Conducting During COVID:
What is possible and how has the role of the conductor changed?

BY RACHEL CARLSON AND SCOT HANNA-WEIR

Spending hours in front of a mirror fine-tuning the most subtle of wrist flicks to maximize our expressivity of gesture might feel less relevant during the COVID-19 pandemic. With so much of our choral music making moving online, it feels like all of our previous musical training that made us expressive and effective conductors and teachers is now no match for these new, unfamiliar circumstances. It is true that while there are still gestural ways to communicate with our ensembles over video conferencing software or live-remote performance tools, our gesture is not currently the primary mode of conducting our singers.

Conductors are managing practice tracks, recordings, volume levels, and a host of apps and programs in the hopes of still creating music together. Of course, new circumstances require new ways to make music, but at the same time, some of the tried-and-true methodologies of rehearsing, teaching, and performing are still fundamental to how we lead our ensembles virtually. Rehearsal techniques that have been effective during in-person rehearsals can be easily adapted to remote music making, and we can focus on what kinds of tools continue to allow our musical intelligence, the core of our conducting experience, to guide and inspire our singers to perform their best, no matter where these performances occur.

Of all the many challenges facing the conductor, this article addresses three specific topics. First, how do we adapt our gesture and rehearsal technique for online synchronous rehearsals and performances? Second, what is the role of the conductor in creating virtual choir projects with pre-recorded individual videos? Finally, how do we train and educate early-career conductors during and in response to this pandemic?

When meeting our choirs synchronously online, two different environments are available. The first is the mass market, high-latency and low sound quality environments of video conferencing software like Zoom or Google Meet. These software have the benefit of being widely available and already adopted by many educational institutions, giving our singers access to a learning and performing environment that many are already using in other areas of their lives (provided they have reliable internet, which is of course a larger access and equity issue). Unfortunately, these software were not specifically designed for live-remote music making, so the conductor must navigate many challenges when using them for choral rehearsal and performance. The second option is a low-latency platform designed for musical collaboration across the internet, such as JamKazam or Jamulus. While these software require more complicated setup, with patience, some technical knowledge, and proper equipment, these tools can allow for live rehearsal and performance that can feel much more like we are singing together in the same room.

Conducting High-Latency Video Conference Rehearsals

Running live-remote rehearsals on Zoom, Google Meet, or a similar video platform is much more technologically accessible for the singers and works better with large groups, but often introduces too much la-

tency and noise suppression for the singers to be able to sing together audibly in real time. Conductors can instead run rehearsals where singers all mute their microphones and sing along with the piano or a recording at home without being able to hear the other singers in the choir. The conductor can lead them through a vocal warm-up at the piano and a piece or several pieces of music that the choir sings together with a recording. This repertoire could include shorter octavos or a larger work, depending on the needs and interests of the choir. The conductor can share their audio and their screen in order to stream recordings of the music and an image of the score. Some conductors conduct along with the recordings to give visual cues to their singers. Sharing a video with a scrolling musical score that accompanies the audio recording or using a tablet with a foot pedal for page-turning can free up the conductor's hands for conducting or managing audio levels or other technology. While neither the singers nor the conductor may be able to hear the ensemble, this can still provide connection for isolated singers and help them continue to sing regularly.

Other conductors are running more traditional rehearsals on video conferences, where they are rehearsing music for either a virtual or live performance. Once again, it is challenging to rehearse without being able to hear the singers, but the conductor can imagine what the singers might sound like and provide verbal or gestural cues based on what they might hear. This feedback might be influenced by the work that the conductor has done previously in-person with the choir or challenges inherent in the piece of music that would be difficult for most singers. It is helpful to leave extra time to engage in a dialogue with the singers about what is going well, what parts of the piece present a problem or a challenge, and what questions the singers have. Asking singers to submit recordings of themselves singing between rehearsals would also help the conductor provide more accurate feedback about what they are actually hearing in the recordings.

