities. Our intellectual context sets up similar tensions, as our research and research training must maintain a balance between the richness that derives from scholarly approaches to music and the rigour and exactitude that are prerequisites of scientific method.

These tensions, and the need for arts & humanities subjects to adapt so as to accommodate to new academic landscapes are increasingly being recognised in the UK at a national level. For example, recently the Arts & Humanities Research Council, the principal funder of postgraduate and post-doctoral research in the UK, introduced a new initiative to try to enhance knowledge of the quantitative research methods typical of the sciences amongst arts & humanities graduate students, arguing that such methods are increasingly privileged in the interpretation of even scholarly data and that arts & humanities students should be encouraged to confront this change. I am not convinced that the methods that they have selected would be particularly helpful; one cannot coerce arts & humanities students to engage with quantitative methods if their relevance to the students' own research interests are not evident. However, the work of the CMS suggests an alternative strategy; one could introduce a component into doctoral training in the arts & humanities that requires research collaboration with a science researcher. This type of interdisciplinary outreach would be beneficial for both parties, and, I would suggest, essential to develop cross-disciplinary understandings. Despite all the institutional, social and intellectual pressures on the Arts and Humanities, they have as much to teach the sciences as the sciences have to offer to the Arts and Humanities.

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