The forgotten classroom? Bringing music encoding to a new generation

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Abstract

Digital methods have begun to make their way into the research practices of music scholars, and most this insurgence can be attributed to the rise of the discipline of music technology. Though music encoding is becoming increasingly prevalent among the research and teaching methodologies of music scholars, evidence gathered from course descriptions and presentations at national meetings of music scholars would indicate that encoding continues to lag other music-based technologies. Drawing from the advancement of music technology and the experiences of digital humanities teaching and scholarship, this paper presents a path for the music encoding community to promote greater integration of encoding and digital methods more broadly into the pedagogical practices of music historians and music theorists.

Introduction

> How do we teach music encoding? Do we profess it? Do we profess to teach it? Or, do we teach (courses like encoding and computer-assisted analysis) so that we might profess (our scholarly understanding of digital musicology as the intersection of musicology and computing)? However seemingly simple the question "what do we do?" may be, we do a disservice to our field and ourselves if we fail to consider the importance of pedagogy when it comes to answering such questions, no matter how commonsensical they might at first appear.[1]

This is a modified quote from Brett Hirsch in which his references to digital humanities have been replaced with references to music. Just as these questions helped frame a budding reemphasis on pedagogy within the digital humanities community in 2012, they are helpful to the music encoding community as it weighs the proper use of music encoding within the classroom. As Hirsch notes, some discussions of pedagogy seem pedestrian and as he says 'commonsensical'. Nevertheless, they are foundational for establishing a pedagogy for music encoding. Indeed, just as current music encoding tools and methodologies had to start from scratch, so also the associated pedagogical strategies for incorporating these digital research methods must start at the most fundamental levels.

And yet, the fundamental nature of these questions belies their complexity. It would be quite bold for any one person to claim to sufficiently answer these questions. After all, as Sean Michael Morris states, "Pedagogy has at its core timelines, mindfulness, and improvisation. Pedagogy concerns itself with the instantaneous, momentary, vital exchange that takes place in order for learning to happen" [2]. Like in improvisation, the pedagogue is constantly adapting to the audience, to the subject, and to the goals of the performance. Although this might appeal to some, the classroom is not a formula by which all students will learn if the instructor follows it. And yet, it is tempting to approach pedagogical practices in this way. Perhaps this is just my background as the son of a carpenter, but one tool will not allow you to build a house. Indeed, I spent many summers as a gofer for my father, crawling in his van to find that one tool among the hundreds that would get a specific job done. So too must pedagogues build and rely upon a set of tools that will facilitate learning depending on the situation. My presentation today is therefore not going to answer the questions outlined

1 Hirsch's original quote is "…do we teach digital humanities? Do we profess it? Do we profess to teach it? Or, do we teach (courses like computer-assisted text analysis and others surveyed in this collection and beyond) so that we might profess (our scholarly understanding of the digital humanities as the intersection of humanities and computing)? However seemingly simple the question 'what do we do?' may be, we do a disservice to our field and ourselves if we fail to consider the importance of pedagogy when it comes to answering such questions, no matter how commonsensical they might at first appear." (emphasis original) [1, pp. 16-17].

at the start, but rather to foster discussions of these questions by presenting a couple of tools to add to our collection of strategies for incorporating music encoding and other digital methods into music classrooms.

Digital pedagogy?

What does "digital pedagogy" mean? Like its parent, digital humanities, this term has been widely discussed across the humanities with little resolution. Simply breaking the term into its constituent parts, Morris describes pedagogy as "...a scholarship unto itself, a study of learning and the many ways it is fueled - in classrooms, in workshops, in studios, in writing centers - wherever learning is poised to occur" [2]. While Brian Croxall and Adeline Koh have likened the digital to that which consists of "electrical elements" [3] I think music scholars require a more precise definition, particularly considering our history with analogue electronic devices such as oscilloscopes, analogue synthesizers, and microphones (just to name a few). So, I turn to the definition from the OED, which states that digital refers to "signals, information, or data: represented by a series of discrete values (commonly the numbers 0 and 1), typically for electronic storage or processing" [4]. We can then infer that "digital pedagogy" is the study of the processes by which learning occurs either in or as a result of the electronic storage or processing of discrete values.

This is an admittedly wide umbrella that may leave many uneasy about the sorts of learning and activities it could include. In many ways, such a broad definition harkens to the unease many digital humanists feel when someone asserts that doing 'digital research' involves simply reading an article online or publishing in an e-Journal. Indeed, at the popularization of Learning Management Systems such as Blackboard and Moodle, many were happily convinced that digital pedagogy simply meant offering a course online. As Morris quips, digital pedagogy "was easy...a mere work of relocation" [2]. In one sense, this view is correct: digital technologies have been used to teach the subject at hand. However, limiting digital pedagogy to posting slides or lecture recordings online hamstrings the types of resources and capacities that the digital affords. Within digital humanities pedagogy, there has been a trend away from the types of sterile and static pedagogical practices that simply transfer existing "analogue" content and methods online and towards more active, student-centered approaches that emphasize collaboration, hacking, process, and construction and that actively bring cutting-edge research into the heart of the classroom. In this regard, Morris's definition of pedagogy is particularly helpful. For within true digital pedagogy there are continuous acts of refinement: learning from the digital approaches that have or have not worked in the past in an effort to improve and enhance the learning experience.

How did we get here?

