Music Technology, Gender and Class: Digitization, Educational and Social Change in Britain

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Abstract

This article addresses the rise of music technology undergraduate degrees in Britain over the past fifteen years. Such degree programmes, situated at the intersection of music, digital technologies and sound art, have exploded in popularity. Yet the social and cultural ramifications of this development, and of the demographics of the young people taking these degrees, have not yet been analysed. In looking comparatively at the student populations taking both traditional music and music technology degrees, we highlight a striking demographic bifurcation, particularly with regard to gender and class. Our analysis is based on demographic statistical data as well as ethnographic research.

The article is equally concerned to analyse the demographic findings in relation to wider historical processes of the late-twentieth and twenty-first centuries. In order to explain the remarkable rise of the music technology degrees, we identify a nexus of synergistic long-term developments—musical, technological, industrial, social, educational, political and policy-related—that fuelled their growth. In the later part, we consider how the rise of music technology degrees is participating in a series of emergent effects, offering divergent interpretations of our findings in relation to a series of wider aesthetic, educational and cultural–institutional developments in the late-twentieth and twenty-first centuries. We suggest that our research partakes in a reflexive musical anthropology of the contemporary that may itself help to form the futures that it attempts to discern. The methodological message of the article is to work against the conceptual fragmentation evident particularly in previous research on music and class, which has focused predominantly on consumption, and to advocate for linking such research to analyses of broader historical trajectories of educational, musical, social and political change.

Introduction

Recent decades have seen major changes in music education in Britain; things are in flux. The clearest manifestation of these changes is the establishment of music technology programmes, which have grown dramatically in the past fifteen years in both schools and universities in Britain. At a time when new Higher Education fee structures have raised serious questions about the value of a music degree, and when many university music departments face recruitment difficulties and some are under threat of closure, the apparent vitality of music technology undergraduate degree programmes is a sign of hope. Yet the social and cultural implications of this development, and of the particular demographics of students taking music technology degrees, have not yet been subject to analysis. In looking for the first time at the character of the student populations on such programmes,[1] this article presents evidence of a possible cause for concern: the bifurcating demographics of what we will call traditional music (TM) degrees and music technology (MT) degrees in Higher Education (HE) in the UK.[2] Our research shows that the student populations entering TM and MT degrees diverge markedly in terms of both their gender and class profiles, which raises the possibility that social differences may be being reproduced, amplified or otherwise transformed through these developments in HE in music. We ask what such developments say about the present moment, how they relate to wider historical trends and existing theories of music, gender and class, and what they bode for the future of music in the UK.

The research reported in this article stems from 'Music, Digitisation, Mediation: Towards Interdisciplinary Music Studies' (MusDig), a five-year research programme funded by the European Research Council. Launched in 2010, MusDig has involved ethnographic case studies in the developing and developed worlds, as well as online ethnographic research, as the basis for analyzing the far-reaching changes to music and musical practices worldwide afforded by digitization and digital media.[3] One of the component research projects, led by Georgina Born, focuses on the present state of 'digital art musics'[4] in Britain, through ethnographic research on several leading centres in British universities as well as other key sites—festivals, conferences, gigs and art events, along with funding bodies and other intermediaries; limited comparative fieldwork was also carried out in Montreal and Europe.[5] In the face of Born's sustained impressions from ethnographic observations of students taking MT degrees, we purchased a large set of demographic data about students entering MT degrees and related TM degrees from the University College and Admissions Service (UCAS). The goal was not only to understand the demographic profile of students taking MT degrees, but also to probe the similarities and differences in this regard between related MT degrees and TM degrees. The UCAS dataset covers twelve institutions, between them hosting thirty-eight degrees, for six demographic variables over

[1] Unless otherwise noted, all figures refer to student acceptances (not applications).
[2] We recognize the risks of reifying these two metacategories of degrees, which have considerable variation within them. See also notes 4, 9 and 11 below.
[3] For more information about the MusDig research programme, see http://musdig.music.ox.ac.uk.
[4] We use the term 'digital art musics' as a problematic placeholder for a wide space of contemporary genres associated with or departing from earlier electronic, electroacoustic and computer art musics. The diversity of genres issuing from these earlier forms is what prompts us to use such an encompassing term.
[5] In Montreal, Born's research is in dialogue with Patrick Valiquet's MusDig ethnography of digital music scenes in the universities and city, in which gender is a theme: Valiquet, "'The Digital Is Everywhere": Negotiating the Aesthetic of Digital Mediation in Montreal's Electroacoustic and Sound Art Scenes' (DPhil diss., University of Oxford, 2014).

a period of five years (2007–8 to 2011–12). The methodology used in the study is therefore hybrid, combining quantitative data analysis with ethnography in the service of what might be called a musical anthropology of the contemporary.[6] A brief overview of the rationale for and limitations of the UCAS dataset introduces the analysis that follows.

Our aim in selecting the institutions involved in this study was to provide a broadly representative sample.[7] We wanted to capture a range of programme types (from traditional music to music technology degrees) at a range of universities (from relatively elite, Russell Group members to 'post-1992' universities known for their music technology programmes) in all four national regions (England, Scotland, Wales and Northern Ireland).[8] The various degrees were then grouped into three metacategories: traditional music (TM) degrees, music technology (MT) degrees with BA and BMus designations (MT: BA/BMus) and music technology degrees with BSc and BEng designations (MT: BSc/BEng).[9] While not entirely satisfactory, this grouping affords general comparison between music and music technology programmes, as well as between them both and the national averages,[10] while also allowing comparison within the music technology programmes between those oriented more to artistic and 'creative' practices and those

[6] On the idea of a musical anthropology of the contemporary, see Born, 'Lecture 5 – Ontologies and Interdisciplinarities' (Bloch Lectures, University of California at Berkeley, 3 November 2014), which is in dialogue with Paul Rabinow, *Marking Time: On the Anthropology of the Contemporary* (Princeton: Princeton University Press, 2008) and Peter Osborne, *Anywhere Or Not At All* (London: Verso, 2013).

[7] Because information about institutions and enrollments is potentially sensitive, we have generalized our findings throughout. Our selection of universities and degree programmes was checked and refined by consultation with senior figures in the field, and the resulting analysis was presented to them for feedback in May 2013. We thank the following for their advice: Michael Clarke, Simon Emmerson, Cathy Lane, Pedro Rebelo, Thomas Schmidt and Simon Waters. None of them are responsible for the results or for the analysis that we present here. We carried out supplementary interviews with representatives from the universities in our sample. The research is complemented by and has its origins in Born's fieldwork in some of the selected universities. Together, the ethnographic and interview research also give insight into the postgraduate music technology degrees (for which UCAS does not collect data).

[8] The twelve universities represented in the study are: Bangor University; University of Central Lancashire; De Montfort University; University of East London; University of Edinburgh; Goldsmiths' College, University of London; Huddersfield University; London College of Communication, University of the Arts, London; Manchester University; Queen Mary, University of London; Queen's University Belfast; and York University.

[9] Carola Boehm, writing about the 'unprecedented increase' of MT programmes in universities, notes that the very phrase 'music technology' carries multiple meanings. She consequently traces a fragmentation of the field into three main areas: sound recording and production (taught primarily in colleges and conservatories), electroacoustic composition and sonic arts (taught primarily in university music departments), and audio engineering (taught primarily in computer science and engineering university departments). She probes the institutional and pedagogical difficulties of fitting this interdisciplinary field into existing disciplinary structures (a problem when defining our datasets, discussed below). Our study extends Boehm's work by looking at demographics, by looking at wider social and historical forces, and by looking at a more recent period (she ends in 2007, where we begin). See Boehm, 'The Discipline That Never Was: Current Developments in Music Technology in Higher Education in Britain', *Journal of Music, Technology and Education* 1/1 (2007), 7.

[10] Throughout, the 'national average' figures cover all students who started university between 2007 and 2012, in all subjects.

oriented more to science and engineering.[11] Conveniently, the tripartite grouping also produced three roughly equal sized groups.

The UCAS demographic variables include gender, several indicators related to social class—all of which are discussed below—and ethnicity.[12] The UCAS data on gender and ethnicity broadly confirm what Born had observed ethnographically during fieldwork. However, the data related to social class bring out demographic dimensions of the student population for the MT degrees that were not readily perceivable ethnographically, in this way extending and enriching the MusDig research. Regarding ethnicity, our data show that the fraction of minority ethnicities on TM degrees (about 6 percent) is less than the national average (about 11 percent)—with the exception of black students, who are disproportionately even less likely to take TM degrees. MT degrees, on the other hand, in consisting of over 15 percent minority ethnicity (and 'unknown' ethnicity) students have a notably higher proportion than both the national average and, particularly, TM degrees.[13] At the same time, the vast majority of students (over 80 percent) on *all* the degrees are white. Both the MT: BA/BMus and MT: BSc/BEng degrees therefore have a considerably stronger representation of ethnic minority students than the TM degrees; and within this, the BSc/BEng degrees have the strongest representation of ethnic minorities (16 percent), particularly black students. These findings on ethnicity, striking and important as they are, are not the focus of this article. However, given the significance of music for ethnic minority youth in Britain, we want to note how they indicate that all available music degrees in our sample seem to be perceived as unattractive or antipathetic by potential ethnic minority students. This appears, then, to be a classic case in which a cultural–educational domain that is conceived as ethnically unmarked or 'non-raced'—as representing the musical-universal, the 'commonality of humanity' in music (Dyer 1997: 10)—is actually experienced as ethnically white and as linked to an invisible politics of whiteness—in the sense powerfully analysed by Richard Dyer, Vron Ware, Les Back and others.[14]

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[11] This is not an entirely satisfactory grouping, and there are certainly other possibilities (e.g. production-based, popular-music based, composition-based, sonic arts-based, etc). These are all generalizations and, despite checking with some care, we are aware that there may be as much variation within the categories as across them, just as all of the MT degrees—both BA/BMus and BSc/BEng—are interdisciplinary and combine, in some measure, both creative and scientific elements.

[12] We should note here two things about the precision of our figures. First, we only have aggregate data for the different degree types by each of these variables, which is to say that we do not have the microdata that would enable us to do close correlations between the variables. Second, for confidentiality reasons, UCAS is required to employ certain types of data suppression. This means that the information they provide is inexact when enrollment figures are particularly low, because doing otherwise might compromise student anonymity. The two problematic values for us were 'less than 3' and 'less than 5. In order to make those figures statistically meaningful, 'less than 3' was numerically translated into 1.5 and 'less than 5' became 2.5. The reasoning behind these conversions, which we verified with UCAS, is that 'less than 3' seems to mean either 1 or 2 but not 0 or 3 (neither of which appear in the data). Likewise, 'less than 5' became 2.5, because the figure seems to mean either 1, 2, 3 or 4 but not 0 or 5.

[13] Here we note obvious problems with the UCAS classification of 'ethnicity' in the data: 'Asian' and 'black' are reductive and vague categories, while 'unknown' may encompass those who feel they do not fit into any given category, as well as those who are politically aware and reject the entire exercise.

[14] See Richard Dyer, *White* (London: Routledge, 1997); Vron Ware and Les Back, *Out of Whiteness: Colour, Politics and Culture* (Chicago: University of Chicago Press, 2002); Paula Rothenberg, ed., *White Privilege: Essential Readings on the Other Side of Racism* (New York: Worth, 2011).

