11. The Interface between Classical Music and Technology

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In March 2020, when music and performance institutions across the world emptied their halls, canceled their programs, and closed their doors for the foreseeable future, it was anyone's guess what would crop up in the void. What we have seen, heard, and maybe watched "live" are various innovative attempts, within the constraints of our biological circumstances and media infrastructure, to provide some sense of continuity to an art world completely interrupted. The MET's At-Home Gala, the offerings of individual artists from their homes, the coffers of video archives freely opened—all awkward-to-melancholic-to-desperate expressive outlets during separation—are dangled carrots of eventual reunion.

Before the reunions happen, our attempts at musical gathering in this liminal space might be the driver of improved technologies, or tech newly entrained to the values and needs of this moment.[2] For one, we like to hear each other, and so far our mainstream live video technologies only have basic functionality around the complexity of sound, in particular of sound that is comprised of more than one input (e.g., a

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1   The views, thoughts, and opinions expressed in this chapter belong solely to the author, and not to the author's employer, organization, committee, or other group or individual.

2   For one small example, the videoconferencing tool Zoom is set to release a "zero latency" version in September 2020, specifically to respond to the sonic shortcomings of the platform.

piano and a voice; a violin, and a guitar, and a bass).[3] While most people are longing to exit the livestream format and get back together again, this concentrated moment of livestreamed musical performance might nonetheless drive improved tech-sonics of the live-by-video concert and pedagogical world. We are hearing, in this forced scenario, what is not working, and what we are missing. And those are chances to drive our technological soundscape toward new ideals and demands. But we are also given an almost perfect experimental environment in which to ask, what are the effective mechanisms of liveness, learning, synchronicity, togetherness?[4]

This lays bare a tension that arises in the remainder of this essay—for all the rapid developments of technological innovations that make things "easier," "better," or "more accessible," at what point and pace does the residue of those growth spurts become slick with loss? What are we left with when technologies stand alone, six feet, or six thousand miles, apart? In other words, there is a longing for in these moments of estrangement—in our educational, social, and creative realms—for something a livestreamed concert or a remote learning environment might never provide. To be sure, the capacities we currently have thanks to our digital tools have been lifelines in this moment, and even opened some remote (to indulge the pun) creative spaces for artists, learners, and institutions. Yet perhaps it has never been so easy to argue the value of gathering, to explicate nearness and community as drives and values many of us share. While our livestreams and our digital archives and our mechanisms of staying digitally connected have been invaluable tools of continuity during this time of estrangement, and will likely get much more use in a post-COVID world, it is easier than ever to realize their status as complimentary, rather than complete.

Classical music and technology have been intertwined in many ways and for a long time. Instrument makers, acousticians, computer scientists, architects and printing presses have all worked to harness

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3   See, for example, Renee Fleming's performance during the MET's At-Home Gala, which Anthony Tommasini of *The New York Times* described as full of the "flawed balances" characteristic of live audio-visuals streamed from home (Tommasini, 2020).

4   Musicologist María Zuazu has recently written about the imperfect and at times generative "temporal co-presence" that "Quarantine concerts" evoke (Zuazu, 2020).

the materials and techniques used to make music and present it to audiences. As meetings of science, industry, material, and practical application, the label "technology" might apply equally to a tuning fork as a tape machine. Yet over the last two decades, the "digital revolution" has had great impact on our perception of space, time, knowledge, and sound, all factors that condition approaches to music. To talk about the interface between classical music and technology today is to talk about the interface between classical music and digital culture.

Some might hold the position that digital technologies detract from this "enduring" musical practice, lumping it in with media that otherwise, and not always happily, dominate daily life (Balio, 2014). Others tout the real-world experimentation, convenience, access, growth, and quality that the use of digital technologies in classical music settings has catalyzed (Schienen, 2012). While it might be assumed classical music's long history allows it to absent itself from the issues currently raised by new technologies, the classical music community does necessarily respond to them, in one way or another, and certainly not always with consensus. For every collection of classical music listeners who commit to analog formats and high-quality audio, there are just as many who celebrate the abundant access of digital streaming services. For every ensemble that emphasizes live concert hall performance, there is another who sees a future in the digital video archive or simulcast. And for every group of composers who explores the potentials of traditional instruments (and not always traditionally), there is another who writes in Logic or for lightbulbs.