Pedagogy has long been at the heart of humanities computing. Workshops such as the "Teaching Computers and the Humanities" series sponsored by the Association for Computers and the Humanities, as well as the Computers and Teaching in the Humanities conference provide some early examples. Moreover, the 1980s and 90s saw the establishment of dedicated digital humanities centers such as the Center for Computing in the Humanities at the University of Toronto, the Centre for Computing in the Humanities (now the Department of Digital Humanities) at King's College London, the Institute for Advanced Technology in the Humanities at the University of Virginia, and the Humanities Advanced Technology and Information Institute at the University of Glasgow (now the Department of Information Studies). But, despite the efforts of these and the establishment of initiatives such as the Digital Humanities Summer Institute at the University of Victoria, pedagogy was sidelined in public discourses through much of the first decade of the 2000s. Whether this occurred as a result of funding availability or other external pressures, research methods garnered the collective attentions of both scholars and benefactors. As Hirsch recalls, Donald Bruce's plenary presentation at the 2009 Digital Humanities Summer Institute highlighted this growing imbalance, something Hirsch labels "bracketing", and the community began to take note. By the end of 2011, the Digital Humanities at Oxford Summer School had been started, the first THATCamp Pedagogy had been held, and two roundtable sessions focused on digital pedagogies had been accepted for the 2012 annual meeting of the Modern Languages Association in Seattle [1, pp. 3-5].

Since that time, pedagogy has become a central concern of the digital humanities community. Since 2011, for example, the National Endowment for the Humanities has approved 63 different grants totaling over $8 million that develop digital teaching resources and pedagogical methodologies.[2] In the same period, the Mellon Foundation has invested over $3.8 million across 7 different grants that are similarly focused.[3] The literature on digital pedagogies has also grown significantly since 2011. The volumes of the *Debates in the Digital Humanities* series, and *Hacking the Academy* have devoted numerous chapters to the topic, and journals such as *Digital Humanities Quarterly* and *Digital Scholarship in the Humanities* as well as blogging platforms such as *Hybrid Pedagogy* have devoted significant space to digital pedagogy.

Music also has a sustained history in pedagogical practice and research, and it has a similarly long history with technology. I'll not rehearse what are well-known stories such as Johann Sebastian Bach's widely varied education in music performance and composition or Edison's invention of the cylinder phonograph. However, it is interesting that music pedagogy and technology became somewhat estranged in the twentieth century. Reporting on the state of higher education institutions in the United Kingdom in 2007, Carola Boehm traced the history of music technology through five generations of researchers and innovators. The first generation, labelled the Experimenters and Innovators, includes Schaeffer, Stockhausen, Eimert and Cage, among others. Then came the "Commercializers" in the 1970s and 80s such as Boulez, Vercoe, Wishart, and Puckett, who first began to teach music technologies in the classroom and who began to market technologies widely. This gave rise to the third generation, the 'First Lecturers' in the 1990s and 2000s, who seeing the rise in affordable digital audio equipment wanted to provide training for enthusiasts. Boehm's fourth generation was therefore one in formation when she wrote, as it included those who were then graduating from newly constructed degree programs in music technology. Finally, the fifth generation was one she projected would move on to graduate-level education in the 20-teens. Despite this optimism, she still concluded that music technology remained the discipline that "never was" [5]. Boehm has since published a reappraisal of music technology within the U.K., conceiving of a sixth generation in which music technology has been cemented as an academic field, with the fourth and fifth generations having begun to have an impact on the industry [6].

Wanting to compare those findings with current pedagogical practices in the United States, I conducted a survey of more than 60 of the country's leading music schools. After exploring the undergraduate and graduate course catalogues of each of these institutions, I found that all of the institutions offer technology-related courses to their students. Although I have only looked closely at schools in the U.K. and U.S, I daresay that one would find similar results in other countries around the world. One could conclude, therefore, that digital pedagogy is well in-hand throughout music schools today.

However, a closer look at the course descriptions of the same group of U.S. institutions reveals another story. Given the emergence of 'maker culture,' it is unsurprising that many institutions are now offering courses on digital music recording, music synthesis technologies, sound production, music distribution and marketing, and multimedia integration and alignment (including audio in video, film and video games). One might even add music notation software to that mix, particularly given the divergent idiosyncrasies of LilyPond, Finale, Sibelius, MuseScore, etc.[4] When I remove these courses from the list, in other words, looking for course descriptions in which digital humanities-related research methods are mentioned (i.e. optical music recognition, notation encoding; GIS; score-media alignment; metadata generation and curation; network analysis; and computer-aided distant reading of corpora, just to name a few), that list is whittled down to just 20 courses, and that generously includes the courses on notation that purport to include the latest developments in digital music notation that may or may not include music encoding.[5] If those notation courses are removed from the list, the number is cut in half. Across more than 60 of the most reputed music institutions of higher education in the United States, only 10 course descriptions could be found that use these methods. While it should be

2 National Endowment for the Humanities, "Funded Projects Query Form," neh.gov, https://securegrants.neh.gov/publicquery/main.aspx (accessed 22 May 2020).