Conducting Low-Latency Live-Remote Rehearsal/ Performance

JamKazam, JackTrip, SoundJack, and Jamulus are some of the specialized software designed for low-latency, live-remote music making. While most of these software have been around for some time, the pandemic sparked a sudden interest in finding technological solutions to our physical isolation. Each piece of software described above carries with it specific equipment requirements and network connection speeds, but when properly configured they can create an environment that allows live musical collaboration for rehearsals and performance (Table 1).

Peer-to-peer software like SoundJack, JackTrip, and JamKazam all require an audio interface and microphone (although these can be combined into one microphone as in the popular Blue Yeti). This can be a particular barrier for outfitting a volunteer ensemble or singers in a program without sufficient resources to provide these devices. Peer-to-peer software also works best when singers are geographically near one another, as the increase in distance between participants increases the latency of the session. Jamulus, on the other hand, uses a centralized server, which can provide a better average latency for more geographically dispersed ensembles. While it is possible to connect to these programs over WiFi (and indeed, both authors have had success with singers in these circumstances), there is a noticeable improvement in quality of audio and reduction in latency if a participant can directly connect to the internet via an ethernet cable.

The technical setup for using any live-remote software will take longer and require more individual troubleshooting than with other methods, but once this is accomplished the role of the conductor changes in some significant ways when running a live-remote rehearsal on Jamulus. The authors have both found Jamulus to be incredibly useful. (The Santa Clara University Chamber Singers were the first university ensemble in the country to perform a live concert after the pandemic started using Jamulus and both the Shepherd University choirs and the DC-based Six Degree Singers have been using Jamulus regularly in rehearsal environments.) Particular issues related to setup and technology needs for Jamulus have been well documented by the Choral Composer/

Table 1. Setup Requirements for Online Collaboration Tools

	Video Conferencing Software (e.g., Google Meet or Zoom)	**Centralized Server Live-Remote Audio Software (Jamulus)**	**Peer-to-Peer Live-Remote Audio Software (SoundJack, JackTrip, JamKazam)**
Minimum Hardware Requirements	Smart Phone, Computer, or Tablet	Computer, Headphones	Computer or Fastmusic Box,[1] Audio Interface, Microphone, Headphones
Preferred Hardware Requirements	Audio Interface and microphone for conductor or accompanists. Enabling "original sound" and using "High Fidelity Music Mode" is recommended in Zoom if sharing live musical sound using a hard-wired internet connection.	Hard-wired Internet Connection, Dedicated Audio Interface, Quality Microphone	Hard-wired Internet Connection
Recommended/ Maximum Size of Ensemble	Zoom: Up to 100/300/500/1000 depending on account tier[2] Google Meet: Up to 100[3]	50 singers maximum, 20-40 recommended[4]	Tend to work best with small ensembles in SoundJack and JamKazam (5-8)[5, 6] JackTrip can theoretically be configured for up to 500[7]
Other Considerations	Zoom costs money for meetings over forty minutes in duration. Google Meet and Jitsi Meet are free.	A better option for more geographically spread ensembles, but the server should be run from as centralized a location to the participants as possible.	JamKazam is rolling out tiered subscriptions that increase audio bitrate and the length of sessions available to participants. There will still be a free tier. Close proximity of participants significantly reduces latency since sharing is peer-to-peer. Best for ensembles that are centrally located.

Conductor Collective in New York and by composer Karen Siegel on their respective websites,[8] by Vocal Revolution, an a cappella group in New England,[9] and in an ACDA webinar.[10]

Even when using a video streaming platform like Zoom concurrently with Jamulus, the Zoom video will have more latency than the Jamulus audio, so conducting in real time will feel significantly ahead of what the conductor is hearing and is very difficult to maintain tempo. In addition, while there is much less latency in Jamulus, there is still some latency, so it is difficult for the singers to keep a steady beat without external support, and the tempo will inevitably slow down.