We do not wish to give the impression that these issues have resulted in a chasm, with ideologues divided on each side; rather, they have created a cacophony, whose noisiness might productively point to what's next. "Technology" is not a teleology; on the contrary the current moment in classical music and in culture writ large speaks to how much technology and its enlistment in creative practices, access, circulation, and aesthetics is up for meaningful debate.

This chapter aims to take on the particularities of the possibilities and challenges that emerge out of the meeting of classical music practices and digital culture more broadly. It addresses some of the implications of digital media on classical music creation, transmission, and education while touching on related questions of access, performance, archiving,

and listening. In closing we suggests some avenues for further thought and practice, and address these themes in relation to what has been revealed in the world-under-pandemic moment in which we currently live and work.

Musical Creation

From a strictly musical point of view, technology has evolved so quickly that in many cases it outpaces our contemporary understanding. At the same time, many institutions seem to have maintained a nineteenth-century approach to the enjoyment of music. They follow a model that aims to mostly select productions from among one of the twenty most famous operas of the repertoire, or to connect concerto and symphony in a single program. Meanwhile, from the 1950s on, many composers have expanded upon these conceptions, or taken up new methods. Much composition explores, sometimes in a very radical way, the electro-acoustic possibilities of venues and often these traditional "music temples" are not equipped to match such ambitions: many major international concert halls are still unable to program some of the works of John Cage, Iannis Xenakis, Annea Lockwood, Luciano Berio, Karlheinz Stockhausen, Kaija Saariaho, or Pierre Boulez, even though some of these masterpieces combining instrumental compositions and synthetic sounds were completed nearly forty or fifty years ago.

Recent forays into new programming have suggested to us what the future might bring: major technical advancements that will improve our abilities to amplify and spatialize sound. This will allow us to easily improve the control of sound in concert halls in order to, for example, increase or reduce reverberation in real time, or program works composed specifically with sound spatialization in mind (see, e.g., Malham & Myatt, 1995; Peters, Braasch, & McAdams, 2011). Such systems will meet many musicians' demands to incorporate, in a piece or a concert, electronic sounds and modified voices, as well as other artistic media. In ten or twenty years' time, these new devices will likely be incorporated into both new concert halls and older, already established ones.

There are recent examples, too, of works that challenge the traditional boundaries of the concert hall and engage new technologically-enabled

performance practices. "Invisible Cities: An Opera for Headphones," composed by Christopher Cerrone and commissioned by The Industry and L.A. Dance Project is one example. The opera was performed in Los Angeles' Union Station in October and November of 2013—while the quotidian life of the train station continued around it—as a sold-out ticketed audience participated. Or, very recently, the International Contemporary Ensemble's performance of Ashley Fure's "The Force of Things: An Opera for Objects" (2017) was delivered at the Gelsey Kirkland Arts Center in Brooklyn, NY in 2018 as part of Lincoln Center's Mostly Mozart Festival. The work garnered critical praise and what audiences described as a profound, disturbing, and memorable musical experience.

There are of course myriad examples that could be added to this list, but the question remains for those committed to or interested in more traditional repertoire of what, if anything, digital technology has to offer music composed with different materials and techniques in mind. Yet music, including that which might be called "classical," is no stranger to technological revolution, and in fact even the most narrowly- or conservatively-defined classical music benefitted from innovations in instrument building, print technologies, concert hall acoustics, and early recording.[5] Music was also one of the first artistic disciplines to integrate acoustic, electronic, and analog techniques in an experimental way. We contend that classical music might well benefit from digital technologies today.