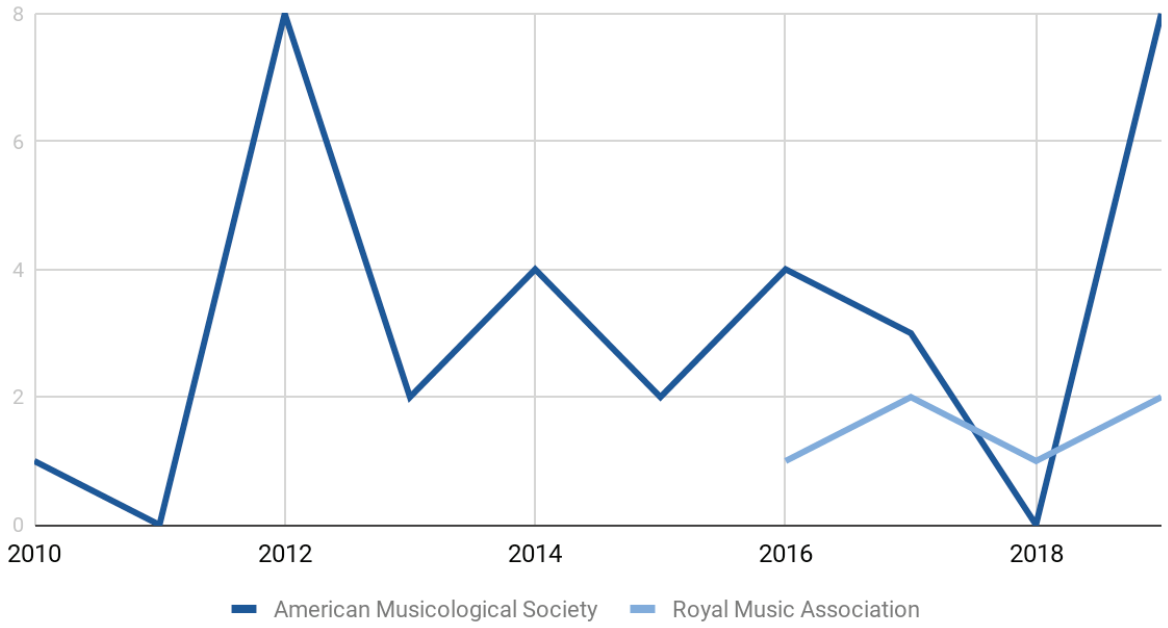
3 The Andrew W. Mellon Foundation, "Grants Database," mellon.org, https://mellon.org/grants/grants-database/ (accessed 22 May 2020).

4 Although the issues with these software packages are well documented, Martin Keary's reviews provide some representative examples of this criticism. Martin Keary, "Tantacrul", YouTube channel, https://www.youtube.com/user/martinthekearykid.

5 As a side note, this list of methods excluded courses that utilized image-based collections and repositories. While beneficial to music teaching and research, there is little computational difference between their utilization and that of PDFs or even hard copies of notated music.

noted how infrequently course descriptions are updated and that they cannot be expected to include all that a particular course might cover, this is symptomatic of the state of today's music academy, and particularly in the core areas of music history, literature, and theory.

Table 1: Digital methods presentations at national conferences



As another example, consider the annual meetings of the American Musicological Society and the Royal Music Association (Table 1). Looking at the published abstracts for the AMS dating back to 2010 and the RMA back to 2016 (earlier ones are not available on their website), a similar pattern emerges. The AMS has twice featured 8 papers, posters, or roundtables that include digital methods in their abstracts: in 2012 and 2019. However, these two years were significant outliers, as the remainder have featured between 0 and 4 presentations. Even if one accepts that some presentations may have been excluded from these counts because their abstracts do not mention any digital methods, the overall percentage remains paltry considering how large the conference is. For instance, 2019 featured more than 380 different presentations, which means that only 2% included digital methods. The Royal Music Association is not any better, as 2017 and 2019 were the high-water marks, featuring only 2 presentations that mentioned digital methods. This all points to an absence of digital methods from research workflows of historical musicologists, or at least the workflows of those considered within the mainstream of their respective disciplines. Indeed, if faculty are not engaging with these methods in their own research, they are not likely to teach them to their students.

On the contrary, emerging areas such as music recording, sound production, and electroacoustics - those fields commonly included under the umbrella of music technology- have largely adopted digital methods in their research and pedagogical workflows. Even applied musical instruction has begun to incorporate more digital resources, as more and more apps are being built to provide access to sheet music, to record practice or performance, and for immediate analysis for those performances. Sadly, music history, literature, and theory have not been so quick to adopt digital methods in either research or teaching. Indeed, based on my findings regarding course offerings and research paper presentations, musicologists and music theory scholars seem to relegate digital methods to research on twentieth- and twenty-first-century music, in essence where digital media already exists. They are much less likely to employ digital methods for music composed before 1900.

This is not to say that musicologists and theorists are unaware of the developments in these other areas, nor are they ignorant of the goings-on in the digital humanities. A survey conducted by Inskip and Wiering in 2015 would indicate that a lack of freely available digital data is one of the largest barriers to widespread implementation of digital research methods. However, it is also true that specialists in music before the twentieth century are often unaware of the latest technologies and therefore how their research could benefit from digital methods. Additionally, a large number are generally uneasy about computers - after all, they argue, learning how to use Finale and Sibelius was traumatic enough! [7] Regardless of the reasons, students continue to pass through theory, literature and history curricula thinking that the cutting edge in these fields remains closely tied to analogue outputs or digital recordings. Looking at it another way, and a more superficial way, compare the 'toys' of musicologists and theorists with the 'toys' of other music scholars. The former has books, journals, eBooks, recordings, and PDFs along with instruments of varying types. The latter has mixers, synthesizers, loudspeakers, microphones, streaming services, and computer algorithms.

So, what is the music encoding community to do? Over the years, this community has frequently engaged in discussions, both internally and externally with other like-minded groups, strategizing methods to promote music encoding and the various capacities it affords. Any attempt to list these efforts would be incomplete and do a disservice to those not mentioned. However, engaging with these scholarly communities at their annual meetings have had positive effects. In addition, pedagogical efforts such as the digital methods workshops hosted at various conferences and intensive summer schools around the world have provided hands-on opportunities for researchers to learn and interact with music encoding practices. These corporate efforts add to the numerous individual conversations that our members all have had with those in our own respective institutions. Of course, these should all continue, but I would argue that an increased emphasis on incorporating these into undergraduate and graduate-level instruction is a critical step in transforming the discipline. Following Boehm's outline, one could argue that music encoding may only be in its second or third generation, so now is the time to start incorporating it into the classroom.

