Digital phasing: Using latency as an agent for metric change

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FOLIO SUBMISSION
Online publication portfolio includes: 2000-word essay by Louise Devenish (below), online performances, open-access score of *Still Drumming 2020* by Jet Kye Chong.

ABSTRACT
Drumming is recognised as a watershed moment in western art music not only for its unique instrumentation and compositional innovations such as phasing, but also for the distributed leadership model in the unconducted ensemble. The well-known rehearsal model used to develop the materials and processes that unfold during *Drumming* fifty years ago seems a fantastical dream from another time, as musical communities disintegrate during pandemic lockdowns, and the physical nearness so valued in music making is not permitted by law. Digital nearness however, offers new opportunities for real-time music making, simultaneously revealing metric quirks reminiscent of the phasing techniques Reich employed in *Drumming*. Commissioned as part of the Digital Phasing project by Louise Devenish, Jet Kye Chong's *Still Drumming 2020* exploits latency and geographical distance, offering a pandemic perspective on Reich's signature techniques. Out-of-phase rhythmic cells are perceived as stable, with moments of unity experienced only in transition as the work progresses. The untethered feeling familiar to phasing performers of Reich's *Drumming* is the default state in *Still Drumming 2020*, as numerous out-of-phase states exist simultaneously depending on location and corresponding latencies. Mirroring the wide range of individual experience during the global pandemic, each performer and listener experience a unique version of this work in performance specific to their location.

Steve Reich's *Drumming* is recognised as a watershed moment in western art music not only for its unique instrumentation and compositional innovations such as phasing, but also for the distributed leadership model in the unconducted ensemble.[1] Until the 1960s, audiences at western art music concert performances typically saw ensembles of 8-25 performers being either conducted or led by a single musician, such as in the case of Béla Bartók's *Music for Strings, Percussion and Celesta* (1936) or Edgard Varèse's *Ionisation* (1929-31). Throughout the 1960s and 1970s, concert performances of unconducted ensembles of this size began to emerge, through performances of works such as Terry Riley's *In C* (1968) and *Drumming* (1970), that challenged these established models. Performed unconducted, the structure of *Drumming* enables each percussionist a moment of leadership over the course of the work. Among other things, Reich's ensemble structures and processes draw on the distributed ensemble structures common to West African and Indonesian musics that he studied during the time *Drumming* was composed.[2] For many percussionists used to western art music ensemble hierarchies that place percussionists on a lower tier than others with traditional ensemble leadership roles, a model of distributed ensemble leadership was both an empowering and community building experience.

Documented by Hartenberger, the well-known rehearsal model used to develop the materials and processes that unfold during *Drumming* fifty years ago seems a fantastical dream from another time,[3] as musical communities disintegrate during pandemic lockdowns, and the physical nearness so valued in music making is not permitted by law in many countries. For example, at the time of writing, restrictions in parts of Australia and Europe require people to stay at home after an evening curfew, to leave home only for essential services, and/or to stay 1.5m away from others. At this time of physical isolation, social connection is crucial for wellbeing. In seeking ways to be alone together while physical nearness is not possible, musicians have sought other means to connect through music, turning to online platforms that facilitate digital nearness. This offers new opportunities for real-time music making, and conferencing and gaming platforms such as Zoom, Discord, Microsoft Teams and Google Hangouts have enjoyed unprecedented popularity and widespread use during this time. However, their design capabilities were developed with the visual, not the sonic, as the primary concern. The majority of these platforms present challenges when they are used to perform with other musicians in real-time, such as poor sound quality due to compressed audio settings or default microphone settings that determine which person will be heard if multiple people speak at once (based on whoever has the loudest voice/microphone). However, the quirk that has been most lamented with regard to musical performance is latency, as long and/or inconsistent delays in the transmission of material between performers renders metric synchronisation impossible.