The easiest solution to the latency-caused tempo problem is to rehearse with a metronome. The conductor may need to adjust the metronome's tempo in reaction to how the choir is singing and this technique obviously works best for pieces with little to no rubato. Other external tempo aides could include midi-generated practice files or recordings, although with recordings it is harder to distinguish between the recorded singers and your singers when listening to provide feedback. The conductor may also need to monitor the volume levels of the recordings during playback to make sure that they are loud enough to be heard but not so loud as to overpower the microphone input levels.

Finally, the conductor or an accompanist could also play choral parts from the piano, as one might in a traditional choral rehearsal, but that will still introduce an element of latency and the pianist is likely to eventually slow down. It can be beneficial for singers' confidence in this new format to begin with pitch and tempo support, such as a practice file or recording and then move to the unaccompanied metronome, where the singers have less pitch support and the conductor can better hear the choir and provide feedback.

Using a traditional rehearsal technique such as the "rehearsal frame" outlined in Barbara Brinson and Steven Demorest's choral methods book, *Choral Music: Methods and Materials,* works well in a live-remote environment.[11] In a rehearsal frame, the conductor isolates a problem area, identifies, diagnoses, and solves the problem, and then puts the isolated area back into the context of the piece to see if the problem remains solved or not. The conductor then gives feedback to the singers and either continues working on the same problem area or moves on to a new section depending on whether or not the problem is still solved. In a live-remote environment, the conductor can easily rehearse smaller sections of music that are proving more difficult by isolating them at the piano and then putting them back into the context of the larger piece. Latency is less of an issue for smaller numbers of measures and accumulates over time, so this type of detail-oriented work can be approached by using more traditional rehearsal techniques.

During a live-remote performance or run-through of a piece, it is still possible for the conductor to provide gestural information that is not tempo related, such as dynamics, articulation, intensity, expression, etc. Karen Siegel, co-founder of C4: the Choral Composer/Conductor Collective, describes how she designates each corner of her screen to each voice part and points to that corner to cue that part.[12] Each conductor and choir can be creative during this time and develop gestural signals to convey relevant information during a live-remote performance. Similarly, number cues (held up with fingers) or even instructions in the chat can be used to guide performance.

Another issue of relevance to both the conductor and singers is how to manage computer screen space. Each computer will have a video platform open in order to see the conductor and choir members, Jamulus open for audio levels, and possibly a PDF open of a musical score. It is important that each singer continually monitors their audio output level on the left side of Jamulus to make sure that their microphone is neither too loud nor too soft. Singers can also adjust the volume levels of the other members of the choir in Jamulus to create their own unique balance of the group. One way to declutter the computer screen is to print out hard-copies of the score or use a separate tablet for the music; but if that is not possible, each singer should arrange their windows so that they can always see the conductor and their own audio output levels at all times.

Vocal warm-ups, ear-training, and sight-reading translate well to the live-remote platform. The con-

ductor can easily lead warm-ups from the piano and can provide feedback on the singers' tone, vowel unification, articulation, and blend. If using a concurrent video platform, the conductor can provide visual feedback by watching the singers' posture, breathing, and vowel shapes. During the warm-up period is a good time to ask all singers to check their overall delay and microphone input levels in their Jamulus settings and adjust their connection settings and microphone levels or the levels of the other singers in the group accordingly. If sight-reading is a part of the warm-up routine, conductors can upload a PDF to a website or file share where singers can open the document on their machines. After the singers look over the sight-reading example, the conductor can lead the chorus by counting them in or using a metronome.

In a live-remote rehearsal, the role of the conductor changes from establishing and maintaining tempo gesturally to managing technology, audio levels, and metronomes. However, the rehearsal techniques that the conductor employs to give appropriate feedback and problem-solve remain largely the same.