In formulating a strategy for incorporating digital research methods such as music encoding into course curricula, the experiences of colleagues in the digital humanities are instructive. As mentioned earlier, pedagogy was not a significant focus of the digital humanities in the 2000s, and when that began to change in the early 20-teens, the initial assessments of digital humanities pedagogy were that it was widely varied. On the one hand, researchers were simply teaching students based on their own research and methods, which of course vary from project to project and person to person. On the other, it undoubtedly confused many students who were trying to figure out what this "digital humanities" thing was (incidentally, something that practitioners themselves still have difficulty defining). However, the field has begun to coalesce, leading Deborah Garwood and Alex Poole to conclude that "DH pedagogy inspires students and faculty members to critically, openly, collaboratively, collectively and symbiotically to explore existing or to carve out new research and scholarly areas across disciplines" [8, p. 552]. The same could be said for digital pedagogy in music-related studies: it should inspire students and faculty to critically, openly, collaboratively and collectively explore existing scholarship and establish new areas of inquiry that are not necessarily limited by disciplinary boundaries.

Music encoding in the classroom

There are a number of tactics that one could employ in tackling the issue of digital pedagogy. Some, like Claire Battershill and Shawna Ross in their recent monograph *Using Digital Humanities in the Classroom*, discuss the barriers that have been constructed against the incorporation of digital methods in the classroom, categorizing them according to the source: that is as coming from the instructor, students, and colleagues [9, pp. 13-24]. Within the context of a monograph acting as a practical guide to incorporating well-established pedagogical methods into classroom environments, such an organization makes sense. However, music pedagogues are not so fortunate in having tried and tested methods for incorporating digital methods into music classrooms, and particularly music history and music theory classrooms. Therefore, the remaining discussion is going to be more topical, exploring the issues of audience and managing stress and chaos, before concluding with a couple of skills that should be included in digital curricula.

Audience-appropriate content

Modern society is fixated on audiences, customers, and even students. While one might argue that this has its drawbacks, considering one's audience does help to provide helpful perspectives from a pedagogical point of view. Student-centered teaching strategies have become quite popular in the past couple of decades, but a challenge to digital pedagogies appears when the instructor gets so excited about a newly discovered or developed tool or digital method. In their enthusiasm, the instructor forgets why the students are sitting there in that lecture theatre, and the class becomes a lesson in a tangentially related digital tool rather than the original subject. Regardless of whether said instructor is excited about a tool, a digital method, or some minutia of digital humanities theory, Ryan Cordell boldly asserts, "undergraduate students do not care about digital humanities," and he continues "most graduate students...do not come to graduate school primarily invested in becoming 'digital humanists'" [10]. His comments could also be applied to music students: most have intentionally chosen to avoid computer science and mathematics. One could take this one step further. There was a pervasive theory in pedagogical writing around the turn of the century that students were "digital natives" and were therefore more comfortable with and competent in all activities relating to computers. However, as Brandon Locke comments, " Students are often much less adept at creating content that is not tightly mediated by some kind of commercial service with restrictions on form (e.g. Snapchat, Twitter, Facebook)" [11]. Students are therefore just as reticent as other generations when it comes to angle brackets and curly braces. Indeed, despite the "digital natives" moniker that sadly still surfaces in the pedagogical literature, it is important to remember that many music students will not have the inbuilt, innate, or otherwise preexisting familiarity with or comfort with music encoding or code-based analysis tools. Nor do they necessarily want to spend significant time learning how to code and encode.

When developing course content that utilizes digital methods, one should therefore consider the students' skill levels at entry and the desired results once they complete the course.

As an illustration, I point to a course I teach at Glasgow called Music Curation and Analytics, which is offered to upper-level undergraduates in Information Studies. Most of these students are not music students (and one would assume intentionally so, since they are studying information studies and not music). The first year I taught the course, I had them transcribe a piece of music in MuseScore and then export it to musicXML and on to MEI before they then edited the MEI file. The idea was that they would gain experience in understanding each format. Since the students already had a level of XML training, I figured that they would be able to handle the MEI modification. For students who had a background in music, this task was not too onerous, but others really struggled with the transcription in MuseScore - despite me providing a basic introduction to reading Western music notation - because they remained too unfamiliar with music terminology and therefore spent much of the semester trying to transcribe their piece, let alone considering what changes could be made to the MEI. In the second year, I focused less on the specifics of music notation and more on the comparisons between the MusicXML file and the MEI file, describing the differences and what those meant both semantically and in terms of the capabilities of both formats. Students did much better with this approach, given their existing background in XML. Indeed, this latter approach was much more attuned to the course objectives, which were to introduce students to the ways in which music-related information is created, stored, analyzed and otherwise reused.