In the next part of the article we discuss the growth of the MT degrees and introduce a set of historical hypotheses attempting to account for such growth. We then present an analysis of gender differences between the MT and TM student populations, relating our findings to previous research with the aim of probing why this gender disparity exists. Following on, we pursue the findings primarily on class, setting out divergent interpretations of this material and what they augur in terms of wider cultural and social historical changes. As will become obvious, throughout the article there is an underlying methodological message: we aim to work against the conceptual fragmentation that is evident in many of the research areas covered in our analysis—particularly in previous studies of music and class, which have focused predominantly on consumption—and advocate for linking such research to analyses of broader historical trajectories of educational, musical, social and political change.

The rapid growth of music technology degrees: a nexus of multiple historical trajectories

The entry of electronic and digital music technologies into university and classroom music teaching has been traced back to the late 1960s and early 1970s.[15] However, the 1980s and 1990s mark a turning point. This is not only because of the proliferation from the early 1980s of affordable digital audio and consumer music technologies in the wider musical culture. It is also due to a series of less obvious developments that between 1994 and 2012 catalyzed the emergence and exponential growth of the British MT degrees. In this section, we move outwards analytically in the attempt to bring into view how the MT degrees can be seen to have arisen and expanded in response to the synergistic interrelations between a number of long-term trajectories of social, political, economic, technological and musical change.

We begin with the rise of digital audio and consumer music technologies from the 1980s into the 1990s. Intensifying uses of digital 'means of musical production', consumption and, from the mid 1990s with the growth of internet access, circulation, were matched by changes in the nature both of musical experience and of musical literacies. Paul Théberge, in a foundational study, outlined how the expansion of digital music technologies—itself significantly enhanced by the interoperability allowed from the 1980s by MIDI and the increasing affordability of digital synthesizers, samplers and recording devices—was accompanied by profound shifts in musical practice. In particular, Théberge points to the appearance of a new musical formation defined by the elision of production and consumption—what has been called 'prosumption'—as well as by related changes in fandom, aesthetic and affective sensibilities.[16]

In transposing Théberge's largely Canada- and US-based study into the British context, we suggest that, educationally, such developments were met at secondary school level in Britain by the introduction in 1998 of Music Technology AS and A2-level courses by the examinations

[15] Virginia Caputo, 'Add Technology and Stir: Music, Gender and Technology in Music Classrooms,' *Quarterly Journal of Music Teaching and Learning* 4/4 (199394), 87.

[16] Paul Théberge, *Any Sound You Can Imagine: Making Music / Consuming Technology* (Middletown: Wesleyan University Press, 1997). See also Théberge, 'Digitalization', in *The Routledge Reader on the Sociology of Music*, ed. John Shepherd and Kyle Devine (New York: Routledge, 2015), 329–38. For a more general discussion of 'prosumption', see for example George Ritzer and Nathan Jurgenson, 'Production, Consumption, Prosumption: The Nature of Capitalism in the Age of the Digital "Prosumer"', *Journal of Consumer Culture* 10/1 (2010), 13–36.

board Edexcel.[17] In marked contrast to the orthodox Music A-level curriculum, which focuses predominantly on performance and composition in the notated western art music tradition of the past 400 years (with little coverage of oral traditions, popular musics, or twentieth- and twenty-first-century art musics), the Music Technology A-level curriculum generally does not require literacy in music notation or performance training on an acoustic instrument. Instead, it is oriented to the use of computer-based sequencing and multi-track programmes which are brought to the development of a vocabulary and an ear for sonic textures and arrangements primarily in relation to popular musics since 1900. As we observed through studying the content of these exams, a Music A-level exam might ask about figured bass in a flute sonata, while a Music Technology A-level exam might ask about the timbral treatment and stereo placement of a flute track in a pop or rock song. The contrast, then, is between Johann Sebastian Bach, on the one hand, and Belle and Sebastian, on the other. There is a striking difference in both the musical literacies and the musical canons being assumed, cultivated and reproduced by the two A-levels.

The explosive growth of university degree programmes situated at the intersection of music, digital technology and sound was roughly coincident with this introduction of the Music Technology A-level.[18] While student numbers in British HE grew during this period (the House of Commons Library reports a 75 percent rise in degrees awarded between 1994 and 2011), these figures are dwarfed by the much larger increase in numbers of students taking MT degrees—which, according to data obtained from the Higher Education Statistics Agency (HESA), rose by nearly 1400 percent between 1994 and 2011.[19]

Wider educational policies also play a role in this history. When the Labour Party returned to power in 1997 with its mantra of 'education, education, education,' the expansion of British HE was already well established: participation rates had jumped from c. 4 percent in the early 1960s to c. 40 percent by the 1990s.[20] A significant factor in this apparently rapid growth from the early 1990s was the end of the Binary Divide in 1992, when vocationally-oriented polytechnics were converted into independent degree-granting universities. Continuing these trends, in 1999 the Labour Party announced a target of 50 percent participation by 2010, promising an enlarged undergraduate population, more egalitarian access to HE, as well as 'broader A-levels and upgraded vocational qualifications.'[21] The advent of the MT degrees, given

[17] Edexcel is the only exam board to offer the Music Technology A-level. The A-level, or more properly the General Certificate of Education Advanced Level, is a school-leaving, pre-university qualification offered in Britain and other countries to 16 to 18 year old school students. The qualification takes one year (AS) or two years (A2) to complete, with a set of exams at the end of the relevant year.

[18] In fact the MT degrees developed slightly earlier: our figures indicate that student numbers on MT degrees began to take off from the mid to late 1990s, while the MT A-level was introduced in 1998.

[19] On the overall picture, see Paul Bolton's Parliamentary report, 'Education: Historical Statistics' (27 November 2012), 13-14. Our own undergraduate figures were attained from the 1994/95–2011/12 HESA Student Record and are based on the 01 December population, for comparability across all years. An information Analyst at HESA ran a keyword search in the Student Record for enrollment in degrees with the following course titles: music and technology; or music and production; or music and comput; or music and sound; or music and sonic; or music and audio. As such, these figures represent an approximation of the growth of music technology and sound art degrees.

[20] Miriam David et al., *Widening Participation in Higher Education: A Commentary by the Teaching and Learning Research Programme* (TLRP and ESRC, 2008), 6.

[21] This goal was not achieved: between 1999-2000 and 2006-2007 the actual percentage rose only 0.6 percent, from 39.2 percent to 39.8 percent. See John Gill, 'Labour Concedes That It Won't Deliver Its 50% Target On Time,' *Times Higher Education* (17 April 2008), online.

their openness to students seeking a music training without classical music qualifications, and their wider range of entry qualifications than TM degrees (see below), clearly responded to this policy agenda. Although not limited to this, the MT degrees took hold rapidly in the post-1992 sector.

In parallel, the 1990s saw significant developments in economic and employment policy. While from the 1980s the UK's economy was restructured from an industrial and manufacturing based one to a post-industrial, primarily financial, service and knowledge based economy, a new era began with the implementation from the later 1990s of Labour government policies intended to stimulate what was called a 'creative economy', with notions of 'creative industries' at the core. In this paradigm, writes Justin O'Connor, 'The cultural industries, previously ignored or lumped with "the Arts," were to become central to a new contemporary image for Britain and high-profile exemplars of the creativity and innovation that were to remake Britain for the 21st century.'[22]

Around the same time, coincidentally with their reconceptualization of what had been known as the cultural industries as 'creative industries', Labour introduced legislation to realize 'the potential of new technology'.[23] Effectively, the internet and other digital media were being conceived from the mid 1990s as burgeoning infrastructures for these developing industries. Indeed, O'Connor argues that the change of terminology from 'cultural industries' to 'creative industries' was hugely consequential, allowing for 'the identification of the creative industries with a "new economy" driven by "digital" technologies and closely related to the "information" or "knowledge" economy. It was the exploitation of intellectual property (IP) rights that was seen to provide the crucial link between these agendas—supposedly positioning the creative industries at the forefront of economic competitiveness.'[24]

The result of these key political and economic developments—at once musical, educational, cultural and technological—was the 'partial transformation of British universities through rubrics of . . . creative economy, knowledge transfer, and interdisciplinarity—as these are equated with "innovation" and cultivating enterprise, with start-ups and spin-offs, partnerships with industry and government, public engagement, and student employability'.[25] MT degrees, then, instance aspects of each of these shifts: they are more open in terms of access; they operate in tandem with a broadened A-level (which tests a different skill set than the traditional Music A-level); and they have a somewhat vocational orientation, one that is distinctive from, broader and more technologically-oriented than the vocational orientation of TM degrees. Indeed, they are centrally concerned with technological education and training. And they are amenable to, or have an affinity with, creative industries initiatives, and appear oriented to cultivating creativity, innovation and enterprise. In all these ways, the 1990s and after can been seen to be an especially auspicious period for the growth of the MT degrees.

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[22] Justin O'Connor, *The Cultural and Creative Industries: A Review of the Literature* (London: Creative Partnerships, 2007), 48. For additional background, see Dave O'Brien, *Cultural Policy: Management, Value and Modernity in the Creative Industries* (London: Routledge, 2014).
[23] On 'the potential of new technology' see British Labour Party, *New Labour, New Life for Britain* (1996); British Labour Party, *Britain* Forward *Not Backward: The Labour Party Manifesto* (2005).
[24] O'Connor, *Cultural and Creative Industries*, 51.
[25] Georgina Born, 'Creative Destruction: Electronic and Digital Art Musics in the UK in the Era of Creative Industries and Creative Economy,' presented at *Music and Digitisation: Industry, Institutions and Livelihoods* (March 2013), University of Oxford.

MT degrees appear, then, to embody one prominent institutional response to these rubrics on the part of the university sector—perhaps *the* key institutional response in music in HE. This suggests a kind of inverse analysis to Boltanski and Chiapello's *New Spirit of Capitalism*.[26] In essence, Botlanski and Chiapello argue that capitalist ideology and managerial discourse have since the 1970s appropriated and deployed to their advantage the modus operandi of those cultural realms that have traditionally been seen as enemies of capitalism: artistic and social critique. It is possible that the shifts described in this section amount to an equal but opposite reaction: that the arts, and notably music, have been conceived from the late 1990s as key repositories of entrepreneurial values, allied to expectations of economic growth and of boosting employment.[27] For the confluence of reasons explored here, the MT degrees appear as one key response on the part of the university sector to such shifts.

A less obvious corollary of the synergistic developments outlined in previous paragraphs is how the shift from an industrial to a post-industrial economy fuelled a changing composition of the British labour force, threatening a large rise in youth unemployment—a threat that was met by policies pursued by governments of both right and left oriented to stimulating rapid growth in HE student numbers aimed, in part, at mitigating this threat. With the exponential rise in parallel through the 1980s and 1990s of young people's engagement with electronic and digital 'means of musical production', and thus of autodidact electronic and digital music literacies, and add to this the catalyzing effect of Labour's creative industries paradigm, based on policy ideas for which music was arguably a core model,[28] and the introduction of both the MT A-level and the MT degree programmes seems almost predictable. In this light, the accessible MT degrees appear to represent a way of combatting the threat of excessive youth unemployment by offering trainings oriented to the creative economy. Yet at the same time, and paradoxically, they portend risks identified as early as the 1980s by two major analysts of cultural industries policies, Nicholas Garnham and Bernard Miège, by fuelling the creation of what Garnham, with reference specifically to cultural labour, called a 'reserve army of the unemployed'.[29]

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[26] Luc Boltanski and Eve Chiapello, *The New Spirit of Capitalism* (London: Verso, 2005).