Transmission

Music was one of the first industries to be transformed by the unexpected expansion of peer-to-peer networks, file sharing, and, within the last ten years, streaming. New devices and audio formats seem to have facilitated a democratization of listening, even if these fundamental mutations force us to be both prudent in our judgment and extremely

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5   See, for example, Emily Thompson's important and exhaustive 2002 book, *The Soundscape of Modernity*. For earlier examples of the intersections of science, technology, and music, see Jackson, 2006.

engaged. Today, the rise of Creative Commons,[6] as a part of a new sharing ecosystem, for example, offers us the promise of an immense amount of knowledge, information, and creativity. Is this a new Library of Alexandria, or just a huge disorganized aggregate of texts and media? It is up to us to choose, to classify, to comment on, and to find a common or shared sense out of this abundance.

Music streaming services like Spotify, Apple Music, and Amazon can feel similarly labyrinthine and vast, and veiled in the opacities of corporate control. These services have obvious drawbacks. First, the economic model of these platforms compensates artists exceedingly poorly, at the rate of about 0.0006 dollars per stream, a fact that even those musics more suited to repeat listening and better-funded through ancillary revenue (like pop) have sought to address and improve.[7] Second, as many audiophiles have noticed, the quality of streamed audio leaves much to be desired.[8] Third, the cataloging systems for streaming services like Spotify and Apple Music bury the pertinent information a classical music listener might seek, like the names of solo artists, the date of a performance, the conductor, the movement, or any number of other descriptors that allow one to choose a specific recording. Instead, the data is reduced to "artist" and "album," making it at times difficult to find and access particular recordings.[9] Furthermore, "classical" is the only genre for which artists who upload their music to iTunes and

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6   Creative Commons is a non-profit organization that aims to organize, distribute, and make accessible "creative and academic works" that have historically existed behind paywalls in private organizations. See https://creativecommons.org/about/

7   Recently, Spotify founder and CEO Daniel Ek responded to ongoing outcry by artists about Spotify's poor artist compensation by suggesting that artists simply need to update their mode of creation to one of "continuous engagement with their fans. It is about putting the work in, about the storytelling around the album, and about keeping a continuous dialogue with your fans" (Dredge, 2020). Artists and some critics responded with vocal objection to this construction, but it is yet to be seen whether that will make much of a difference in the streaming giant's business model.

8   Spotify streams audio at 160 kbps (kilobits per second) in its standard version, about half the quality of an Mp3. The pay-only service Tidal offers "lossless compression" streaming, which is about equivalent to that of a CD. Other streaming services vary in their kbps, with most topping out at 320 kbps, or the equivalent of a standard Mp3, and less than the "definition" of CD audio.

9   Using the "Search" tool on Spotify, for instance, will yield tiered results, with "Popular" individual tracks, followed by "Merch" (merchandise), followed by "Albums." Combined-term searches have the tendency to take the user far afield from the content they seek.

Amazon streaming services are required to list a record label under which their music is released.[10] This not only creates a barrier that does not exist in other genres, it excludes new creators by adding an unnecessary gatekeeper.

Yet streaming services have their advantages, too, in particular that they give access to a great store of recordings, which is utterly unprecedented. This can be of great use not only to curious individuals, but also to teachers who are given the opportunity to assign readily-available listening to students and share listening experiences in the classroom environment, researchers looking to evaluate a large amount of material or closely listen to one rare recording, or institutions who might aggregate publicly-available playlists around a season's theme, or a conductor's or performer's previous work.

Perhaps most encouragingly, "streaming" is not confined to large commercial platforms; in the past ten years, there has been an initiative to digitize audio collections that might never find themselves as a Tidal or Amazon search result. There is the Naxos Music Library, the Library of Congress's National Jukebox, the Alexander Street video and audio streaming archive, all of which are staples in many private research libraries and some public libraries. Large institutions like Carnegie Hall, the New York Philharmonic, and the Library of Congress Digital Collections (to name just a few US-based organizations) have received generous grants to create digital archives to stabilize older analog recordings and make them available to future generations. This is of course no replacement for live performance, but these no-pay services could have some effect on providing context, history and intrigue to new listeners, and will likely reshape for researchers what it means to do "archival" research.