As the pandemic has continued, some tech-savvy conductors are getting even more creative as they create hybrid solutions that combine multiple technologies. Some conductors are streaming Jamulus into their Zoom rehearsals, so a portion of their ensemble can sing in Jamulus while the rest sing along in Zoom (for choir members who cannot get Jamulus to work on their computer, for instance.) Other conductors are streaming their in-person rehearsals with a portion of the choir into Jamulus so the rest of the choir can participate online. Each of these hybrid solutions requires audio re-routing software that can be complicated to set up at first, but this becomes easier with the help of online setup guides[13,14] and technical support groups such as the Facebook group, "Jamulus Choral Community." Other conductors are making music together in person using David Newman's "car choir" solution,[15] where choir members sing together from the safety of their parked cars using wireless microphones and radio signal transmissions routed into a mixer. The conductor can play the choir members' mixed sound through an amplifier system, wireless headphones, or out through the singers' car radios so the choir members can sing along. This and other outdoor solutions have been successful through the summer months.

Conducting Asynchronous Virtual Projects

Many choral conductors have turned to virtual choirs as the predominant method for creating a performance during this pandemic. In their 2020 position paper on Virtual Choirs, the National Collegiate Choral Organization (NCCO) references one of the primary challenges of a virtual choir:

> Dynamic interaction is the heart of artistic communication. The interaction of the composer's thought, the written page, and the conductor's imagination; the interaction between conductor and choir, among the choir members, between performers and audience: these are essential to creating music that has an impact on those who hear it. Often a key component of this connection is the freedom to make a new creative choice in the moment, led by some instinct or unexpected emotion.[16]

This dynamic interaction is at the heart of the conductor/ensemble relationship, but when the role of a conductor in a virtual choir is to prepare singers to successfully record their parts on their own and to provide both the resources to do this on the front end and the critical eye and ear to assemble the project on the back end, what does conducting look like? The conductor often creates their conducting video at the beginning of the project, and singers use this video to record their parts for the project. This makes conducting a fixed and non-reactive experience. While it may be the impetus for the musical performances, the conducting is not responsive or collaborative with these performances. That dynamic exchange is key to what conductors are trained to do: listen with big ears and respond to the ensemble in real-time rather than performing pre-rehearsed choreography. All of this seems impossible in the virtual context.

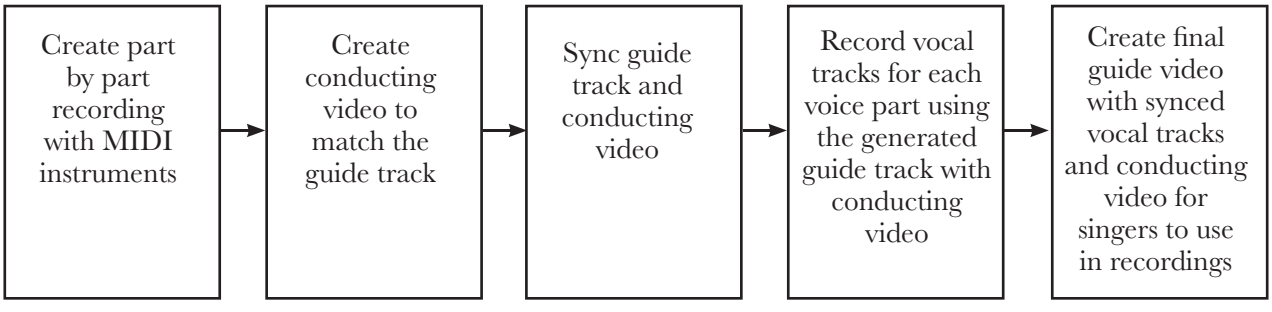
Beyond this, as much as we might hope, conducting is often less precise than we as conductors imagine it to be. While our conducting might be clear and easy to follow in-person, much of that has to do with our ability to process live performances and micro-adjust to the intricacies of how a performer or ensemble is following us. If a conductor, for example, makes a conducting track to their imaginary performance and then sends it off to their accompanist to create guide tracks, the performance may not fully represent what that conducting would have generated in a live situation. This can then create challenges when singers are listening to the guide track if it doesn't match precisely with the conducting, as every introduction of a moment of discrepancy can be multiplied by the various interpretations of the singers recording along with the track.