[27] On this phenomenon see Adam Behr "Cultural Policy and the Creative Industries," in *The Routledge Reader on the Sociology of Music*, eds. John Shepherd and Kyle Devine (New York: Routledge, 2015), 277–286; Robert Hewison, *Cultural Capital: The Rise and Fall of Creative Britain* (London: Verso, 2014).

[28] See O'Connor, 'The Cultural and Creative Industries: A Critical History', *Ekonomiaz* 78/3 (2011), 35, where Sheffield's 'Creative Industry Quarter' is cited as exemplary. According to O'Connor, 'There is little doubt that the emergence of "independent" music—that cultural, technological and economic space––in the 1970s was crucial for the experiments amongst [certain British] metropolitan authorities in culture-led urban regeneration', which influenced 1980s GLC cultural industries policies, and thence the Labour government's creative industries paradigm from the late 1990s (personal communication, Dec. 2014).

[29] See O'Connor's (2007: 26-28) discussion of Miège and Garnham. O'Connor cites this phrase from a 1983 paper written by Garnham for the GLC, a paper reprinted in his later book: Nicholas Garnham, *Capitalism and Communication* (Sage, 1990). Miège's 1987 analysis of the same issue points to the majority of cultural producers being 'almost permanently unemployed', along with a trend 'towards increased casualization': see Bernard Miège, 'The Logics at Work in the New Cultural Industries', *Media, Culture and Society* 9: 274-5. See also Nicole Cohen, "Cultural Work as a Site of Struggle: Freelancers and Exploitation," *tripleC* 10.2 (2012): 148. It is worth noting that both Garnham and Miège link their analysis to a Marxist teleology in which the reserved army of the unemployed, via the existence of a vast reservoir of surplus cultural labour, is seen as a necessity for the continuing vitality of the capitalist

A complementary feature of the rapid growth of the MT degrees revealed by our demographic data is that they may contribute to combatting one of the key problems highlighted in recent HE and social policy: that of educational underachievement among white working-class boys. It seems that since the 1990s, white working-class boys have been identified as underachievers in relation both to working-class girls and to working-class minority ethnic groups.[30] While this issue has been a concern for educationalists and policy makers for a number of years, it was recently given added urgency due to 'a massive slump in applications' from this group at university age with the sharp rise in university fees in 2012.[31] Given that, as we show below, students for MT degrees are primarily white, male and come from lower social class backgrounds, it might be argued that another reason for the expansion of these degrees is their apparent ability to attract and absorb what HE policy debate deems to be this problematic demographic better than other degree programmes. This suggests, again, that MT degree programmes appear, in part, to offer a means of mitigating excessive youth unemployment—while the risk is that they delay or convert the problem, by generating a reserve army of musical labour specifically among white working-class young men.

In parallel with the spate of historical developments outlined, the wider twentieth-century musical culture was undergoing significant change. Indeed, the rapid growth of MT degrees represents a radical departure from TM degrees in terms of both music curriculum and the emergence and espousal of new canons, echoing the divergences apparent in the two music A-levels. Their growth responds to much longer arcs of twentieth- and twenty-first-century musical and cultural history involving the expansion of sound recording, sound reproduction and electronic music technologies; the work of early and mid twentieth-century composers advocating a revolutionary expansion of musical and sonic materials—from Russolo and Varèse to Cage, Schaeffer, Stockhausen, Xenakis and beyond; the site-specific sound and sound installation works that developed from the 1960s in part under the aegis of post-conceptual art; as well as the electronic and amplified sound materials characteristic of post-war popular musics.[32] Across these multiple historical currents, music was reconceived in the terms of what Varèse called 'organised sound'. The MT degrees thus both respond to and encourage an increasing engagement among young musicians and performers with the creative possibilities offered by the enlarged palette of musical and sonic materials provided by sound recording, electronic and digital manipulation and synthesis, including 'the microphenomena of musical sound itself'. In this light, the departures represented by the MT degrees at the turn of the twenty-first century might be seen as energizing nothing less than a modernization of music in HE in Britain, catching up educationally with a vast terrain of combined technological, aesthetic and conceptual developments in the decades since the Second World War, and addressing in various ways the

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cultural industries: a teleology that current developments around digitization surely test to the limits. See also David Hesmondhalgh, *Why Music Matters* (Oxford: Blackwell, 2013), 128–129.

[30] Emma Perry and Becky Francis, *The Social Class Gap for Educational Achievement: A Review of the Literature* (Action and Research Centre, 2010).

[31] Richard Garner, 'Treat White Working-Class Boys Like Ethnic Minority,' *The Independent* (03 January 2013): online.

[32] See *inter alia* Peter Manning, *Electronic and Computer Music* (Oxford 2013), Georgina Born, *Rationalizing Culture: IRCAM, Boulez, and the Institutionalization of the Musical Avant-Garde* (Berkeley: University of California Press, 1995), Joel Chadabe, *Electric Sound* (Prentice Hall, 1997), Douglas Kahn, *Noise, Water, Meat: A History of Sound in the Arts* (MIT, 1999), Christoph Cox and Daniel Warner, *Audio Culture* (London: Continuum, 2004).

challenges of integrating areas of music and musical discourse—art and popular, electronic, digital and acoustic—that have historically been disarticulated.[33]

Finally in this section, we want to pinpoint one obvious worrying effect of these mutually modulating trajectories: the tendency towards a fetishistic technophilia in educational and policy discourses centred on technology, including those associated with creative industries, as well as in everyday technological discourses.[34] Jonathan Sterne develops this critique in relation to digitization writ large, the discourses of which, he argues, are prone to an uncritical valorisation of 'newness' itself as 'an index of sociocultural significance.'[35] Closer to our concerns, such an uncritical discourse pervades the Quality Assurance Agency for Higher Education's *Music* benchmark statement of 2008, which notes: 'Music technology is a constantly developing area requiring up-to-date equipment for creative work and recording.'[36] This directs us to the educational reverberations of the growth of the digital consumer music technology industry—an industry in which 'the incursion of capitalist [and consumerist] relations' into musical practice has long been wedded to sunny discourses of opportunity and promise. In this light, the expansion of the digital music technology industry, rather than being led by prior musical needs, was premised on the intensifying role of consumer music technologies as commercial intermediaries, or obligatory passage points,[37] in musical practices worldwide, including music education practices. Indeed, in Born's ethnography, a senior academic figure in the field took the view that the very creation of 'music technology' as an educational category was partly 'perpetrated by manufacturers like Yamaha'.[38] Our contention, then, is that the conjunction of technophilia and dependence on the digital music technology industry has been synergistic both

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[33] In this way both the MT degrees, and the analysis of them presented in this paper and the MusDig research programme as a whole, exemplify a 'relational musicology': see Born,

[34] For examples of such discourses in policy and educational discourses, see British Labour Party, *New Labour, New Life for Britain*; Department for Education, *The Importance of Music: A National Plan for Music Education* (2011), 32, 36.

[35] Sterne, '368. Of course, the tropes of the 'newness' and 'innovation' are pervasive in modernist discourses and are not limited to this period or this sector.

[36] Indeed, the statement goes on to accept as a matter of course that providing 'an adequate environment for the teaching and learning of music' places 'substantial demands' on resources. See Quality Assurance Agency for Higher Education, *Music* (QAA: Mansfield, 2008), 22. Subject benchmark statements are issued by the Quality Assurance Agency (QAA) for Higher Education, an independent organisation that oversees and councils various aspects of British HE. Benchmark statements are understood to 'set out expectations about standards of degrees in a range of subject areas. They describe what gives a discipline its coherence and identity, and define what can be expected of a graduate in terms of the abilities and skills needed to develop understanding or competence in the subject' (http://www.qaa.ac.uk/assuring-standards-and-quality/the-quality-code/subject-benchmark-statements).

[37] Latour, .

[38] Similarly, for the USA, Ryan Diduck in his historical work on MIDI argues that organizations like the National Association of Music Merchants (NAMM) promoted the view that digital instruments 'would revolutionize music education.' Computers and electronic instruments were 'sold to educational institutions en masse as part of music programmes aimed at simplifying and speeding up the practice of making music. [They] were seen as enabling devices that could be had at a nice price, … allowing one child to create entire symphonies, and eliminating the repetitive necessity of mastering multiple instruments'; see Diduck, 'The 30th Anniversary of MIDI: A Protocol Three Decades On,' *Quietus* (22 January 2013), http://thequietus.com/articles/11189-midi-30th-anniversary. Théberge shows how connections between the instrument manufacturing industry and private and public educational curricula were established much earlier, in relation to pianos, organs and band instruments: *Any Sound*, 30, 32, 104.

with the rise of the creative industries paradigm and with neoliberal transformations in British universities; indeed, in some ways the MT degrees might be seen as the face of such neoliberalisation in music in HE.[39] It is worth considering, then, the economic, musical and other costs of the fetishism of the new as it links to a now-entrenched institutionalized dependence on music technology corporations.[40]

In accounting for the 1400 percent rise in the student numbers taking MT degrees between the mid 1990s and 2012, we have pointed to the confluence of an array of historical trajectories: technological, industrial, social, educational, political and policy-related, along with long-term musical changes. This nexus of synergistic historical forces fuelling the growth of the MT degrees in turn has a series of major emergent effects, which we now turn to consider. We do this initially through analysis of the demographic qualities of their student bodies with reference to gender and class, in each case bringing our findings into dialogue with existing research.

Gender and music technology degrees: Musical toys for boys?

Of all the demographic variables in our data, gender is the most alarmingly imbalanced: for the student population of music technology programmes across the MT: BA/BMus and MT: BSc/BEng designations is nearly 90 percent male. Traditional music degrees, by contrast, show a more balanced gender profile, on a par with national averages: 55 percent female to 45 percent male. Although MT programmes accept more males in absolute terms, there is a slightly higher acceptance rate for women, which could indicate an awareness of—and even an attempt to redress—the gender imbalance. However, the significant bulk of male applicants,[41] combined with the large number of places that have to be filled in each MT degree programme, suggests that there are not enough women applicants to reach parity between men and women at the level of absolute acceptances. A key problem, then, is the sheer lack of women applying. As such, it is the explosive growth of the MT degree programmes combined with women's relative lack of application to them that opens up the huge gender gap we have described.[42]

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[39] For a broader discussion of the conjunction of music, technology and neoliberalism in academia, see Timothy Taylor, 'The Seductions of Technology,' *Journal of Music, Technology and Education* 42–3 (2011), 227232.

[40] Compare, for example, the Music benchmark statement with the more measured thoughts of Philip Tagg, 'The Göteborg Connection: Lessons in the History and Politics of Popular Music Education and Research,' *Popular Music* 17/2 (1998), 231: 'It is impossible, musically and intellectually as well as economically, for any institution with any limits on its funding to keep abreast of the stylistic and technological developments of the commercial music industry. For this reason, institutional acquisition of "state-of-the-art" equipment leads to either (a) funds that might otherwise have been better spent on human resources being swallowed up by the ongoing purchase of updates and replacements, or (b) "state-of-the-art" rapidly becoming out-of-date'. See also Born, *Rationalizing Culture*, 2528 for an analysis of the problems caused by 'enforced' obsolescence and the resultant dependency on corporate technologies in a world-renowned public computer research institute.