In this spirit, contemporary ensembles have innovated approaches to digital archives that can catalog a season's program for future viewing, highlight new composers and works, and provide new audiences an introduction to a group's or institution's approaches to performance. One sophisticated example is DigitICE, the digital video archive of the International Contemporary Ensemble, which allows the user to search by composer, season, location, concert hall, performer, and instrument.

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10   As of 2018.

It is a place to browse a decade of performances, or search out exemplary new repertoire for bassoon, hammered dulcimer, electronics and so on. It is hosted on an integrated webpage that places this archive alongside ways to view upcoming events and buy tickets, see upcoming educational workshops, and read about participating artists, all of which encourage participation and engagement "out of the box".

Of course, real-world engagement is the aim, but it must be acknowledged that before concert-goers visit any performance space, they most often make first contact with institutions' and artists' digital platforms, whether they are archives or simple, ticket-issuing webpages. These are places where visitors are able to discover the program of the season, watch videos of previous performances, and possibly buy tickets for concerts or other activities. As such, web design for these platforms is a worthy (and relatively inexpensive) investment. Based on the fact that there is rarely a professional or fledgling ensemble or institution without an Instagram and Twitter account, Facebook page, and YouTube, or Vimeo channel, we also recognize the ways social media "branding" has come to seem like a prerequisite for representation and audience engagement. We might lament this reality if it does not extend far beyond things such as the likes, shares, and views usually used to calculate value in digital space. While the specifics of social media strategy are not our focus here, we do contend that there are novel possibilities for how participation in this part of the mediascape might cultivate excitement around places, performers, and ensembles, and translate into real-world encounters.

Another shift in transmission that digital technology has facilitated is the recording and broadcasting of live concerts on apps and websites. Although we think this is a positive move, it has not sufficiently opened doors in ways some institutions had hoped. For example, The Berliner Philharmoniker launched its "Digital Concert Hall" over ten years ago, which allows customers an unlimited access to all live concerts and archives. Approximately 22,000 paying users are registered, including 75% non-German viewers. This result is, without a doubt, inferior to what was initially projected. The high subscription cost of this business model is surely the cause of these disappointing results.[11]

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11   In 2020, the subscription cost was 134 euros ($151) for a twelve-month ticket.

These examples show the scale of the challenge musical institutions face. It is however certain that digital media are a key to facilitating and encouraging access: access to youth, openness towards artistic disciplines and techniques, and an eye on and towards the international. However, in the current moment a working business model is almost impossible to find. Many concert halls have recorded their concerts and offered them in open access on their websites. From a long-term perspective, this approach could be beneficial. Thus, the Cité de la musique Philharmonie has now over three thousand five hundred hours of video and audio recordings, which are about to become an important database for educational tools as well as the subject of specific agreements with private internet operators worldwide.[12]

Education

Concerning classical music education, our efforts and investments only fully make sense if we are able to clearly define our priorities. Pedagogy across disciplines is grappling with how to present, test, and train material in light of new tools and shifting realities of classroom equipment, attention, and educational expectations. Music is no different, and as noted elsewhere in this report, there are several levels on which musical education has changed in recent years, and not necessarily in relation to digital technologies. For our part, we focus on some possibilities of digital educational tools for children, researchers, and audiences.

Digital educational activities are best, of course, if they coexist with more traditionally embodied activities. Children and teenagers might discover the beauty of woodwind and brass instruments, learn to sing and dance, collaborate in person to perform and compose, while *at the same time engaging* digital pedagogical tools offering rewarding tactile and intellectual experiences, complimenting instead of replacing more traditional approaches. With that in mind, we should focus and look at digital tools as cognitive possibilities: such technologies can empower

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12   The full collection may be accessed at the multimedia library of the Philharmonie de Paris, as well as through an internet network for French public libraries and high schools. A collection of 100 hours of video may also be accessed via the platform "Philharmonielive". For more information see https://bit.ly/2TgqIGG and https://pad.philharmoniedeparis.fr/comment-ca-marche.aspx.

the young musician, giving her/him/them both the means to progress and to develop her/his/their curiosity.