One possible approach, that requires a major release of our conducting egos, is to treat conducting as a reactive choice and to focus our initial efforts on crafting the guide track. In this approach, after the musical decisions are made, the guide track comes next and should thoroughly represent the artistic choices that the conductor wants each performer in the ensemble to make. Conducting can then be added on top of this pre-recorded guide track to visually reinforce what is happening. While this might feel very disingenuous for us as conductors, used to being the generator of the musical interpretation, the conducting is more likely to be synchronized to the musical ideas being expressed in the guide track, and we have more control over the musical product than we might in any kind of video exchange or conducting response (Table 2).

The benefit of this approach is that the initial source recording provides stability for the process that follows, and the conducting video clearly reinforces the artistic choices represented in the guide track. The recorded voices (which could be conductor generated or from leaders in the ensemble) are responding to the conducting gesture and the synced guide track. This process hopefully produces a more accurate and representative response to the interpretive ideas for the performance.

Similarly to live-remote rehearsals and performances, the rehearsal process for a virtual choir also varies understandably from the normal in-person rehearsal. One particular strategy that can yield a much more thorough, grounded, and pedagogical approach to creating virtual projects is to record iteratively. At Santa Clara University in the spring of 2020, the unauditioned concert choir completed a virtual project using this approach by submitting three successive recordings of the same piece with opportunities for feedback in between. After initial rehearsals and essential materials were provided, singers sub-

Table 2. An Effective Process for Creating Virtual Choirs Workflow



mitted their first recordings, and these were evaluated anonymously by their peers using a rubric. Additional resources were provided for further success, including individualized guide tracks with real singers (who were particularly successful in the first round), and the singers recorded again, trying to incorporate the feedback of their peers. For the second recording, each singer received individualized feedback from the director, and for the final recording, had the opportunity to record with a guide track augmented by a full set of eight singers roughly edited together to provide the experience of singing with a real ensemble (Table 3).

This approach encourages the "perform, evaluate, perform again" model of rehearsal, albeit over a much longer period of time than singers are used to. It particularly meets the challenges of welcoming lesser-skilled singers into these projects as they are given more time and more resources to help them succeed, and it also lessens the burden of creating performance projects because more time is spent on teaching and improving as an ensemble and individual.[17]

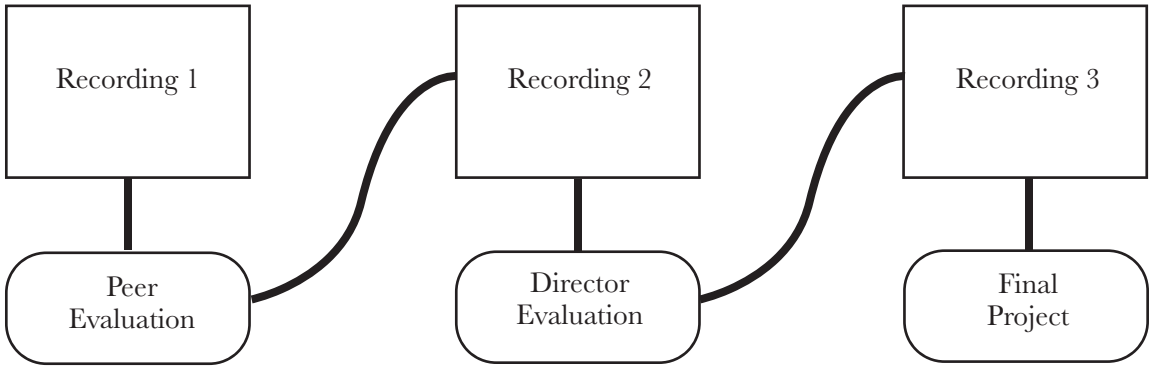
Training Conductors

In training early-career conductors during this pandemic, what do we need to teach them? Should we incorporate our new hyper-tech focused circumstances into the curriculum, and if so, how will conductors trained during this period be able to handle the challenges of in-person rehearsals when we return to normal?