[41] Our gross figures show over 11,000 men as opposed to under 1,400 women applicants to all the degrees over our five year period.

[42] In a summarising study of the classical music professions and trainings that resonates with our own, Christina Scharff notes that gender inequality is not limited to digital music formations: 'women are [also] under-represented in positions of authority and prestige' in the classical music profession. See Scharff, *Equality and Diversity in the Classical Music Profession* (ESRC, 2015), 5.

It is striking that at the border of secondary and tertiary education, a greater proportion of young women take MT A-levels (17.5 percent) than enroll in MT degrees (12 percent). While our figures cannot explain why fewer women go on from MT A-levels to MT degrees at university (although the higher acceptance rate suggests it is not necessarily because women are being disproportionately turned away by admissions processes), these figures invite comparison with a paradigm commonly used to describe the relatively weak representation of women in HE in science, technology, engineering and mathematics (STEM) more generally: the leaky pipeline.

This paradigm probes the successively smaller participation of women in STEM from school age to university to postgraduate to professional career trajectory. If we start with the observation that the percentage of women taking MT A-levels is very low to begin with, recent research by Hallam et al. suggest that the gender dynamics of music and technology are established well before the sixth form. Using data from the UK's Music Services, they show that the proportion of students aged 5 to 16 choosing 'music technology' as their instrument is about 40 percent female (sometimes more). After age 16 this figure drops to 25 percent, while among MT A-level entries the fraction of young women is 18 percent. And, finally, at university enrollment on MT degrees they represent approximately 10 percent. A leaky pipeline indeed.[43] How can we make sense of these pronounced and cumulative gender disparities? In what follows we present three sets of arguments.

The first, as our reference to the leaky pipeline paradigm suggests, rests on the supposition that music technology is a microcosm of broader processes relating to women and technology. This is a common argument from different disciplines addressing gender and IT. Social psychologist Joel Cooper, for example, reviewing two decades of research on gender and IT, argues that 'women are not reaping the benefits of the technological revolution on a par with men',although slowly the 'digital divide' is becoming less pronouncedand the pipeline less leaky. Overall, however, 'existing efforts to attract women to science have not worked' and women still display 'lowered interest, negative attitudes, lowered performance, and . . . anxiety' when it comes to computers and digital technologyJudy Wajcman, a leading feminist science and technology studies scholar, summarizes current thinking:

> In contemporary Western society, the hegemonic form of masculinity is still strongly associated with technical prowess and power (Wajcman, 1991). Different childhood exposure to technology, the prevalence of different role models, different forms of schooling, and the extreme gender segregation of the job market all lead to [what Cockburn (1983, p. 203) describes as] 'the construction of men as strong, manually able and technologically endowed, and women as physically and technically incompetent.' Entering technical domains therefore requires women to sacrifice major aspects of their feminine identity. Notwithstanding the recurring rhetoric about women's opportunities in the new knowledge economy, men continue to dominate technical work. . . . These sexual divisions in the labour market are proving intransigent and mean that women are largely excluded from the processes of technical design that shape the world we live in.[44]

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[43] The figures for music qualifications, while not disaggregated for different music or music technology courses, also conform to the leaky pipeline model, with students being predominantly male: thus, total entrance to all music in 2012 were 25,000, of which 30 percent were women. See http://www.edexcel.com/btec/news-and-policy/Pages/BTECResultsDay.aspx (accessed May 2013).

[44] See also Born and Devineed, Gender, Education and Creativity in Digital Music and Sound Art,) Nelly Oudshoorn, Els Rommes and Marcelle Stienstra, "Configuring the User as Everybody: Gender and Design

We are persuaded by these arguments. But the question remains: why are these gender processes so subject to reproduction and resistant to change, when certain STEM domains—for example medicine and the biosciences—have seen marked improvements in the professional representation of women?[45] For our purposes, the leaky pipeline and similar research seem to describe more than they explain the continuation of gender disparities in STEM.

A second set of relevant arguments concerning gender comes from the sociology of music education, a rich literature with a number of productive analyses. One is the theory of 'indirect discrimination' whereby, through classroom observations and other methods, it has been possible to identify how gendered preconceptions enter into teachers' interaction with and assessment of school children in the music classroom.[46] For example, boys' compositions and uses of technology tend to be lauded as testifying to natural ability, confidence and creativity, whereas girls' are seen as conservative and traditional, and girls themselves as lacking in 'natural' ability. Such ideas also manifest more directly in discourse surrounding music, sometimes in the use of 'discrete critical vocabulary[ies]' for men's compositions (described using signifiers like 'virile' and 'powerful') and women's compositions ('delicate' and 'sensitive').[47] Indeed, Lucy Green, in her classic book on *Music, Gender, Education*, traces similar discriminatory discourses through 19th- and 20th-century criticism—discourses that link to the exclusion of women composers from the music-historiographic canon more generally.[48]

In her study, Green also describes a long history in which women have been marginalized in compositional practice as such. Part of this marginalization has to do with the construction of composition as a rational, cerebral and therefore 'masculine' pursuit, as opposed to the apparently emotional and 'feminine' character of musical performance. Green identifies technology as a pivot-point of these exclusionary processes:

> Women's access to the kind of music education required for contemporary compositional developments originally became restricted at a time when the first major technical developments in music for centuries were rearing their heads in the shape of polyphony. Compositional activity after polyphony becomes increasingly separate from that of performance, requiring more control over instrumental technology and musical technique.[49]

Another theme in this literature is the gendered character of instrument choice. Scholarship on the topic tends to begin from the hypothesis that the general increase in women's social equality through the twentieth century should lead to a decreased gendering of musical instrument choice.[50] Although there is evidence that the differences between stereotypically male and female instruments are becoming less pronounced,[51] certain musical instruments and

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Cultures in Information and Communication Technologies," *Science, Technology and Human Values* 29/1 (2004), 30–64.

[45] For one analysis of this widely observed phenomenon, see Elianne Riska, *Medical Careers and Feminist Agendas* (New York: Walter de Gruyter, 2001).

[46]

[47] 142

[48] Green, *Music, Gender, Education*, 96*ff*. On gender and the wider musical canon, see Citron

[49] Green 113.

[50] See for example Hallam et al.

[51] Abeles

technologies are still predominantly associated with men, prominent examples being the electric guitar and the turntable. Explanations given for the continued male coding of certain instruments include design issues, role models, and received notions about acceptable public presentations of self.[52] In particular, as Green notes, there are discursively constructed expectations that girls will 'avoid performance on electric or very loud instruments, especially those associated with popular music' while 'boys are depicted as flocking to these instruments'.[53] Instruments can thus serve as key avenues through which larger musical formations such as genres are constructed as gendered communities of practice. In this sense, digitization in music education extends a tradition in which men have dominated electronic and electroacoustic composition and instrumental performance both in the classical avant-gardeand in technologically-oriented popular genres such as rock, hip hop and various dance musics. None of this is immanent in the materialities of sound or technology: characteristics like electricity and loudness, which Green singles out as especially problematic or repellent for young women, are functions of history and culture; they are not inherently gendered.

A further theme of the sociology of music education concerns the gendering of music classrooms as technological spaces. 'Often the spaces in which women are expected to compose', notes Victoria Armstrong, 'can seem alien'. She observes that classroom music technology suites 'were consistently occupied by male pupils', while 'girls were more likely to be found in practice rooms, trying out ideas on the piano, and notating them down on manuscript paper' (ibid.). The reason was not that the girls intended to compose only using pen and paper; indeed, they would often plan later to digitize their work. But the male-dominated atmosphere of the technology suite made the space feel 'off-limits' to Armstrong's young female interlocutors. Such practices extend beyond the classroom, for the gendered discursive and spatial segregation and discrimination noted by Armstrong in the school technology suite has parallels in professional recording studios, in music retail, and even in the use of consumer audio in the domestic sphere (Keightley 1996, Cohen 1997, Théberge 1997, Leonard 2007, Sargent 2009). In sum, the cumulative insights from feminist STS and the sociology of music education suggest that while girls and women are no longer formally excluded from scientific and technological pursuits, they are subject to observable processes of gendered exclusion—occupationally, discursively and practically. Such an analysis is consonant with Born's observations in her fieldwork on MT degrees in HE.

A third set of arguments turn on the idea of a gendered historiography of sound, highlighting the materiality of music, sound and technologies. Tara Rodgers, most prominently, has furnished a historical critique that portrays digital music technologies as extensions of what she calls a 'logic of controlling sound waves' that was established as a material–semiotic assemblage by the acoustic sciences. Rodgers outlines a '"network of analogies" that converged in epistemologies of electronic sound at the turn of the 20th century':

> Acoustics experimenters and authors aligned the physical properties of sound waves with connotations of fluidity and excess that have been associated with female bodies throughout Western history and philosophy. To analyze and control sound meant to experience the pleasure and danger of unruly waves, and to seek their control from a

[52] Green Hallam et al. Bourdage

[53] Green 176. Gender bias is also evident in acoustic instrument choice. Regarding conservatoire teachers, for example, : Women are particularly over-represented amongst staff who teach flute and harp, and significantly under-represented in conducting, percussion and brass.

> distanced perspective; both the objectified material of sound, and the subject position of acoustics researcher, were gendered in audio-technical discourse.

In this light, it could be argued, the very epistemology of 'sound' that underpins the cultural origins of sound reproduction and manipulation—including today's digital music technologies—emerged from a historical conjuncture governed by a hegemonic rationalist masculinity locked in dualistic relation with its subordinate feminine Other. In a kind of strategic essentialism of sound and gender, then, studies by Rodgers, Holly Ingleton, Marie Thompson and others are excavating the long-standing historical associations between sounds and gendered cultural formations.[54]

Together, the three sets of arguments above suggest that the gendering of MT degrees can only be explained in terms of overlapping and synergistic historical processes: not just to do with gender and technology, but how these continuously refract music-specific historical processes of gender discrimination. Indeed, in view of these several strands of argumentation, we find it persuasive that the gendering evident in our study might be understood as the evolving product of a double mediation in which the gendered character of compositional practice is compounded by the gendered practices associated with digital music technologies. Of course, seen in the historical context of a leveling off in the gender balance of TM degrees, after a period in which such degrees were predominantly 'feminine' pursuits,[55] it may be that the underrepresentation of women in MT degrees represents simply a spike on the route to eventual parity. On the other hand, the MT degrees might also be exacerbating or entrenching a musicalized male hegemony, institutionalizing a future gendered division of labour in the music professions and in musical cultures more broadly.