Music creation and mixing apps that one can manipulate without any prior knowledge of theory provide interesting examples for children. Some of them are designed so well that they come close to being true artistic objects. We are referring, for instance, to the cost-free app *Toc & Roll*, which enables children to compose songs using a multitude of sounds. New digital tools might also promote the creation of an innovative educational discourse on music, which will be key in maintaining a fascination for classical music over generations. An interesting example is the app for iPad made by Esa-Pekka Salonen and the Philharmonia Orchestra, named *The Orchestra*, which enables the user to listen to a piece while reading a scrolling score and watching the movements of the conductor.

For researchers, Digital Score archives at places like the Morgan Library & Museum in New York, the International Music Score Library Project based in Canada, or the Loeb Music Library at Harvard University make available a host of rare manuscripts, public domain works, and lesser-known compositions that can be studied, analyzed, or played without or prior to visits to the institutions that house them. They also make it possible to share these works in the classroom, and open students up to works that might fall outside of narrowed and reduced canons of works. On the business research side, digital data analytics services can help us understand how new audiences are constituted, what they are interested in, and thus adapt our discourses in accordance. Data analysis and services related to ticket sales are evolving towards counseling and guiding more and more "independent" visitors, precisely the kind of visitor classical music has most precipitously lost over the last thirty years.

For audiences, institutions might harness their web platforms to offer interactive content around a piece, a season, or a performance. Program notes and pre-concert talks can be useful in clueing audiences in to details about a work they might not otherwise know, yet these institutional standbys might at times feel a bit stale to new audiences. Player, composer, and conductor testimonials, "behind the scenes" looks into rehearsals, and short video documentaries that provide historical context for works from 1450 or 1980 are some of the ways to deepen

audience engagement pre-concert. These kinds of materials might easily be included and sent along with a digitally-purchased ticket.

We must combine our knowledge of pedagogy, entertainment, design and programming, and find ways to connect these new tools to the artists, the orchestras as well as to concert halls. Presumably, we should bring artists and spectators closer, gather energies and talents, and contribute to the education of younger generations. If we want to share classical art with the largest and most diversified audience, we must try to redefine all the elements that make up the mass of experiences and knowledge that will then enable us to generate new ties with music lovers.

Conclusion

That people love various kinds of music and in various ways is evident in every corner of daily life; but no fan, practitioner, or institution of any genre is entitled to the fandom and participation of "new" or "diversified" audiences. Technologies that present things differently in order to make them more readily available, and offer context, education, and possibilities for artistic innovation, do not themselves guarantee that new audiences will be bitten by the classical music bug. They do, however take seriously contemporary realities of saturated and diffracted art markets; the way standard repertoires may appear opaque or alienating to newcomers; and the desire for musical experience to speak to quality as well as relevance, accessibility, and personal and communal significance.

The degree of hopefulness around digital technologies presented here is not an uncritical one. "Digital" does not flatly translate into the more complicated ambitions of "education," "engagement," or "access". Meeting these aims requires a level of media facility among the community that allows individuals and groups to critically assess, navigate, and make use of things like digital archives, streaming audio, and digital educational and data analysis tools. Not all of these things are equally useful or well-designed, but without some degree of media literacy it is difficult to tell the difference, and even more difficult perhaps to suggest improvements to these relatively young technologies that might serve classical music makers, programmers, and listeners.

Of course, engaging with and building new structures for technology in music is not an end in itself. Yet arguments that stabilize "classical" by asserting its perennial quality[13] are unsurprisingly baffled by how to grapple with an ever-changing technological landscape. While these times seem overwhelmed by disagreement and change, it is worth remembering that very similar questions have been asked before (see, e.g., Dolan, 2013; Jackson, 2006; Bijsterveldt & Pinch, 2003). The challenge is how to avoid nostalgia for norms without falling into the fetish of the new, or newly mediated. In other words, we should approach with as much caution the discourses that claim classical music as transcendent and universalizing as those similar discourses that attribute those ideals to technology.