Latency and liveness

In trying to recreate live performance conditions in online projects, a number of researchers have sought to address this in various applications and programs, developing code designed to reduce latency while also creating user-friendly graphical interfaces for musicians new to performing online. Animated notation applications such as the Decibel ScorePlayer are excellent for networking performer scores to coordinate performer activity. This ensures the point of attack is simultaneous even when in separate locations, however another program is required to broadcast performers to each other and to audiences if used in an online context. Thus, although the point of attack can be coordinated remotely, the point of *audibility* will still be different depending on which program is used for listeners. The most successful platform for coordinating the point of audibility thus far is open-source software JackTrip, created by Chris Chafe and Juan Pablo Caceres at Stanford University. Developed between 2000 and 2007, this software was rapidly and substantially improved during the pandemic by volunteer developers around the world, who worked to create new graphical user interfaces, fix bugs to further reduce latency, and develop online rehearsal rooms linked via servers installed in different cities. The closer the proximity of performers to a server, the lower the latency - in some cases reaching near-zero latency. Other examples include the combination of Audiomovers subscription software with Max patches designed for specific performances.[4] However, regardless of which software program is used for remote online performance, latency cannot be entirely removed, as internet speed and geographical distance also play a part in transmitting sound online. The further apart performers are, the greater the latency, as the signal still needs to travel the distance between them. Recognising the impossibility of truly synchronous online performance when creating new remote collaborations, many musicians have adapted their practice to work *around* latency issues. This has primarily been done by either composing music that favours pulseless or indeterminate material, or by building compositional structures that do not require any synchronous gestures from performers.

When measuring online synchronous performance against live, face-to-face synchronous performance standards, one can be disappointed by what can or can't be achieved. When measured against face-to-face possibilities, latency has largely been considered a problem in real-time online performance. However, online performance and live performance are not the same medium: measuring one against the other is a little like comparing apples and oranges. If the inevitable latency in online performance is not viewed as rhythmic interference, but is instead viewed as a rhythmic tool, new creative and performative possibilities arise. For example, attempting to perform rhythmic cells online that are similar in construction to the rhythmic cells used in *Drumming* reveals metric quirks reminiscent of Reich's phasing techniques. With this in mind, the Digital Phasing project was designed to harness the latency resulting from non-music-based software programs and geographical distance between performers, working *with* it rather than around it through the commissioning of a series of new works.

Still Drumming 2020

The Sound Collectors Lab at Monash University commissioned Australian composer Jet Kye Chong to develop a new work exploiting latency and geographical distance in online percussive performance as part of the DRUMMINGat50 project.[5] Presented by The Substation, the resulting work *Still Drumming 2020* was premiered on 1 November, 2020.[6] Echoing Reich's *Drumming* nonet, *Still Drumming 2020* was performed by nine performers, shown below in Figure 1. Unlike *Drumming*, which is performed with instrumental setups nested closely together in a performance space, each performer in *Still Drumming 2020* is geographically distanced, performing in isolation from cities and towns across Australia, South East Asia and New Zealand as shown below in Table 1. Online performance of this nature is designed to take place in a virtual venue, offering a digital perspective on proximity and shared space and challenging notions of musical togetherness. In joining this virtual space, performers and audience found themselves in three spaces or rooms simultaneously: their immediate physical room, the virtual venue, and on-screen in the rooms of each of the performers. In the virtual space, each performer is the same distance from the others (that is, however far away they are from their screen), but in the physical space, the performer distribution is across nine locations in three timezones, which served to enhance the latency.

Figure 1. The artistic team in *Still Drumming 2020*, as they appeared on screen pre-performance on 1 November 2020. Top row (L-R): Germaine Png, Jackson Vickery, Jet Kye Chong. Middle row (L-R): Justin DeHart, Louise Devenish, Matt Prendergast. Lower rows (L-R): Michael Askill, Niki Johnson, Rachel Thomas, Yoshiko Tsuruta.

Table 1. Location and time zone of the nine performers.

Time zone	City	Musician
GMT+8	Perth	Jackson Vickery
	Singapore	Germaine Png
	Kuala Lumpur	Matt Prendergast
GMT+10	Melbourne	Louise Devenish
	Sydney	Niki Johnson
	Mullumbimby	Michael Askill
GMT+12	Christchurch	Justin Dehart
	Auckland	Rachel Thomas
	Tauranga	Yoshiko Tsuruta

The virtual space for *Still Drumming 2020* was Discord, a free online platform originally designed for gaming communities to chat privately in groups. To enter a Discord space (known as a 'server'), performers and audience must have a ticket in the form of an invitation link, enabling the virtual venue to be discoverable only by those with tickets, and for the 'door' to be closed for the performance. For *Still Drumming 2020*, audience members entered a virtual Foyer on arrival, where they were advised of the preferred settings for the performance before moving to the virtual Auditorium at the performance start time. The choice of Discord - a platform that was not specifically designed for musical use - was intentional, not only for ease of access to a wide audience base, but also to capitalise on the latency inherent in a platform not designed for music performance. Discord is also a platform that enables audio levels to be set and adjusted to remove echo cancellation, noise reduction, noise suppression and individual audio settings for each player.