Social class: Music degrees, class, and educational differentiation

In addition to gender, our data register divergences in terms of the social class profiles of the student populations on TM and MT degrees. Before outlining these findings, it is necessary to note that social class, sometimes equated with socio-economic status (SES), is a difficult demographic variable to pin down. It has a number of competing definitions associated with distinctive sociological traditions. For this study, moreover, further challenges stem from UCAS's refusal to release certain of their data on class.[56] When we asked UCAS which of the demographic variables regarding university entrance that they were willing to release related to social class, they directed us towards a five-tiered, postcode-based classification system called Participation of Local Areas (POLAR). POLAR indicates the likelihood that students from a particular postcode or region—allocated a 'quintile' score—will attend university.[57] The higher

[54] See the articles by Ingleton and Thompson in Born and Devine ed, Gender, Education and .
[55] See Green .
[56] UCAS collects information on university applicants such as parental education and occupational background. However, as this information is self-reported and entered in a free text field (which is then matched to a standardized list of SES indicators), the data are unverified and unavailable for analysis.
[57] The adoption of the POLAR system as an indicator of relatively advantaged and disadvantaged sectors of the population (in terms of neighbourhood) is justified by HEFCE as follows: 'Where you live is important. This is reflected in academic research on the effect of location on life chances, the use of area statistics in targeting poverty, and in the everyday experience of the differences between neighbourhoods. Where you live determines the environment you experience and the people you are in daily contact with, and can determine your access to a range of resources, including schools. Small areas in the UK are strongly differentiated by housing type, tenure and, for private housing, house price; they show marked

the quintile (5 being highest), the more likely school students from that region are to attend some form of tertiary education. POLAR is not, then, a direct indicator of either social class or SES; moreover, it seems somewhat tautological as an indicator of social class amongst university applicants. So in an effort to provide a more robust picture of the class profile of students entering MT and TM degrees, we analysed POLAR in conjunction with three other variables: school type of students admitted, overall A-level score of students admitted, and the nature of the music A-level taken (Music or Music Technology). Our 'social class' indicator is thus an alloy of several variables,[58] and although we were not able to analyse strict correlations between them, by reading across them it is possible to approximate the social class profile of students entering the various music degrees.[59]

POLAR attempts to capture relative degrees of advantage or disadvantage that result in variable rates of university attendance by region or postcode. Our findings are that TM degrees, although close to the national average, admit a greater proportion of students from POLAR quintiles 4 and 5, i.e. those regions most likely to participate in HE and showing greatest relative advantage. The opposite is true for MT programmes, and particularly the BA/BMus degrees, which admit more students from lower POLAR quintiles.[60] Interestingly, while UCAS reports that the last ten years have seen HE participation increase across all quintiles, the greatest increase is found in the lower quintiles.[61] While MT degrees resonate strongly with this trend,[62] TM degrees do not.[63]

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differences across a range of social, economic and educational statistics. It is reasonable to suppose that the young HE participation rate will differ between areas in a significant way, and that these differences will reflect the combination of different kinds of advantage and disadvantage experienced by children growing up in these areas' (HEFCE 2005: 16-17). See http://www.hefce.ac.uk/whatwedo/wp/ourresearch/polar/.

[58] We prefer the analytical term 'social class' to SES, since class is widely understood in sociological theory today to include dimensions—notably the variable accumulation of cultural and educational capital—that may be occluded by a focus primarily on social and economic aspects of disadvantage and inequality, and that are particularly pertinent for assessing class position in relation to applicants for the two kinds of music degrees.

[59] As noted above in footnote 3 with regard to our overall variables, because we only have aggregate data, and not microdata, we are not able to do close correlations across these social class indicators. We should also note that A-level scores have been included in our social class profile because higher educational achievement in the UK often correlates to a significant degree with school type and socioeconomic background.

[60] Over 60 percent of students on TM degrees arrive from the highest two quintiles (4 and 5), while the opposite is true of students on MT degrees: about 50 percent come from the *lowest* three quintiles (1, 2 and 3), and of these, the MT: BA/BMus contingent is about 55 percent, while the MT: BSc/BEng contingent is about 45 percent.

[61] UCAS, *How Have Applications for Full-Time Undergraduate Higher Education in the UK Changed in 2012* (UCAS Analysis and Research, 2012), p.2.

[62] In terms of growth in student numbers, whereas the MT: BA/BMus degrees increase over 50 percent across all 5 quintiles (with anomalies of less growth in quintile 4 and negative growth in quintile 1 likely attributable to a smaller size), the most remarkable growth happens in the MT: BSc/BEng degrees. Here the number of students from lower quintiles taking MT: BSc/BEng degrees stays about the same while the number of students from higher quintiles almost doubles. This could speak to a process of 'crowding out' among higher social class groups taking MT degrees, despite the broader remit to equalize access to HE. Additionally, the greater proclivity of students from higher quintiles for taking the MT: BSc/BEng degrees could be explained by the widespread perception that the natural sciences are more 'legitimate' and

In terms of school type, the data show that the representation of selective schools (i.e. grammar and independent schools) is much higher in TM degrees than in both MT programmes and the national average. Indeed, the MT: BA/BMus courses have a particularly low proportion of students from grammar and independent schools.[64] The A-level exam results at admissions in terms of tariff (or point scores) are similarly differentiated between the TM and MT degrees. The TM degrees take a much lower proportion of students (under 10 percent) than the national average (approximately 25 percent) with 240 points or less, and a considerably higher proportion (about 60 percent) with 420 points or more (compared to the national average of 40 percent).[65] Almost opposite to this, the MT: BA/BMus degrees take a much higher proportion of students with 240 points or less (approaching 50 percent—almost double the national average); and they accept a much lower proportion with 420 points or more (less than 25 percent, around half the national average). Occupying a middle ground, the MT: BSc/BEng degrees take an above-average proportion of students with 240 points or less (about 30 percent), and a lower than average proportion of students with 420 points or more (about 30 percent). This is a strikingly polarized picture, which resonates strongly with the analysis of the differentiation of school type.

There are several key findings regarding Music and Music Technology A-level performance.[66] The TM degrees have a strong requirement for Music A-level (c. 80 percent of students admitted have this), and a small proportion of students admitted to them also have MT A-level (less than 10 percent). In marked contrast, only a low proportion of students admitted to the MT degrees come with either Music or MT A-levels (approximately 15 and 20 percent, respectively). Almost 80 percent of students on MT courses therefore appear not to have taken the MT A-level, and even fewer have taken Music A-level. This takes us to the limits of our data by raising the question of what qualifications and experience the students admitted to the MT degrees actually have.

In sum, compared to national averages, the students admitted to TM degrees tend largely to come from higher POLAR quintiles, attend selective schools at twice the rate of the national

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'serious' subjects than the arts, and perhaps also the perception that as well as more prestige and cultural capital such degrees confer greater labour market advantages.

[63] The exception here is a 64 percent increase in quintile 1, the lowest, which is likely to be an overstated effect due to small sample size.

[64] TM degrees take over 30 percent of their students from grammar and independent schools, compared to approximately 5 percent on the MT: BA/BMus designation. MT: BSc/BEng takes approximately 15 percent of students from such schools, which is on a par with the national average.

[65] The UCAS tariff point system assigns numerical values to A-level exam scores, so that A* is 140 points, A is 120, and so on down to E, which is 40 points. To score 420 points or above, then, requires at least A*A*A* at A-level. To further understand the overall exam tariffs (from 240- to 540+ points), it is necessary to bear in mind that these totals include both AS and A2 level exam scores, and that AS scores are given a tariff equal to half the A2 scores. Moreover, many schools encourage pupils to take additional qualifications such as AS or A2 courses in General Studies or Critical Thinking, which add further points. For these reasons it is unusual for a pupil with three As at A2 level to have as few as 360 UCAS points.

[66] Explanation: 1) the data aggregates those students who took the 2-year A2 course and those who took the 1-year AS course for both Music and Music Technology. 2) The data also offers no way of discerning whether the figures represent the same or different students taking A-levels: i.e. the same individual may have taken both Music and MT A-levels, or the figures may represent separate individuals.

average, take Music A-level, and score considerably higher on their A-levels.[67] In contrast, MT degrees have less competitive A-level entry requirements, draw a greater proportion of students from non-selective schools and lower POLAR quintiles, and few students have taken either of the music A-levels. The TM degrees can thus be understood as comprised of students with a higher social class profile than the national average, while MT degrees draw those with a relatively lower social class profile; although within the latter degree category students taking the MT: BA/BMus have a particularly pronounced lower social class profile, while students on the MT: BSc/BEng programmes appear to occupy an intermediate position. In both TM and MT degrees we therefore witness a kind of cluster effect associated with mutually reinforcing conditions that accrue to different positions in the social class spectrum. Our findings point clearly to a bifurcation in the social class profile of the students entering the two kinds of music degrees, as well as highlighting the role of music education today in mediating differences of social class.

In the last third of the article, we develop divergent interpretations of these stark findings. The discussion is necessarily speculative: in addressing the implications of the material we have presented, we cannot resolve these contradictory interpretations. This is because at stake, just as in the earlier analysis of synergistic trajectories of historical change, are multiple dynamics for social and cultural change within which the development of the MT degrees are entangled, but to which they also contribute—dynamics that have the potential to catalyze alternative emergent directions. We therefore offer these interpretations in the spirit of an enquiry—a musical anthropology of the contemporary—that itself has the potential to feed back into the very processes it describes. In this sense we adopt a reflexive stance on this research and its possible impacts: the production of this analysis will, we hope and intend, feed into the ongoing fields that it addresses and may be formative of the futures that it attempts to discern. One of our purposes, then, is to offer the academic and educational MT and TM communities an analysis that includes future scenarios that may affect their futures.

Music-educational futures: The entrenchment or transformation of social class through music?

In analyzing our material on social class, we face a sociological literature that has researched and conceptualized the relation between music and class mainly through patterns of consumption and taste formation among populations in countries of the global North. Although a recognizably sociological interest in such issues can be found in the early twentieth century,[68] the touchstone for contemporary research is Pierre Bourdieu's study of French culture and class, *Distinction: A Social Critique of the Judgement of Taste*, first published in 1979.[69] Bourdieu argues for a correlation between the structure of social class and the differentiation of cultural tastes and practices, including tastes in music. In numerous cultural realms, and especially in music, he found strong associations between those of higher social class backgrounds and tastes for

[67] It is worth noting here that Scharff's (7–8) analysis supports our findings here, demonstrating the similarly higher social-class profile in conservatoires and classical music training (realms which are strongly related to the TM degrees).

[68] See for example John Mueller's 1935 paper, "Musical Taste and How It Is Formed," in *The Routledge Reader on the Sociology of Music*, eds. John Shepherd and Kyle Devine (New York: Routledge, 2015), 49–55. See also Karl Schuessler, "Social Background and Musical Taste," *American Sociological Review* 13.3 (1948): 330–335.

[69] The first nglish edition was published in 1984.

"highbrow" cultural forms, while those of lower social class backgrounds gravitated toward "lowbrow" cultural forms. Moreover, Bourdieu found that lower class fractions are at a disadvantage because those of higher social classes (who have greater amounts of cultural capital) are more able to set the criteria for what counts as good taste. Bourdieu's analysis thus highlighted the role of differential access to and acquisition of cultural capital—in part through differences in forms and levels of education, as well as family socialization—in creating and reproducing wider class differences.