Managing stress and chaos

Despite this anecdote, some outside this community (and perhaps some within it) might argue that music encoding is too new, and its accompanying toolset too underdeveloped to be presented in the classroom. Those promoting this view might worry that students could be overwhelmed and frustrated by complicated software installations and tools that frequently "break" or do not perform as expected. On the one hand, this risk can be reduced by limiting student expectations of the technology. For instance, MEI rolled-out version 4.0 while I was in the middle of teaching music encoding to a group of masters students. As you may be aware, version 4.0 involved significant changes to the way metadata was captured in the meiHead element, and this impacted some of the validation functionality afforded by plugins to Atom. However, at the beginning of the course, several weeks in advance of the release, I had mentioned that MEI is a community-based standard for encoding music notation and that those standards can change to adapt to meet the needs of the community. The

students were therefore much more flexible in their expectations of the technology. Rather than causing significant upheaval in the middle of the class, the update in MEI versions offered us the opportunity to explore the new guidelines and to learn from them together. We were able to discuss the changes and to consider the semantic impacts of those changes. This is a relatively tame example, but there are others in which something may actually fail. Indeed, Katherine Harris goes so far as to insist that students *will* break digital tools [12, p. 21]. As Lisa Sprio notes, however, "...the digital humanities community recognizes the value of failure in the pursuit of innovation...since it indicates that the experiment was likely high risk and means that we collectively learn from failure rather than reproducing it (assuming the failure is documented)" [13]. Indeed, students should not be completely shielded from unsuccessful results. Rather, they should be trained in ways to document them and to learn from them.

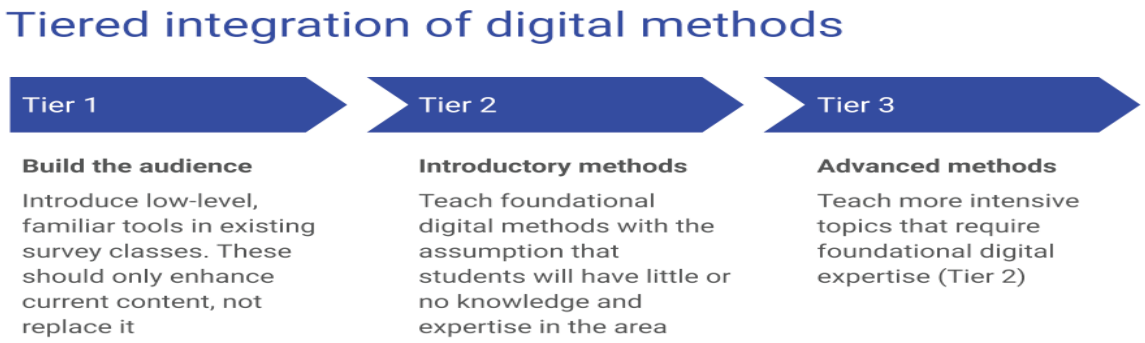


Figure 1: Proposed integration of digital methods into music curricula

Beyond turning these challenges and even failures into positive learning experiences, the music encoding community can recommend systemic controls that effectively would limit students' potential exposure to frustrating results until they have reached a point at which they can either troubleshoot them or can properly contextualize their experience. The music encoding community therefore needs a coordinated progressive strategy for introducing digital methods into music history, literature and theory curricula (as that suggested in Figure 1). Of course, tiered approaches to curricula are nothing new to music pedagogues who teach a broad range of courses from music appreciation to advanced Schenkerian analysis. However, the same pedagogues may not have considered that a similar approach is required for digital methods. Given the general reticence that many music students have towards computers, digital pedagogues need to start with some simple digital discovery before throwing students into the world of angle brackets and curly braces. That is, show them the utility and capabilities that digital methods afford. This is the step that many instructors missed in the early days of the digital humanities. In the early days of the digital humanities, instructors rushed to create survey courses, forgetting that students first needed to be shown why DH was important and how it could positively benefit their studies and research. As Cordell notes [10], students and colleagues are more receptive to digital methods when they were integrated into a course that they already deemed relevant to their studies. Indeed, this is what Adeline Koh also describes, as she encourages instructors to employ the tools with which students are most familiar (i.e. Google Maps, Wikipedia, etc.) before delving into more complicated elements [14]. Music teaching should therefore start with simple tools that are integrated into survey curricula to provide data-intensive illustrations of the overarching concepts that are being taught. At this level, it is critical that the expertise and training for the digital resource should be minimal, so it does not overshadow the subject-specific training. Jonathan Howell provides a good illustration of the balance required at this level. He describes how he created a linguistics course that relied heavily on R, but that his students struggled to keep up with both the programming requirements of the course and the linguistics content. Before offering the course a second time, he built a web application that allowed his students to take advantage of analytical tools offered

by R without requiring them to know how to code in R. The result was a much better student experience that recognized the benefits of digital approaches within the context of linguistic research [15]. Resources such as the Verovio Online Editor and jSymbolic could be incorporated in this same way because they do not require significant coding expertise at the outset. However, music pedagogy would benefit from more of these types of low-level digital tools that allow students to start familiarizing themselves with digital methods.

There are, of course, limitations to digital tools, as Locke argues, "Tool-based literacy limits sustainability, cross-platform work, and understanding of the impact of media upon the message" [11]. It is therefore important for curricula to build on the initial introductions that occur in the first tier with both surveys of digital methods and more focused digital training to provide much-needed critical skills to evaluate those digital methods. Although it is not a degree-based curriculum, I would argue that the offerings of the Digital Humanities Summer Institute (DHSI) are a helpful exemplar. Begun in 2000, DHSI provides intensive training in the digital humanities. It offers over 50 different one-week courses over a two-week period in June that cover a broad range of topics relating to DH research and pedagogical practices. Much like other digital humanities summer schools, DHSI operates on the assumption that its students have already encountered digital methods within their coursework, research, or teaching. This digital first contact has the DHSI student itching to learn more, but that person may not have any level of technical expertise. DHSI therefore offers a number of "Foundations" courses that provide entry-level surveys of digital methods and training in courses such as TEI, DH technologies, introductory computation, digitization, and even music encoding.[6] I would argue that these types of courses are the logical second step in a tiered digital curriculum. For degree-based music instruction, this could include introductions to music encoding in which students actually start encoding music using various standards. It could also include basic introductions to computational analysis of musical content. The key is that these courses should effectively build from the ground up, that is, they should start with the assumption that students have little or no expertise in that particular area.