In *Still Drumming 2020*, the digital phasing that emerges as a result of latency is the primary focus in the work. The work is based around a series of looping rhythmic cells, performed by an 'engine' of four percussionists on

glockenspiels. The tempo is not determined by following a standard metronome marking such as MM = 200, but by following the directive of q = (30,000/avg latency), as shown below in Figure 2. The average latency for this ensemble is 150,000, however the exact tempo is determined prior to performance by sound-checking the engine ensemble. Player 1 essentially serves as the timekeeper, playing a consistent pulse throughout. The tempo set by Player 1 is determined by a simple exercise with Player 2: counting '1, 2, 3, 4 clap'. The tempo is the time between the two unison claps as heard by Player 1. Player 2 also sounds a consistent pulse, aligning their attack with the downbeat from Player 1 as heard in their location. Player 3 and 4 play rhythmic cells comprised of either pulses or simple patterns looped in individual or grouped cells. All additional players from Player 5 onwards take on the role of 'sensors'. The 'sensors' determine which of the pulses they hear from the engine as their downbeat. Following, they play either cells that sound the downbeat, or resultant patterns that emerge from the 'engine' players' material as they phase over one another. Here, a 'dance of agency'[7] between human and machine emerges, as the phasing phenomena is controlled not by human performers, but by the software. In this way, the platform can be considered as much of a creative contributor to the performance of the work as the human performers, producing composite rhythmic material and determining the tempo of the work. The 'sensor' instrumentation is left open, taking the material to be performed and the effectiveness of different instruments in blending with the online ensemble. in the premiere performance, the sensors each used two instruments, one for the downbeat material, and one for the resultant material (e.g. small cymbal and marimba, small djembe and vibraphone, muted temple bowls, tambourine and ceramic mugs, and tambourine and glockenspiel). The resulting sound world was a proliferating metallic texture created by musical gestures that are both rhythmic and pulseless at the same time. Out-of-phase rhythmic cells are perceived as stable in different locations, with moments of unity experienced only in transition as the work progresses, and numerous out-of-phase states exist simultaneously depending on each performer's location and the corresponding latencies. The untethered feeling familiar to phasing performers of Reich's *Drumming* is the default state in Chong's *Still Drumming 2020*.
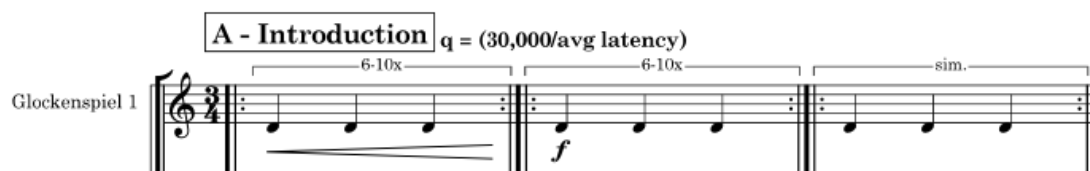
Figure 2. Excerpt of the *Still Drumming 2020* score by Jet Kye Chong, showing the tempo marking.[8]

A glocalised experience
Mirroring everyone's individual, localised experience of the global 2020 pandemic, each performer and listener experience a unique version of *Still Drumming 2020* specific to their location. Each of the nine cities where the performers were located had different experiences of the virus, with different restrictions, lockdowns and work capacities at different times. It has been widely observed that although the pandemic is a global event, individual experience of this global event is unique. However, human connection, even in digital form, has remained vitally important. In acknowledgement of this experience, the Digital Phasing project resists the trend to record and upload online performances for on-demand viewing for two reasons. First, the project was designed to exist as a music performance project, an impermanent moment in time to be experienced by a group of people. It was not designed to exist as a video documentation project. The distributed nature of the work not only means that the music is heard differently in every location, it also means that each is equally valid. This blurring of the individual is reflected in the promotional image for the project, shown below in Figure 3. As there is no way to determine which location is the primary location in order to make a definitive recording, and it cannot be accurately recorded from any one location. Second, a key reason that the loss of live performance during the pandemic has been felt so keenly, is because of the associated loss of the human connection created through face-to-face performance. In making performances of this work available in real-time only, performers and audience are aware of each other in the moment. Admittedly, commenting in a chat window or posting emojis is not quite the same as a post-show face-to-face conversation, but there is a notable difference between viewing an event in real-time with the knowledge that others are doing the same, and watching the same event at a later date with the knowledge the moment has passed.
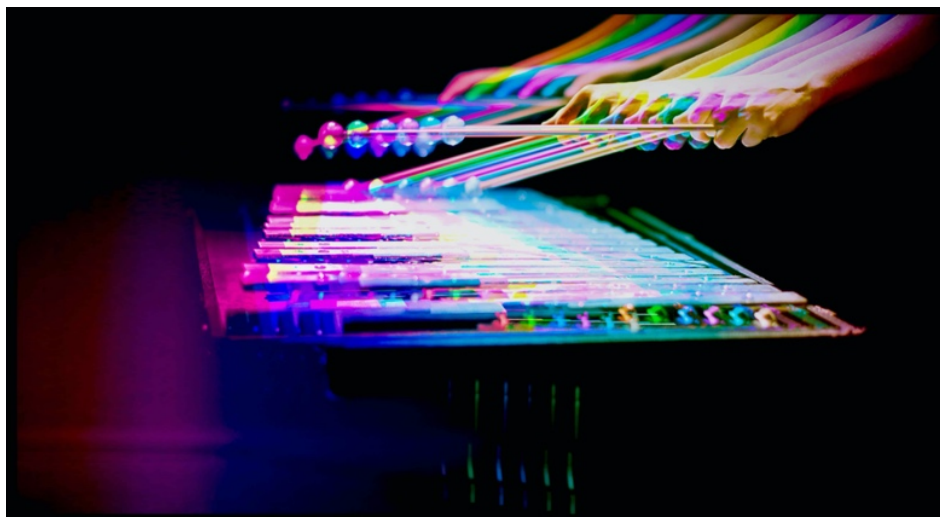
Figure 3. The Digital Phasing promotional image. Photo by Karl Ockelford.