Distinction has been both hugely influential and controversial. An especially significant set of challenges has centred on whether Bourdieu's analysis is generalizable beyond its immediate setting: France in the mid-late 1960s. In a series of publications from the early 1990s, for example, Richard Peterson conducted broadly similar analyses using US survey data. In essence, Peterson corroborated the basic thesis of Bourdieu's study: social class distinctions based on differential access to cultural capital are at work in the musical field. Yet Peterson's interpretation contained a subtle but critical difference: he argued that the musical tastes of more privileged social classes, in contrast to the exclusive and 'univorous' proclivity for art music identified by Bourdieu in 1960s France, were marked by openness, diversity, eclecticism and cosmopolitanism.[70] Such eclectic tastes, Peterson observed, were more constitutive of high cultural capital in music in the US context in the 1990s. This interpretation has become known as the 'omnivore thesis'.[71]

The omnivore thesis is by no means universally accepted; indeed, it has generated substantial debate. A number of theoretical and methodological queries have been voiced, ranging from conceptually confused homological relations between status and class,[72] to an over-reliance on the quantitative aspects of existing preferences and participation patterns at the expense of understanding the qualitative and generative dimensions of such experiences,[73] to the problem of over-simplified genre categories and the idea that omnivorous taste patterns are an effect of method more than an observable phenomenon of musical culture.[74] Particularly important among efforts to test and expand upon both Bourdieu's analysis and the omnivore thesis was the Cultural Capital and Social Exclusion Project, one goal of which was to update the method used in *Distinction* for twenty-first-century Britain. In looking at British culture during

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[70] See for example Richard Peterson, "Understanding Audience Segmentation: From Elite and Mass to Omnivore and Univore," *Poetics* 21.4 (1992): 243–258.

[71] Certain scholars even suggest that the omnivore thesis is an increasingly viable interpretation of the French context. To cite only one among many examples, Phillipe Coulangeon and Yannick Lemel use French data to suggest that wider shifts in social mobility in France have been paralleled by educational massification and a greater mixing of classes at secondary-school level—which, in turn, 'may confront young people with a growing diversity in musical influences, in addition to the diversity of social origins of their school peers.' Indeed, Coulangeon and Lemel argue overall for a positive correlation between education and omnivorousness in musical tastes. Philippe Coulangeon and Yannick Lemel, 'Is "Distinction" Really Outdated? Question the Meaning of the Omnivorization of Musical Taste in Contemporary France' *Poetics* 35 (2007), 107.

[72] Tak Wing Chan and John Goldthorpe, 'Social Stratification and Cultural Consumption: Music in England,' *European Sociological Review* 231 (2007), 1–19.

[73] Will Atkinson, 'The Context and Genesis of Musical Tastes: Omnivorousness Debunked, Bourdieu Buttressed,' *Poetics* 39 (2011), 169–186; Mark Rimmer, 'Beyond Omnivores and Univores: The Promise of a Concept of Musical Habitus' *Cultural Sociology* 63 (2012), 299–318. See also Antoine Hennion, 'Those Things That Hold Us Together: Taste and Sociology' *Cultural Sociology* 1/1 (2007), 97–114.

[74] Atkinson, 'Musical Tastes.

the mid 2000s, Tony Bennett, Mike Savage, Elizabeth Silva and their colleagues produced a landmark book—*Culture, Class, Distinction*—in which they found it necessary to nuance Bourdieu's study. Like Bourdieu, the recent British study found music to be an especially intense field of taste differentiation; indeed music was 'the most divided, contested' set of cultural practices encountered in their study.[75] However, unlike the primarily class-based analyses that defined Bourdieu's work and the omnivore debate, the British researchers additionally highlight the roles of age, ethnicity and gender in the differentiation of cultural practices. In terms of the character of those differentiations, Bennett et al. found a strong clustering in the appreciation for western art musics, and another cluster for popular musics. Although this division was articulated along lines of class and education, they found that *age* was the strongest indicator.[76]

Mike Savage and Modesto Gayo, in a recent paper extending *Culture, Class, Distinction*, emphatically refute the omnivore thesis by insisting that 'In contemporary Britain, at least, the debate on the omnivore has distracted us from examining the profoundly divided nature of musical taste'.[77] Extending their analysis of consumption, they go on to suggest a major conceptual reorientation that resonates with our own work: 'Rather than people changing their musical taste and ranging across more musical genres, we are seeing the reworking of the boundaries of musical genres themselves. What we are seeing today could be a fundamental remaking of the musical canon, in which the historic investment in classical music as the dominant position in the musical field is being reworked'.[78] While Savage and Gayo suggest that the 'field analytical perspective' developed in their article makes it possible to 'recognize the wider historical patterns of musical production, institutionalization and mediation' at the basis of such shifts, in this paper their argument is not yet fully worked through. In what follows, then, we pursue and deepen their opening move by etching the contours of an analysis of wider institutional and aesthetic changes in relation to our earlier findings on music in as it mediates social class.

Despite the evident importance of discussions of the shifting articulation between 'highbrow' and 'lowbrow' in music consumption, the post-Bourdieu and omnivore debates have paid scant conceptual or empirical attention to how such shifts are being affected by the changing tenor of the institutionalized valorisation of the distinction between 'high' and 'low' in music. Thirty-five years ago, this distinction and its presumption of a fundamental difference in the value and legitimacy of art musics and popular musics was being resiliently reproduced by the major British cultural institutions for music: educational institutions (schools, conservatories, universities), media institutions (the BBC), and performance institutions (concert halls, music festivals, opera houses). But today, due no doubt to long-term cultural processes (including expanding media coverage of popular musics, the BBC's search for popularity in its music coverage, and the growth of new forms of popular and critical discourse, knowledge and competence about popular musics fuelled by their increasing ubiquity) that have engendered widespread identification with and valorization of a vast and diverse range of popular musics, there has been both a flattening of the difference, in that certain popular musics are now routinely subject to public valorization and critical appreciation, and yet a continuation of the

[75] Bennett et al. 75.
[76] Bennett et al.chapter 5 Savage Savage and Gayo 342, 345
[77] Savage and Gayo 353
[78] Savage and Gayo (2011: 353). On the necessarily relative and mutable character of the cultural field and cultural capital, see Annick Prieur and Savage, 'Updating Cultural Capital Theory: A Discussion based on Studies in Denmark and in Britain,' *Poetics* 39 (2011), 566–580.

institutionalized distinction between 'high' and 'low' music repertoires, not least in music in Higher Education. It is this evolving situation that Born encountered in her fieldwork on music in HE, along with clear signs that the historical settlement is in process of change. The puzzle thrown up by this reality, then, which the focus solely on consumption in earlier research evades, is that of the relationship between shifting patterns of taste, on the one hand, and the changing institutionalization of differences in the valorization of art and popular musics, on the other—particularly as they surface in music education, since along with popular media and the internet it is music education that is arguably most influential in forming musical tastes and competencies among large sections of the population. In this last section we aim to stimulate the beginnings of a discussion on this crucial and neglected issue.

While the post-Bourdieu and omnivore debates covered important ground, then, from the perspective of this study they have been constrained by insufficient attention to wider social and historical developments, including aesthetic, educational and cultural-institutional changes, that must bear some relation to the trends uncovered by studies of music consumption. We turn now to two divergent and speculative interpretations of the potential emergent effects of the dynamics evident in our research as a contribution to opening out the debate on music and class formation to encompass such aesthetic, educational and cultural-institutional changes.

Negative interpretations

We offer, first, a set of negative interpretations based on the possibility that the two kinds of music degrees, MT and TM, participate in the reproduction or intensification of class differences through music. Thus, while we have clear evidence of the differentiation by class of those entering the two degrees, the educational experiences offered by the two degrees, and their cultivation of particular and divergent musical literacies and competencies, subjectivities and tastes, might well be understood as further augmenting or entrenching the relative class trajectories and future life chances of their different student populations. The point is that our research on higher education shows the mediation of class formation by music in process: on the one hand, at degree entry, how individuals' earlier class formation and educational provision influence the kind of music degree that is taken; on the other hand, over the course of the degree experience and its influence on musical literacies and subjectivities, how music education is likely to mediate individuals' post-degree class trajectory.

What we see, then, is the dynamic production of class position in childhood and young adulthood through music: for children from advantaged social backgrounds, a) the existence of high cultural capital (in musical and other spheres) through family socialization and upbringing is compounded by b) privileged schooling and a western art music curriculum, including access to traditional musical literacy, instrumental music training, choir, orchestra and so on, and then further by c) A-level choice, including the ability to take Music A-level; and this can lead to d) success at entry into the elite universities and their TM degrees. The system amounts to a self-reinforcing dynamic of the reproduction (or attainment for students from families buying their way into educational advantage via selective schools) of higher class position associated with cultural capital in music, and—importantly—a relatively unchanging relation to the historicist canon in music, itself being defended and reproduced, without significant change, in the elite universities' TM degrees.

In this account, western art music, the basis of the curriculum in TM degrees, is correlated with a student population having higher social class and higher cultural capital than those studying the MT degrees both at entry and at exit. That is to say, the bifurcation of the student

population taking MT and TM degrees correlates with the intensification of differences in cultural capital, and thus the augmented reproduction of class differences, through the degrees' fuelling of students' training and competence in the divergent musics offered by the two kinds of curricula, and thus students' differential access to and acquisition of cultural capital in music—as it is still institutionally defined, with qualifications given below.

Such an interpretation is reinforced by the pronounced hierarchy evident in the institutionalization of the two degrees and their curricula within the British university system: the TM degrees largely occupying the elite end of the university spectrum, along with several of the most prominent music conservatoires, which are emblematic of the high end of TM training in musicology, performance and composition; while the MT degrees have, with exceptions, developed mainly at the lower status end of the university spectrum among the 'post-1992' universities. In this sense the MT degrees are in their very institutionalization, their academic location, subordinate in status and legitimacy to the TM degrees.

Thus, regardless of the rapid growth in MT student numbers and the attempted reform by the MT degrees of what counts in terms of curriculum and canon, and thus their attempted redefinition of cultural capital in music, the negative interpretation suggests that the MT degrees and their curricula are not experiencing a marked rise in legitimacy. Moreover, in terms of absolute size of student population, and thus likely cultural impact, the TM degrees still dwarf the MT degrees—although the gap is lessening.[79] From this perspective, the definition of cultural capital in music may well continue to be defined by the western art music-focused curriculum of the TM degrees, so that cultural capital will remain concentrated in those degrees, with the effect that MT graduates will not experience significant social mobility as a result of their university training.[80] At the same time, the UCAS data on TM degrees, and the demographics and A-level results going into them, suggest that this aspect of the field is relatively static or self-reproducing, or even resists change. That the TM degrees may resist change is plausible because of the wider cultural changes charted in Born's fieldwork, discussed below, which suggest that effort may be required to stay still (as it were) in terms of the curriculum and canon that they propound.

Positive interpretations

Alternatively, it is possible to give more positive interpretations of our data. In this light, the growth in MT degrees opens out potentially progressive sets of developments for their student populations and in other significant ways. Such developments include, but are not limited to, the contribution of MT degrees in conjunction with other institutional changes to reconfiguring the musical canon and reworking the boundaries between art and popular musics, thereby auguring far-reaching changes in the musical field.

A first observation is that along with their broader social access, MT degrees arguably cultivate new vocational strengths for students of music, beyond those offered by TM degrees. Because of their interdisciplinary engagement with aspects of science and technology, MT

[79] Between 199495 and 201112, the TM degrees saw an overall growth of 150 percent, with student numbers expanding from 7500 to 19,000 p.a. In the same period, the MT degrees saw a 1400 percent growth in student numbers, from c. 545 to 8165 p.a..