The third and final step in this tiered approach involves offering much more advanced courses in digital methods that require a certain level of expertise at the outset. These courses may explore the areas of computer learning, analytical methods in python or R, or even combinations of digital methods, and often these courses are much more focused in terms of their musical remit. For instance, one could envision a course on computational stylistic analyses of Stravinsky's oeuvre.[7]

Skills development

Having outlined this hierarchy, it is important to consider what topics are fundamental to the discipline as it moves towards digital research methodologies, and which are less crucial. Given the widely varied and changing state of digital methodologies in music, I would not pretend to offer such a hierarchy on my own here. That said, I would suggest two important skill sets that should be included.

Digital literacy

Despite the increased use of digital pedagogies, Locke comments, "there should be reason for concern that students are often taking part in digital information and media transmission, but are not currently trained in the literacies and affordances of the technology they use" [11]. Indeed, it is almost cliché that every course today claims to instill in students critical thinking skills, but this can be very difficult to achieve in a single course. I would argue that if music teachers continue to make these claims, particularly for history and theory curricula, there needs to be a reevaluation of how students in the digital age can be trained in critical thinking so that it approaches what Locke and others would label digital literacy. Although students are accustomed to taking surveys and to providing reviews of their meals and shopping experiences, it can be difficult to encourage them to think outside their own experience and particularly about the strengths and weaknesses of those digital methods and the resulting limitations of the data they produce. I would argue that there are four components to digital critical evaluation. To illustrate the first two, permit me a brief excursus.

6 For a list of courses, see "Course Offerings," *Digital Humanities Summer Institute* (DHSI), https://dhsi.org/course-offerings/ (accessed 22 May 2018).

7 A similar hierarchical structuring of instruction is proposed by [10].

Nestled in the hills of Western Pennsylvania, is a small city called Beaver Falls. Known as the hometown of American Football Hall-of-Famer Joe Namath and the setting of the 1980s TV show Alf, Beaver Falls is also home to a small liberal arts school called Geneva College. As an alumnus of Geneva, I could regale you with some of its historical claims to fame, which include participating in the Underground Railroad during the American Civil War, as well as claiming to have played the first men's college basketball game in 1893. However, my reason for mentioning Geneva in this context is not for one of these claims to fame but rather for what some might consider to be a mundane architectural feature: a bridge at the edge of campus that crosses some 50 feet (15.25 meters) above the Beaver River connecting Beaver Falls to the small township of Eastvale. This was the site of an interesting experiment that did not result in a discipline-changing discovery but rather an experiment that epitomizes the learning experience.

A personal friend and Geneva alumnus told me of one of his experiences as a student there. During one of his summer vacations, he worked as a lab assistant for one of the chemistry professors. This meant that he and another student were tasked with preparing the labs for the upcoming autumn term. They cleaned the labs and their equipment; took inventory; and disposed of, ordered and received new equipment and supplies. One day, he and the other lab assistant came across a substantial container of sodium that needed to be disposed of. This was back in the 1960s, and what else were two college students to do with a bucket of sodium? Of course, let's take it down to the Eastvale Bridge and heave it over the side to see what happens! According to my friend, the result was quite spectacular, resulting in a jet of water that shot up onto the bridge and the vehicles crossing it.

Looking back on the situation, said alumnus admitted that it was probably not the safest or smartest thing to do. However, it illustrates two elements that I think are critical to education: knowledge and play. The two students knew of sodium's reactivity with water, and they were willing (admittedly unadvisedly) to apply that knowledge to "see what happens". And, given the fact that my friend told the story with a smirk on his face some forty years later would indicate that he has never forgotten about the violent reaction that can occur when sodium comes into contact with water. I would therefore argue that first and foremost, students need to have the requisite subject knowledge to be able to contextualize information. Then students should be afforded the opportunity to apply that knowledge while playing with specific digital tools. This approach to digital pedagogy is well established across the sciences and humanities, as is chronicled by Jentery Sayers [16]. Despite the benefits of allowing students the space to play with digital tools and methods, Nuria Garcia, *et al* caution that the digital sandboxes established for classrooms need to have boundaries, arguing "The goal in the college classroom should not be to allow for open-ended digital play and exploration of the kind that professional humanities scholars are motivated to undertake, because as one learner noted, ,the amount of information can truly be overwhelming, and a large part of the success of this exercise seems to lie in not only how to use the [digital] tools to the best advantage, but in…avoiding dead-ends" [17].

Even if students are afforded the space to tinker with digital tools, they often lack the ability to understand the raw data they are gathering, particularly if it is quantitative data. As Jonathan Howell argues, "…quantitative literacy ought not to be regarded by the instructor in a non-STEM field as an add-on to existing course content, but ideally as an integral part of teaching students how to be a historian/anthropologist/classicist/etc" [18, p. 16]. The past 3-4 months have provided an instructive illustration of the dangers of quantitative illiteracy if one is willing to look. The COVID-19 outbreak has provided an unparalleled (I refuse to use the word "unprecedented", given its overuse and abuse lately) deluge of quantitative data for public consumption. There have been daily updates of test rates, positive test results, negative test results, hospital admission statistics, ICU admission statistics, daily deaths with COVID-19 listed as a potential cause, deaths of people who had previously tested positive for COVID-19, care home deaths, and now "R-numbers." Despite all this raw data, it has been painfully obvious that many (including the media and politicians) are ill-equipped to parse the numbers and to understand what the numbers mean and what they do not mean. Similarly, as quantitative analyses become increasingly present in musical analysis, it is important for the field to consider how it can teach students how to value these analytical techniques and the data they generate, evaluating the assumptions inherent in the methods and tools and thereby critically evaluating the conclusions that result.