In the spirit of DRUMMINGat50, the Digital Phasing project offers a way of working that acknowledges the connections between musical pasts and presents, peoples and places.[9] In both design and execution, it embraces a twenty-first-century understanding of music making as a networked and distributed practice that is engaged in by communities of people. Collective creativity, the ensemble and the community surrounding it is celebrated, even as familiar notions of ensemble performance, community and connection are fundamentally challenged by the COVID19 pandemic, and the way we live, work and interact with one another has abruptly shifted. New performance practices, ensemble and listening skills developed for the digital performance realm require us to reconsider how we utilise musical structures such as rhythm and metre, as well as how we understand concepts of liveness and virtuosity.[10] The Digital Phasing project offers one of many models for maintaining connection through music during this unprecedented time. For those who might like to join us, the score for *Still Drumming 2020* is open access, available in perpetuity on the DRUMMINGat50 website.

Author biography
Dr Louise Devenish is a contemporary percussionist whose creative practice blends performance, collaboration and artistic research. As a soloist and with ensembles including Decibel, The Sound Collectors Lab and Intercurrent, she develops new works exploring notation, post-instrumental practice and collaborative creativity, performing around Australasia, Europe, North America and UK. Louise has collaborated on award-winning recordings with these ensembles and others including Speak Percussion and Synergy Percussion, released on Hat Art, Listen/Hear, Immediata, Innova, room40, as well as solo album *music for percussion and electronics* (Tall Poppies). Louise is Senior Research Fellow (ARC DECRA) and Percussion Coordinator at Monash University. www.louisedevenish.com.au

Jet Kye Chong is a Perth-based composer, percussionist and researcher. He received the 2018 Scarlet's Fund for his string quartet *Umbral Orbits*, and the 2018 Ransom Prize in orchestral composition. Chong recorded works of Myburgh for UK and Australian labels and has recorded with the Australian Baroque for ABC Classic. He received the 2017 Malaysia Percussion Festival Performance Prize for his marimba solo *Rev 3*, and is a two-time winner of the Vose Concerto People's Choice Award. Chong holds a BPhil (Hons.) from The University of Western Australia, where his thesis *Predicting Marimba Stickings with Neural Networks* leads ongoing research.

Dr Michael Askill is a percussionist, composer, musical director, musical ambassador and educator - an icon of Australian music known and admired for his enduring contribution to the Australian contemporary music landscape and his original blending of Asian and Western sounds. Michael is Lecturer (Percussion) at University of Queensland and recipient of the Percussive Arts Society Lifetime Achievement Award.

Justin DeHart is a GRAMMY-nominated performer of contemporary musical styles and a current member of Los Angeles Percussion Quartet. A Senior Lecturer at the University of Canterbury in Christchurch (NZ), Justin is a Yamaha Performing Artist and an endorser of Black Swamp Percussion, REMO, Sabian, and Innovative Percussion Inc.

Niki Johnson is a contemporary percussionist and interdisciplinary artist who seeks out experimental performance practices and presentation models. In her collaborations she explores sound, relationships through collaborations, and theatre. She also performs with chamber ensembles Synergy Percussion and Ensemble Offspring, and will be performing in the 2021 theatre show DrummerQueens.