Nonetheless, we contend that digital culture *is* the culture in which classical music is currently embedded, and in which it might thrive in a real-world context. As we see it, a robust classical music future requires neither a wholesale adoption of new media, nor a protectionist rejection of what these media might offer. Instead, it requires a community committed to confronting a changing world, and finding a home for the art it prizes within it.

Coda: Black Lives Matter
Catherine Provenzano

In June 2020, after the police killings of Breonna Taylor in Louisville, KY and George Floyd in Minneapolis, MN, and with the momentum of recent memory (Sandra Bland, in 2015; Michael Brown, in 2014; and Tamir Rice, in 2014; to name just a fraction of similar tragedies) and the centuries of oppression behind them, millions of people took to the streets with calls for a restructuring that have reverberated through just about every institution in the United States, and beyond. This is a time of accountability and opportunity, and there is no need to go back to a "normal" that, for so many, never appealed, or never worked.

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13   To quote the "independent, non-partisan, and nonprofit think tank dedicated to classical music," Future Symphony, classical music is "eternal and transcendent," and "stands outside of time, and looks lovingly from its vantage point across the wide panoply of history".

This moment also takes to task the ideals of community engagement, education and accessibility, the responsibility for which we so often pass off to new technological interfaces and tools, as though these are going to fix the problems of racial oppression and economic injustice that permeate the classical world. This is not to say that artists and institutions have not engaged technology in profound creative ways, or to diminish the fact that artists of color so often make up the vanguard of technical and technological experimentation and practice in musical forms. It is simply to emphasize that no digital tool is going to change the white-dominated and deeply classist lineage and current reality of the North American classical music world. At least in North America, and to varying extents in other places, classical music has been bolstered by its proximity to, even its very index of, governmental and financial power, class status, and cultural capital, to use Pierre Bourdieu's famous term. In the US, this power and status has in many historical instances been built upon the explicit exclusion and othering of Black people. What we are seeing now is that the "technological savior" narratives that are both upheld and papered over by the new offerings of technological advancement (e.g., "This new tool might help Black and Brown children become interested in classical music!" or, "Now that we have made concerts available online, more people from all walks of life will feel comfortable in our concert halls!", to exaggerate somewhat) are no longer going to work.

But what will work? Anti-racism, a term many have learned over the last few months, means a commitment to active restructuring, space building, accountability, resource allocation, and policy change that is far from the passive "non-racist" laurel-resting that stops, contentedly, at representation without enacting any real change for individuals and communities. Lest this seem like too high of a mountain to climb, the insight on how to move forward is everywhere, offered (not just, but especially) by Black artists and administrators (see Woolfe & Barone, 2020; and Lewis, 2020), by the members of our institutions we tend to take care of the least, like staff, teachers, custodial, and tech support workers. There are organizations such as Chineke! Foundation in the UK, and the Sphinx Organization in the US, which work to redress the imbalances in opportunity and education that have accumulated in

classical music spaces and practices.[14] And the art is everywhere, too, we simply haven't programmed it (see Lewis, 2020; and the Black Music History Library). Anti-racist work happens at every single level, from there interpersonal to the institutional. But it bears stating that it is not the sole responsibility of people of color in our musical communities to educate those of more power and privilege on these issues—that requires a voluntary willingness and commitment from individuals ready educate themselves. What if, in that spirit, we heard what our colleagues have to say? Heard, and took seriously, those alienated by the current institutional structures and workings? Heard, and took seriously the artworks of those the classical world has thus far tokenized at best and ignored at worst? The good news is, these hearings draw on a skill and a value that brought most of us here in the first place—a desire to listen.

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14   Chineke! Foundation, https://www.chineke.org/. It is also worth watching founder Chi-chi Nwanoku's introduction to the Foundation https://www.youtube.com/ watch?time_continue=212&v=oepETzk0YLU&feature=emb_title ("Introduction the Chineke! Foundation", 3:32, posted online by Chineke! Foundation, Youtube, 28 April 2017).

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