Moreover, focusing solely on digital and quantitative methods provides students with a limited scope and therefore hampers their ability to critically evaluate those methods. As suggested by Paul Fyfe the combina-

tion of analogue and digital methodologies gives students the requisite space for critical observation. In a class on *Pride and Prejudice*, Fyfe comments, „Unplugging the search engine can help students perceive the limitations as well as the possibilities of what makes these engines run: pattern matching, which by itself is a far cry from reading at any distance. It sharpens students' attention to forms of analysis that explore the analog and digital domains along a continuum. It helps students to interrogate the various kinds of readings they can do therein. And it reveals all of those kinds of readings as actively constituting critical interpretations" [19]. Critical evaluation of digital tools, resources, and methods - even such as music encoding - require students first to have discipline-specific knowledge of music. They then should be trained in how to encode that music before they are given space to play around with various approaches to encoding music. Whether or not quantitative methods have been used, the students need training to illuminate the strengths and weaknesses of the encoding techniques they have employed. Finally students need to be able to compare these digital methods with analogue versions of the same.

Collaboration

In addition to digital literacy, digital pedagogies in music should include skills in collaboration. This may be an area of discomfort for many music theory scholars and musicologists, who, as noted by Kris Shaffer, prefer working in isolation [20]. However, one of the hallmarks of the digital humanities has been the promotion of collaborative research. Digital humanists freely recognize that no one person possesses the requisite skills and knowledge to produce a high-quality digital resource. Students should therefore be confronted with this reality: they may not be able to master all things musical while also trying to master all things digital. They should therefore be encouraged to specialize and then to collaborate with those with complementary specialties.

Even so, as Rebecca Frost Davis asked, "..but how do you *teach* collaboration?". This question has been problematic in DH pedagogy, particularly in terms of assigning credit in assessments. Recognizing the potential inequity of assigning all group participants the same grade regardless of their contribution level, some have innovated systems of assessing each person according to their contribution to the group's final output.

While I do not pretend to have solved the issue, I have found one method that works with my Music Curation and Analytics students while avoiding some common pitfalls. From the beginning, I was confronted with the reality that most of my students do not know how to read Western music notation and that I did not have the time to provide significant training in this while also covering aspects of encoding and curating notation data. Two other facts were also clear to me as I was planning this course. First, students rarely invest the amount of time outside of class that the University recommends they do (for humanities, 9 hours of prep for every hour spent in class). Second, students are often frustrated by graded group projects because of the inequalities that often surface. My solution was to have a scheduled session at the beginning of each week during which students have structured time to prepare for the week's lecture. During that period, they were given a brief introduction to the week's topic, and then they were asked to "play" together in groups, trying to accomplish some set tasks that are unassessed. The following day we discussed their group work during the lecture. This was then followed by a lab period in which the students were individually assigned an assessed task that builds on that week's group activity and lecture. During the first week's group session, I told the students that they could form their own groups, but I made sure that each group had at least one person who could read music. For the tasks relating to music notation (i.e. using MuseScore to transcribe a piece of music or encoding a piece to MEI), the person who could read music was asked to assist those who could not. This approach to group work was largely successful, as by the end of the semester the students were working well together not only on the group activities but also on their individual assignments. In fact, several of the students remarked that the group session helped them to better understand both lecture content and to be better prepared for the assessments.

Conclusion

Imagine a situation in which a music theory instructor is teaching about chord progressions, and asserts that an Authentic Cadence is the most common and most authoritative way to end a piece of tonal music. Immediately a student shouts, "Prove it!" I daresay the vast majority of instructors today would not be able to prove it, even though they might be able to point to some important examples, While complete proof might be outside our grasp (particularly considering how little music throughout history has been preserved), it is well within the realm of possibility that said instructor could run a quick script on a large corpus of music and show said student that an Authentic Cadence is indeed most prevalent. At the same time, however, said instructor could simultaneously discover that a VI-I cadence is also common in a certain group of pieces, which then could provide an avenue of investigation for both the instructor and the class. However fantastical this story may seem, situations like this arise on a regular basis within digital humanities classrooms around the world, even if on a smaller scale. With training and a strategic approach to digital methods implementation, the same could be true for music classrooms.

Some historical musicologists or music theory scholars might recoil at what has been presented here as too statistical or at least too unsettling and computer dependent. After all, much of what I have advocated here requires a reconsideration of the ways in which we approach music history, literature, and theory instruction, even at the most fundamental levels. And yet, the music encoding community offers a supportive atmosphere for those who want to incorporate encoding into their research workflows. As this community continues to grow and as music encoding continues to become more prevalent in research methodologies, we must consider the future and particularly how these methodologies can be passed on to the next generation of researchers. So, while communities such as ours may not be able to realize a change in music history or music theory curricula by ourselves, we can encourage those respective communities to update and expand their methodologies. Indeed, we can continue to promote the latest innovations in digital methodologies at national meetings and focused workshops, and thereby continue to highlight the benefits of employing digital methods within those respective fields. We can also start developing hierarchies of digital pedagogy as guides to both professional societies and individual departments for incorporating digital methodologies into their curricula. Finally, as you "go out" to your institutions (I am speaking in the digital sense since we remain in our homes for this conference), consider how you could either start incorporating music encoding and digital methods into your classes or alternatively how you might encourage your colleagues to do so. Indeed, by promoting best practices in both research and teaching as a collective, we can, like Boehm, look ahead to our own fourth, fifth, and sixth generations of music encoders and the exciting innovations that will accompany them.