[80] An instructive finding comes from Coulangeon's work on contemporary France, supporting this interpretation. He finds that, despite evidence for increasingly omnivorous taste practices among certain social classes, it is traditional forms of highbrow cultural capital that still convert most readily into upward social mobility.

degrees provide the basis for a wider range of potential employment and training opportunities than the TM degrees, including an array of technical and professional jobs in music, audio, media/new media, IT and design. This has immediately to be qualified with reference to the rapid growth in MT student numbers, pointing (once again) to the risks of overproduction of MT graduates, along with the problematic gendering of this population.

A second potential series of effects of the growth in MT degrees points to the interrelations between educational, aesthetic and institutional change, as well as the changing boundaries between art and popular musics. They arise because the MT degrees, in conjunction with other cultural-historical processes, synergistically fuel transformations both of the musical canon and of the current institutionalized settlement between 'high' and 'low' in music. This occurs as a consequence of their curricula, specifically their modernizing break with the historicist basis of TM degrees, and their orientation towards a spectrum of 20th and 21st century electronic and computer-based art and popular musics, along with aspects of sound art.

Moreover, while they centre aesthetically on electroacoustic music, the MT degrees also participate in a wider struggle over the changing canon in electronic and computer musics—partly under the pressure of student interest and student identification. This is very clear in Born's ethnographic fieldwork. It is driven in part by the need to appeal to the students' own musical tastesBut the evolving MT curriculum also reflects shifting musical orientations among the generation teaching the MT students, especially those under about 45 years of age who grew up in an era in which punk, post-punk, new wave, industrial and related avant-garde popular musics, along with techno and post-techno musics associated with rave, were crucial reference points as they developed alongside the electroacoustic and computer art music repertoires. Indeed for this generation, arguably, the two are experienced as inextricably related, a finding supported by Born's fieldwork among musicians of this generation. A further dynamic fuelling these shifts stems from the emergence over recent decades of lively, increasingly vocal and visible non-academic electronic and digital music scenes that, since the end of the 1990s, have been recognized by the circuit of international prizes and festivals and that exert escalating pressure for aesthetic and ideological change, beyond academic electroacoustic and computer music.[81]

The spread of musics the MT students are being taught, then, differs radically from the acoustic music canon of the TM degrees: it necessarily centres on electronic and computer musics dating from the mid 20th century onwards; and this appears to make it easier, and arguably necessary, to elide the long-standing boundaries between art and popular musics: from Varèse to the Beatles, Cage to John Cale, Stockhausen to Aphex Twin, Xenakis to Jimi Hendrix. This aesthetic opening happens more and less voluntarily or enthusiastically: our research on MT degrees in Montreal, for example, suggests greater reluctance than in the UK degrees to crossing the art-popular divide in teaching, and more condescension and ambivalence on the part of key MT university faculty. Moreover, even in the British MT degrees, popular musics enter the curriculum as a fruitful margin, or as a specialist subject treated in a similar way to the TM canon—for example as in an option course, in one research site, on the Beatles.

[81] A turning point is considered to be the award in 1999 of the Prix Ars Electronica for digital musics to Aphex Twin and the Viennese label Mego. The Jury Statement, by Kodwo Eshun, criticized the hegemonic 'ancien regime of [academic] electroacoustic music', rejecting its arrogant narrowness, and charged it with 'undeserved authority at the cost of cultural irrelevance'. Two influential articles gave the same analysis: Bob Ostertag, 'Why omputer usic ucks', *Resonance*51 (1996)Kim Cascone, 'The esthetics of ailure', *Computer Music Journal* 243 (2000). The Jury Statement is available at: (accessed June 2014).

In the positive interpretations, then, as a result of the growing legitimation of those musics propounded by the MT degree curricula, and how they catalyze both marked shifts in the curriculum of music in higher education and incipient transformations in the electronic and computer music canon, students going through the MT degrees may enter with lower cultural capital, along with their lower social class position; but they nonetheless gain particular kinds of cultural capital in music as a result of their degree training—a very different kind of cultural capital in music, to be sure, than that accumulated by students taking the TM degrees.

Two further logical questions, both to do with the potential consequences of the rapid expansion and relatively large size of the MT student populations, and both strenuously departing from the negative interpretation, then arise. First, if the MT degrees represent a growing trend in music in higher education in Britain, then a key question is whether their expansion and student success will lead to their growing influence on the TM degrees? Indeed it is plausible that the nature of the musical canon as currently institutionalized in the higher status TM and conservatoire degrees might pluralise to include, or might converge with, the emergent canons of the MT degrees;[82] and if this occurs, then what constitutes cultural capital in music is likely also to evolve. And second, given a changing configuration of cultural capital in music, might the students who graduate from MT degrees actually be becoming ascendant in terms of the kinds of cultural capital in music they accumulate from higher education? Will this eventually eclipse the historicist cultural capital bestowed by the TM degrees? The result might be that students coming out of the MT degrees become bearers of greater cultural capital than at present. And if so, what does this augur more generally for changes in the future relations between social class and cultural capital in music?

But a third crucial question follows this hypothetical scenario: is the cultural capital in music bestowed by the MT degrees likely to be convertible into other forms of capital—economic and social capital—that are equally or more formative of students' eventual class position?[83] Or are we likely instead to witness an expansion in the guise of the MT graduate population of what Bourdieu described as the 'dominated fraction of the dominant class'—that is, artists and intellectuals with considerable cultural capital but little economic and other forms of capital?[84] And might this population constitute or fuel in their growing numbers, as predicted by Garnham and Miège, a reserve army of labour in music?

Institutionalization, legitimation, and the production of consumption: Against conceptual fragmentation

To make greater sense of the foregoing distinctive scenarios, it is important at this point to widen the lens beyond the universities and acknowledge larger shifts signaling a transition in the

[82] Such a convergence is difficult to discern. In Manchester University's undergraduate music degree, TM and MT coexist as streams within a single degree structure. But in Huddersfield University, although previously separate departments of Music and Music Technology have recently been combined, a spectrum of differentiated undergraduate degrees including Music and Music Technology are retained.
[83] On this see note 80: Coulangeon's (2013) findings for France today suggest that although omnivorous taste practices are expanding among some French social classes, the forms of cultural capital that ensue are less likely to convert into other types of capital, and enable upward social mobility, than traditional forms of highbrow cultural capital.
[84] Bourdieu,). For further explanation of this concept, see Simon Stewart, *A Sociology of Culture, Taste and Value* (Basingstoke: Palgrave, 2014), 79.

institutionalization of the structure of value and legitimation in music alluded to earlier. For our research shows that the momentum for change in the contemporary music repertoire does not stem only from the growth of the MT degrees. In recent years, the key cultural institutions for contemporary music in Britain—the BBC in the guise of the Proms and Radio 3's new music programmes, Arts Council England through its new music proxy, Sound and Music, and major and emergent festivals like the Huddersfield Contemporary Music Festival and the London Contemporary Music Festival, have all moved in the direction of mainstreaming and beginning to canonize three broad lineages that had hitherto been considered marginal or alternative to the dominant post-WW2 lineages of post-serialist, spectral and electroacoustic composition. The three broad lineages are: American, British and European experimental musics, free improvised musics, and sound art. At the same time, a fourth incipient lineage is being recognized: a host of burgeoning electronic and digital music genres that cross over between academic and nonacademic, art and popular musics, among them ambient, glitch, microsound, noise, experimental electronica, live coding, live electronics and extreme computer music. Why are these emergent changes—at once aesthetic, educational and cultural-institutional—happening?

On the part of the music sector, they derive in part from long-standing political criticisms of elitism in public provision in music and the arts, allied to arguments about the need to justify public funding of the arts, to boost 'cultural participation' and cultivate new audiences who had previously been excluded through audience 'development'. These shifts were associated with the rise from the mid 1990s of policies advocating that publicly funded arts organization must measure their capacity to engender 'public value' by assessing the 'social and economic impact' of their work, in part by engaging in various forms of audience research.[85] But they derive also from a parallel drive among the main music institutions to cultivate younger audiences for new music—which makes them subject to similar pressures for change as the MT degrees. Indeed, it is plausible to see the motivations driving this historical dynamic in recent decades as culturally democratic ones on the part of key public cultural institutions, with effects that are particularly responsive to generation (and age) as well as class.

But the impetus for change is also specifically musical: the ongoing unfolding, evolution and intermingling of major aesthetic lineages. In this regard, the main new music institutions are rapidly recalibrating the contemporary western art music canon: they are engaged in elevating the experimental music lineage over the post-serialist avant-garde, to which it was previously secondary, endowing emblematic experimental composers and musicians with canonic status equal to Boulez, Stockhausen or Carter. This is evident, for example, at the Huddersfield Contemporary Music Festival, which is in partnership with the other bodies mentioned (the BBC, ACE, Sound and Music and so on), and where figures such as Cage, Feldman, Tudor, Wolff, Tenney, Alvin Curran, James Dillon, Brian Eno and Evan Parker have been to the fore in recent programming. The doyen of free improvisation, saxophonist Evan Parker, is a case in point: in earlier decades an outstanding figure in a then-alternative international scene, in recent years he

[85] For an exemplary organization offering audience research across the arts sector, see http://www.theaudienceagency.org. On the 'public value' paradigm, its basis in audience research and other modes of assessing the 'social and economic impact' of the arts, and its influence in Arts Council England, see Michelle Reeves, *Measuring the Social and Economic Impact of the Arts*LondonACE2002. For critical historical analyses of these developments, see David Lee, Kate Oakley and Richard Naylor, 'The public gets what the public wants?: The ses andbuses of "ublic alue in ontemporary British ultural olicy", *International Journal of Cultural Policy* 17/3 (2011), 289300; Hewison, *Cultural Capital* chapter 3.

has been championed by a series of bodies and festivals linked to leading MT universities. While the free improvisation scene is identified historically with an ideology that rejects western art music's ontology of the work, that there is little breach with prevailing canonic modes of valorization and legitimation is evident in how Parker's astonishing virtuosity as a performer makes it possible for him to be equated with leading composers and thus recognized within existing western art music discourses of value. It would therefore be mistaken to see these moves by the major contemporary music institutions—the BBC, ACE, Sound and Music and so on—as non- or anti-canonic. Rather, these bodies are energetically engaged in producing a transition to a new canonic regime, in some cases incorporating practices antithetical to the work ontology, as though there was no tension. It would also be mistaken to see these shifts as without conflict: they are, rather, riven with interests and struggles over what counts and what does not (see below).

A final element in this picture is the rise of sound art, a diverse area of practice that developed in recent decades outside the music institutions under the auspices of the visual arts, and which has begun to register as an element in the curricula of the MT degrees. The result is an alternative genealogy both to the post-WW2 avant-garde and to experimental music (albeit with links to the latter). Certain of the MT degrees have responded to the rising profile of sound art by including 'sound art' or 'sonic arts' in their titles; while the London College of Communication, part of the University of the Arts, London, inaugurated what has become the heartland degree.[86] These developments have accompanied a growing legitimation of and public profile for sound art, such that a convergence of a kind has occurred between sound art and the electroacoustic and experimental music lineages—a convergence confirmed by the eruption in spring 2012 of a major political conflict between these lineages and representatives of British acoustic composition over the naming and remit of the key public funding body for new music, Sound and Music.[87] This conflict signaled a growing coalition among electroacoustic-experimental-improvisation-sound art proponents in their struggle with contemporary inheritors of post-WW2 acoustic composition, whose instrumental and orchestral work connects to the lineages of early 20th century musical modernism and thence, arguably, to the historicist canon espoused by the TM degrees. The MT degrees therefore form part of a much wider reconfiguration of British contemporary music that

[86] See http://www.arts.ac.uk/lcc/courses/undergraduate/ba-hons-sound-arts-and-design/, http://www.arts.ac.uk/lcc/courses/postgraduate/ma-sound-arts/ and related degrees; and the linked LCC-based research centre CRiSAP (Creative Research into Sound Arts Practice): http://www.crisap.org.