Certainly one of the key components to conducting is facilitating the development of the conductor-ensemble relationship. While many of the other topics of conducting easily adapt to online instruction (e.g., rehearsal planning, repertoire selection, vocal technique, fostering inclusion and a welcoming rehearsal climate, cultural and stylistic understanding) the experience of coaching a conductor as they rehearse a live ensemble is difficult to replicate, and even if possible, is substantially different from an in-person experience. While responding to the moment that we are currently working in is important, we must continue to educate conductors for their future roles when singing returns to normal. If nothing else, the COVID crisis makes clear that training conductors to be adaptive and independent musicians is just as important as it has always been, and even more important when responding to a global crisis.

In individual conducting lessons, creating pre-recorded videos (either to create a virtual choir project or for the teacher or an accompanist to respond to) can simulate the experience of conducting an ensemble. It also gives the instructor the opportunity to watch and rewind in

Table 3. The Rehearsal Process for a Virtual Choir



real-time with the student to address successes and challenges. While not always ideal, conducting along to recordings can also be a viable way to see the gesture in action. In a webinar presented by NCCO in March 2020, Deanna Joseph noted that having students sing or speak the music while they conduct can also help create the connection between music making and gesture.[18]

Undergraduate conducting classes are successfully being delivered over video conferencing. The conducting teacher can begin by modeling the conducting exercise over video, asking the students to conduct along with them, and observing the students' conducting gestures and providing feedback. Students can ask questions if anything is unclear. The teacher may wish to stream a recording of the musical excerpt so students are more familiar with how the music sounds. Then, students can take turns conducting the class. The class will need to mute their microphones, but can still sing or play along with their classmate's conducting gestures and can provide feedback on what went well and what could be improved.

To allow for more students conducting at the same time, the teacher may wish to use video breakout rooms to put students into small groups so they can each get a chance to conduct and receive feedback from their classmates. The teacher can navigate between breakout rooms to observe students and provide feedback as well. Then the class can come back together and discuss what went well, what was challenging, and to ask questions. When teaching a group of conducting students over video conferencing, it may be useful for the teacher to have a large monitor or a second monitor so they can more easily see each conducting student. Using "speaker view" instead of "gallery view" or "pinning" the student makes it easier to focus on the student who is conducting while still being able to monitor the rest of the class.

The conducting teacher may wish to supplement video conferencing classes with asynchronous video uploads, where students make video recordings of themselves conducting the musical excerpt between classes for classmate and/or teacher feedback. An online platform such as Flipgrid may facilitate this process. This way, the students must continue to engage with the musical material between classes and can incorporate feedback into their next video each week. One plus side to responding to student videos is that the teacher can go back and rewatch the student's conducting as many times as is necessary to give proper feedback, which is harder to do in a live class setting.

When attempting to provide opportunities for experience in front of an ensemble, schools of music with graduate programs in conducting may find that they are relying on their graduate students to manage much of the new technology being implemented to run rehearsals and to create virtual choir projects. While this may help these conductors meet the current challenge of running choir from a distance, it remains to be seen how persistent these technological solutions will be when the necessity of the pandemic recedes. Individual recordings like those used for virtual choir can certainly be instructive by demonstrating mastery of a voice part individually and providing the conductor with a tool for individual assessment. Video and audio editing skills gained during this period by conductors could certainly help conductors find new ways to market and promote their ensembles across social media, but the technological skills of live online collaboration or virtual choir production may be specific to this time.