Works cited

[1] Hirsch, Brett D. "</Parentheses>: Digital Humanities and the Place of Pedagogy" in *Digital Humanities Pedagogy: Practices, Principles and Politics,* ed. Brett D. Hirsch. Open Book Publishers, 2012.

[2] Morris, Michael. "Decoding Digital Pedagogy, pt. 1: Beyond the LMS". Posted on *Hybrid Pedagogy* (5 March 2013), https://hybridpedagogy.org/decoding-digital-pedagogy-pt-1-beyond-the-lms/

[3] Croxall, Brian, and Adeline Koh. "Digital Pedagogy?". Posted on *A Digital Pedagogy Unconference at #MLA13* (2013), https://www.briancroxall.net/digitalpedagogy/what-is-digital-pedagogy/

[4] "digital, n. and adj.". *Oxford English Dictionary Online.* Oxford University Press (March 2020), https://www.oed.com/view/Entry/52611?redirectedFrom=digital

[5] Boehm, Carola. "The discipline that never was: Current developments in Music Technology in higher education in Britain" *Journal of Music, Technology and Education* 1, no. 3 (2007), 7-21, doi: 10.1386/jmte.1.1.7_1.

[6] Boehm, Carola, Russ Hepworth-Sawyer, Nick Hughes, and Dawid Ziemba. "The discipline that ‚became': Developments in Music Technology in British higher education between 2007 and 2018" *Journal of Music, Technology & Education* 11, no. 3 (2018), 251-67, doi: 10.1386/jmte.11.3.251_1.

[7] Inskip, Charles, Frans Wiering. "In their own words: using text analysis to identify musicologists' attitudes towards technology" in *Proceedings of the 16th International Society for Music Information Retrieval Conference* (ISMIR 2015), 1-7. https://www.researchgate.net/publication/291096095_In_their_own_words_using_text_analysis_to_identify_musicologists'_attitudes_towards_technology#fullTextFileContent

[8] Garwood, Deborah A., Alex H. Poole. "Pedagogy and public-funded research: an exploratory study of skills in digital humanities projects" *Journal of Documentation* 75, no. 3 (2019), 550-76, https://doi.org/10.1108/JD-06-2018-0094.

[9] Battershill, Claire, and Shawna Ross. *Using Digital Humanities in the Classroom.* London: Bloomsbury, 2017.

[10] Cordell, Ryan. "How not to Teach Digital Humanities" in *Debates in the Digital Humanities*, ed. Matthew K. Gold. Minneapolis: University of Minnesota, 2016, https://dhdebates.gc.cuny.edu/read/untitled/section/31326090-9c70-4c0a-b2b7-74361582977e#ch36

[11] Locke, Brandon T. "Digital Humanities Pedagogy as Essential Liberal Education: A Framework for Curriculum Development" *Digital Humanities Quarterly* 11, no. 3 (2017), http://www.digitalhumanities.org/dhq/vol/11/3/000303/000303.html

[12] Katherine D. Harris, "Play, Collaborate, Break, Build, Share: ‚Screwing Around' in Digital Pedagogy, The Debate to Define Digital Humanities...Again" *Polymath: An Interdisciplinary Arts and Sciences Journal* 3, no. 3 (Summer 2013), 1-26.

[13] Spiro, Lisa. "‚This is Why we Fight': Defining the Values of the Digital Humanities" in *Debates in the Digital Humanities*, ed. Matthew K. Gold. Minneapolis: University of Minnesota, 2016, https://dhdebates.gc.cuny.edu/read/40de72d8-f153-43fa-836b-a41d241e949c/section/9e014167-c688-43ab-8b12-0f6746095335#ch03

[14] Koh, Adeline. "Introducing Digital Humanities Work to Undergraduates: An Overview". Posted on *Hybrid Pedagogy* (13 August 2014), https://hybridpedagogy.org/introducing-digital-humanities-work-undergraduates-overview/

[15] Howell, Jonathan. "When Technology is too Hot, too Cold or Just Right" *Emerging Learning Design Journal* 5 (2017), 9-18, https://digitalcommons.montclair.edu/cgi/viewcontent.cgi?article=1020&context=eldj

[16] Sayers, Jentery. "Tinker-Centrick Pedagogy in Literature and Language Classrooms" in *Collaborative Approaches to the Digital in English Studies*, ed. Laura McGrath. Logan, UT: Computers and Composition Digital Press, 2011, https://ccdigitalpress.org/book/cad/Ch10_Sayers.pdf

[17] Alonso Garcia, Nuria, Alison Caplan, and Brad Mering. "A Pedagogy for Computer-Assisted Literary Analysis: Introducing GALGO (Golden Age Literature Glossary Online)" *Digital Humanities Quarterly* 11, no. 3 (2017), http://www.digitalhumanities.org/dhq/vol/11/3/000323/000323.html

[18] Howell, Jonathan. "When Technology is too Hot, too Cold or Just Right" *Emerging Learning Design Journal* 5 (2017), 9-18, https://digitalcommons.montclair.edu/cgi/viewcontent.cgi?article=1020&context=eldj.

[19] Fyfe, Paul. "Digital Pedagogy Unplugged" *Digital Humanities Quarterly* 5, no. 3 (2011), https://www.digitalhumanities.org/dhq/vol/5/3/000106/000106.html

[20] Shaffer, Kris P. "A Proposal for Open Peer Review" *Music Theory Online* 20, no. 1 (February 2014), https://mtosmt.org/issues/mto.14.20.1/mto.14.20.1.shaffer.php