Germaine Png (GERMY) is a percussionist, electronic musician, and performance artist. They are currently completing a Bachelor of Music (Hons) at Western Australia Academy of Performing Arts. In 2019, Germaine curated an interdisciplinary display of poetry, visual art, dance, music and solo percussion titled *Breaking Point: A Show On Sexual Assault*.

Matt Prendergast, Principal Percussionist of the Malaysian Philharmonic Orchestra since 2009, began his classical training at The Boston Conservatory and the Manhattan School of Music, where he received his master's degree in orchestral performance. As guest principal percussion, Matt has performed with several orchestras including the Philharmonia Orchestra in London.

Rachel Thomas holds a Bachelor of Music (percussion) from The University of Canterbury. Rachel has performed with the Auckland Philharmonia Orchestra, Christchurch Symphony Orchestra, NZSO National Youth Orchestra, numerous brass bands throughout New Zealand and Australia, and the percussion ensembles From Scratch and BaDaBoom.

Japan-born marimbist **Yoshiko Tsuruta** studied percussion in New Zealand and Austria. Yoshiko is Principal Timpanist of OPUS orchestra, with whom she premiered Gareth Farr's *Marimba Concerto*. Her solo and ensemble repertoire includes her own arrangements, which explore the expressive possibilities of the marimba beyond its stereotype as a percussion instrument.

Jackson Vickery is a freelance percussionist and educator based in Western Australia. He specialises in contemporary and world percussion and has studied and performed internationally with several world-class musicians including including Steve Schick, Sō Percussion, Keita Ogawa and Marcelo Woloski.

[1] S. Reich, *Drumming*, musical score, Boosey and Hawkes, New York (1970).

[2] Reich's study of West African and Indonesian musics is discussed in numerous historic and recent publications, such as S. Reich, *Writings on Music, 1965-2000,* Oxford University Press (2002); A. Momeni, *Analysis of Steve Reich's Drumming and his use of African polyrhythms,* self-published (2001); S. Gopinath and P. ap Siôn, *Rethinking Reich*, Oxford Scholarship Online (2019) etc. A range of perspectives on the influence of West African and Indonesian musics on Reich's compositions is available, and while this article is not the place to discuss that literature, readers are encouraged to consult both historic and recent publications.

[3] R. Hartenberger, *Performance Practice in the Music of Steve Reich*, Cambridge University Press (2016).

[4] Further information on these platforms is available via their websites:
Decibel ScorePlayer: www.decibelnewmusic.com/decibel-scoreplayer
JackTrip: www.jacktrip.org
Audiomovers: audiomovers.com/wp
Max: cycling74.com
Examples of a range of online performance projects using these programs can be found at www.louisedevenish.com.au/research

[5] The Sound Collectors Lab is a modular studio-lab directed by Louise Devenish dedicated to the research, development and creation of new music through making, performing and writing. Based at Monash University, The Sound Collectors Lab expands and contracts to accommodate creative collaborators on each project, including artists, artist-scholars and academics interested in interdisciplinary research-based artistic practice working across composition, sound design, performance, studio engineering, design and the visual arts. Supported by the Australian Research Council through the Discovery Early Career Researcher Award.

6 Additional discussion on the creative process is available via an artist talk: Spolding, B. and Devenish, L. (2020). *In Conversation with Louise Devenish*. Melbourne: The Substation, 12 November. See 13'35". Available at https://www.youtube.com/watch?v=S22YuJCfRP0&feature=youtu.be&fbclid=IwAR3pBkuTxvnfhjfec3kaDFUfIKW89myOJ55NnmUsZzOgSDKbhUvSP7enGRA.

7 A. Pickering, "Material Culture and the Dance of Agency" in *The Oxford Handbook of Material Culture Studies*, Oxford Handbooks Online (2012).

8 J. K. Chong, *Still Drumming 2020,* unpublished musical score (2020).

9 L. Devenish, *Digital Phasing*, figshare, online resource (2020). DOI: http://doi.org/10.6084/m9.figshare.13088927

10 Observations and thoughts on the nature of virtuosity in music in the twenty-first-century are offered here: C. Hope and L. Devenish, 'The New Virtuosity: A Manifesto for Contemporary Sonic Practice*', ADSR Zine,* Volume 11, p.3 (2020). Available at: https://f3a7ef68-fbab-4d89-9436-183b772ae50a.filesusr.com/ugd/884980_2687012fc8764872904f6db14cf1b64c.pdf#page=3