Conclusion

Where we meet our ensembles during this pandemic has shifted dramatically, and even as our choirs return in masked outdoor distant rehearsals or in parking garages or parked cars, the online format for many choirs remains a challenging space to use to connect with our singers. While it is true that our years of study to perfect a gestural vocabulary may seem moot in these spaces, fundamentally, the roles and responsibilities of the conductor have not lost their relevance. Now more than ever, our ability to lead and inspire is necessary for our singers to make music together. The way that we problem-solve in rehearsal is still effective and prepares us for the challenges of problem-solving the technology, the latency, the social isolation, and the volatile world that we seek to bring beauty into. While our downbeat

might be replaced with a click track and our cut-off with a chat message, nothing can replace the inspiration that we provide our singers as we model resilience, dedication, and a belief that no matter what divides us, we can still come together in song. CJ

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NOTES

[1] Fastmusic boxes are specially designed computers that use an audio interface, a custom hardware build, and special software to provide the best possible connection for audio collaboration. Symonics is currently selling a Fastmusic box based on the Raspberry Pi. http://symonics.com/fastmusic.

[2] https://zoom.us/pricing

[3] apps.google.com/meet

[4] https://github.com/corrados/jamulus/issues/208

[5] forum.jamkazam.com

[6] ACDA COVID-19 Response Committee, "ACDA COVID-19 Response Committee Report," published June 15, 2020, https://acda.org/wp-content/uploads/2020/06/ACDA-COVID-19-Committee-Report.pdf, p. 42.

[7] Mike Dickey, "Scaling to 500 with JackTrip," accessed December 2, 2020, https://25ms.org/2020/07/21/scaling-to-254-and-beyond/.

[8] C4's Remote Live Music-Making with Jamulus, accessed November 25, 2020, http://www.c4ensemble.org/remote-live.html.

[9] Anand Sitaram, "Getting Started with Jamulus," accessed December 2, 2020, https://tinyurl.com/14p4nqdu

[10] Daniel Andor-Ardó, Scot Hanna-Weir, Brian Mountford, and Karen Siegel, "All Together Now: Live Remote Choral Performance in the Age of Social Distancing" webinar, August 11, 2020, https://www.youtube.com/watch?v=xs0B2PgimtI.

[11] Barbara A. Brinson and Steven M. Demorest, *Choral Music: Methods and Materials* (Boston, MA: Schirmer Cengage Learning, 2014): 276.

[12] Karen Siegel, "How To Do Live Remote Choir," accessed August 20, 2020, http://karensiegel.com/live-remote/.

[13] Anand Sitaram, "Sending other audio to Jamulus and then sending Jamulus audio to Zoom using ASIO Link Pro," accessed November 25, 2020, https://tinyurl.com/14p4nqdu

[14] C4's Remote Live Music-Making with Jamulus, "Audio Routing," accessed November 25, 2020, http://www.c4ensemble.org/remote-live-audio-routing.html.

[15] Tori Cook, *Chorus Connection*, "Could Drive-In Choirs be the Solution We have all been waiting for?" accessed November 25, 2020, https://blog.chorusconnection.com/could-drive-in-choirs-be-the-solution-choruses-have-been-waiting-for.

[16] Nicole Aldrich et al., "Virtual Choirs in Higher Education," *The National Collegiate Choral Organization*, June 22, 2020, accessed September 12, 2020, https://www.ncco-usa.org/wp-content/uploads/2020/06/NCCO-Virtual_Choirs_Higher_Ed.pdf.

[17] Scot Hanna-Weir, "An Iterative Approach to Virtual Choirs" webinar, ChorAmor, August 7, 2020, accessed September 12, 2020, https://www.youtube.com/watch?v=R_E9Jud4UOU&t=3227s.

[18] National Collegiate Choral Organization, "Remote Lessons and Gesture: Ideas for teaching conducting students virtually" webinar, March 30, 2020, accessed September 12, 2020, https://www.ncco-usa.org/pubs/webinars/archive-s1/s1w3/.