[87] The crisis was initiated by an 'open letter to Sound and Music' released to the British press on March 27th 2012 signed by some 250 composers, performers and administrators of British contemporary music led by leading acoustic composers including Sir Harrison Birtwistle, Sir Peter Maxwell Davies, Julian Anderson, George Benjamin and Michael Finnissy. The letter complained of many aspects of Sound and Music's functioning, arguing that it had 'abandoned virtually all of the long-established and constructive activities of [the earlier bodies that it had replaced], largely in favour of a bland and unfocused endorsement of "sound art" and the promotion of relatively fringe activities which [have] little or no connection with the mainstream'. This began a tense, sometimes acrimonious debate between these representatives of 'notated and modern composition' and a broad coalition of experimental and electracoustic composers, sound artists and improvisers. In this way the Sound and Music conflict enacted the ongoing production of boundaries between what crystallised as two broad and distinctive traditions: the contemporary classical mainstream and the experimental coalition. The original letter is here: http://www.holstfoundation.org/index.php?pr=Open_Letter_to_SAM_and_ACE; and the coalition reply is here: http://www.chrisswithinbank.net/2012/04/response-to-letters-to-sam-ace/. Sound and Music made an official response which is no longer available on the web. (Websites accessed Jan. 22nd 2015.)

includes other key cultural institutions and that entails struggles—for recognition and legitimation, as well as economic subsidy—over the reshaping of the prevailing canon of 20th century art music. Yet despite the contestation, contemporary acoustic composition retains considerable traction and status with the BBC, conservatories and concert organisations; so the various lineages continue an uneasy coexistence, competing for status, legitimation and funding.

A further interpretation follows: it might be summarized as 'the musical field as multiverse'. This would suggest that we are seeing not so much a replacement of one canonic nexus (the historicist curricula of TM degrees) by another (the contemporary curricula of MT degrees), nor their convergence, but a proliferation and diversification of the very forms of cultural capital in music. This scenario foresees a musical field in which various ideologies of musical value and legitimation coexist, associated with particular aesthetic nexuses and institutional formations, but with no necessary relationship between them; and in which their eventual relative status, educational reach, and institutionalised forms are as yet unknowable. This points to the potential for a sustained fragmentation it is a conception of the field as a concatenation of incommensurable forms of musicalcultural capital—a musical 'multiverse'.

Overall**,** whatever the future evolution of the relationship between the two kinds of music degrees, and between them and the larger musical field, a final overarching question raised by this article concerns the articulation between the earlier research on music consumption and class (by Bourdieu, Peterson, Bennett et al, Savage and Gayo) and the research presented here on class and gender in relation to music in higher education and its influence on musicians' training—that is, on the production of music producers. The student output of the MT degrees are musicians that may or may not enter the worlds of professional music-making and that may remain amateur and/or unemployed musicians; yet in all cases, these students will be music consumers, and quite possibly, through their sustained and committed amateur and 'independent' practices, particularly influential consumers ('prosumers'), helping to reshape the musical future, including its aesthetic and institutional forms.[88] So we propose that something of what we've uncovered in this study may also augur, or may be affecting, broader changes in music consumption in the UK. For the generations coming out of MT degrees now span almost two decades—from those born around 1980 to those born in the late 90s. The huge expansion of the MT degrees, then, is likely to be having real effects on the configuration of British musical tastes; and the student outputs of the degrees, c. 8000 graduating a year in the last years of our sample, will be exerting pressures on the correlations seen by previous writers on music and class in Britain. To put it crudely, the relative market share of the TM degrees has shrunk; while the MT students fuel demographic taste formations in music with real audibility. Moreover on leaving university, through their practices, MT graduates help performatively to propagate the aesthetic changes staged by the degrees in which they have participated. The MT degrees are surely themselves formative of wider movements both in taste formations and in the relations between music and class.

The production of music producers by music degrees influences consumption, including the MT degrees' mediation through the use of digital technologies of the changing boundary between the production and consumption of music and of the massively expanding populations of skilled amateurs. But this crucial element—the mass formation of amateurs, unemployed musicians, consumers and 'prosumers'—has been missing from the existing debates issing also, as we have tried to indicate, has been a conceptualization of consumption as but one element in a larger socio-musical ecology in which production, education (the production of producers and

[88] Indeed, it is this category of musician—independent, non-academic musicians who have not received formal or elite trainings—who promoted the major aesthetic changes registered previously: see note 81.

consumers) and consumption, along with large-scale aesthetic changes and their evolving institutionalization, are intrinsically and recursively interrelated—albeit always in distinctive ways as catalyzed by particular historical conditions. A final methodological message of this study, evident in the analytical span of this article, is therefore that future research will need to resist conceptual fragmentation by addressing how shifts, for example, in music in both influence and are affected by wider changes in the production and consumption of music, as these developments in turn mediate and are mediated by wider aesthetic, technological, social and political transformations. In decontextualizing certain key findings, for example related to music and class, previous research risks misidentifying how changing taste formations relate to institutionally-sanctioned valorisations of cultural capital in music, as they in turn may be static or changing—as we have indicated for Britain today.

Conclusions

The optimistic tone of some accounts of the omnivore thesis in cultural sociology—which suggest 'that there is a sector of the population of western countries who do and like a greater variety of forms of culture than previously, and that this broad engagement reflects emerging values of tolerance'[89]—is matched by optimism on the part of some of those researching gender in music. years ago, Chris Comber, David Hargreaves and Ann Colley concluded their study of 'Girls, Boys and Technology in Music Education' on a hopeful note: 'In the earliest days of the "computer revolution" there was much discussion of the potential of IT to dissolve the barriers between "masculine" technology and "feminine" creativity. That dream of a gender-free technology may yet be within reach'. As we have shown in this article, however, in relation to music, class and gender in the UK, such optimism may be misplaced—or premature.

Yet two important qualifications must be acknowledged. We are aware that the period covered by our UCAS data set (2007–2012) may be exceptional, and in two ways. First, it may be a particular 'divergent' period with respect to the bifurcation of the two degrees, TM (traditional music) and MT (music technology), into which our UCAS data falls, and on which our analysis has been founded. There are signs that certain British university music departments are bringing these two sides of the curriculum into closer relation, or integrating them into the same degree. Second, a major limitation of the study is that our data end just before the British government's introduction in autumn 2012 of undergraduate tuition fees of £9000 per year, which is likely to have had significant impacts both on undergraduate student recruitment numbers and on students' demographic profiles, perhaps particularly deterring students coming from lower social class backgrounds into the MT degrees. These recent developments are therefore likely to be highly consequential for our analysis, but regrettably, they lie outside the scope of this study. We would need to purchase UCAS data for subsequent years to understand the impact these changes have had since on the influx particularly of young white men of lower social class background into the universities, drawn by innovative non-traditional music degrees that offer them, without regard to prior musical literacy, a serious training in creative music practices and related skills. Yet despite these qualifications, the study captures an important period and provides an analysis that can fuel reflection among the community engaged in provision of music in higher education.

[89] Alan Warde, David Wright and Modesto Gayo-Cal, 'Understanding Cultural Omnivorousness: Or, the Myth of the Cultural Omnivore,' *Cultural Sociology* 1/2 (2007), 143.

Fifteen years after the introduction of the Music Technology A-level, at a point when the first generation of music technology students is now mentoring and educating the next,[90] we have presented the following picture. TM degrees tend to draw students with higher social class profiles (and fewer ethnic minority students) than the British national average, while the gender profile parallels the wider student population. The demographic of MT degrees, by contrast, is overwhelmingly male and lower in terms of social class profile (and slightly more ethnically diverse, though still predominantly white). We have suggested that it is possible to interpret these developments in different ways.

From one perspective, MT degrees can be understood as a fulfillment of almost twenty years of educational reform: technology and, to a variable extent, science have become central to music in , institutionalizing a strong interdisciplinarity. This has engendered a widening of access and a huge growth in student numbers, and has offered a quite different vocational orientation to the TM degrees. In this light, the growth in MT degrees—with their interdisciplinary embrace of technology and science, their less elitist and more experimental musical orientation, and their broader social access and vocational strengths—represents a crucial transition away from the predominantly historicist orientation of TM degrees. They aspire to train students who are equipped for and can be inserted into a host of new technical and professional occupations in the burgeoning, intersecting fields of music, sound and audio, IT, design, and the other media and arts. In short: modernization, and potentially hope for the future. But difficult questions remain, particularly with regard to the potential overproduction of students from the MT degree sector. Simply put, where will all these students go?[91]

In another light, the TM and MT degrees seem to participate in feedback loops whereby existing ideologies of gender and technology, and class differences, are being reinforced or even amplified through music in . This is not a new phenomenon.[92] But there is an argument to be made that digital technologies inflect these established processes in particular ways. We would therefore argue against the common sense of our time, in which the digital mediation of these developments is often thought to have ushered in 'an era of greater abundance and choice for consumers' and 'a more democratised set of production relations.'[93] While such interpretations may seem persuasive—a world in which the exclusions and rigidities of vertical integration appear to give way to the ostensible liveliness of disintermediation, where the eclecticism and mobility of digital files participate in the 'consecration of incoherence,' and where shuffle functions and recommendation algorithms afford new modes of musical discovery[94]—our research suggests a more cautious reading. While it is doubtless true, to a certain extent, that digital mediation affords vectors of musical encounter (and thus of aesthetic experience and practice) that are less encumbered by the institutionalized, historicist spheres of influence that

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[90] See Boehm

[91] We address questions of musical labour and employment arising from our research in other papers.

[92] As Théberge argues of the twentieth century: 'Formalized training in Western art music. . . is characterized above all by the need to acquire skill in music "literacy", that is, the ability to read and interpret musical notation and to gain, thereby, an introduction to the repertoire of so-called "great music". What is more, you never simply learn to play a musical instrument; in the process, you also assimilate both a repertoire and a set of musical/aesthetic values. . . . Musical literacy has never been equally distributed across social classes, however, and, even within the privileged classes, it has not been equally distributed across lines of gender See also Green.

[93] From Hesmondghalgh57, who is strongly criticizing the underlying ideology. See also Théberge

[94] For various articulations and critiques of these ideas, see Jones Beer BullRimmer (2012: 303)Nick SeaverBeer and Taylor Eitan Wilf The idea of a 'consecration of incoherence' is adapted from

characterized pre- and proto-digital channels of production, consumption and circulation, in identifying the bifurcating demographics of TM and MT degrees we invite careful reflection on the musical formations which, unchecked, will be created through the currents in music technology education that we have identified. Things are in flux. At stake is nothing less than the future relation between music, gender and class in the UK.

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