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Composing Improvisational Cells for Networked Music Performance

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INTRODUCTION

Autumn of 2020 was a challenging time to teach about musical ensembles at a university. As our institution was operating entirely remotely, our normal range of bands, choirs and other groups were unable to rehearse and perform as normal. I became one of many lecturers across the world supporting students in exploring networked music performance, an ensemble scenario where some or all musicians participate remotely via the Internet (Blackburn and Hewitt 2020; Wilson 2023). Following a summer of background research and experimentation with other musicians, I fleshed out a toolbox of methods to use at the university to keep our community of ensembles active and vibrant. These methods centred on addressing the most prevalent issue of networked music performance: latency. Latency is the delay that occurs when data is transmitted digitally. Although it exists in all forms of data transmission, the delay is much larger when that data travels via the Internet. When attempting to play music together at distance or online, George Hajdu explains that 'the interactions between [performers] as well as the sounds they perceive are offset by latencies that can exceed the tolerable threshold for on-the-beat performance and may require the establishment of new musical genres' (2016: 257). Rebekah Wilson builds on Hajdu's research, arguing that

> latency will become a fully exploited and accepted property of networked music as it affords distinct creative opportunities. While the technical limitations of the Internet may disrupt traditional musical performance, the potential for making music together over the Internet remains to be fully realised; i.e. new aesthetic forms and genres remain to be seeded. (Wilson 2023: 1,873)

Networked music performance broadly centres on three approaches identified by Renaud, Carôt and Rebolo (2007). The Realistic Jam Approach aims to minimize latency by 'sending and receiving relevant data as quickly as possible as well as ensuring that the network quality between peers is as good as it possibly can be' (Renaud *et al.* 2007: 2). However, the allure of playing remotely with minimal synchronization issues carries significant technical demands often beyond the scope of public Internet infrastructure (Wilson 2023). The Latency Accepting Approach, on the other hand, dismisses the importance of precise synchronization within ensemble performance and embraces 'new ways of delayed musical interaction' (Renaud *et al.* 2007: 3). While this allows musicians to play together online using commercially available technology, the resulting noticeable variable latency precludes the performance of a significant amount of Western classical and popular musics. Finally, the Remote Recording Approach moves ensemble interaction into an entirely asynchronous space, ignoring latency issues as there are 'no real human-to-human interactions' (Renaud *et al.* 2007: 4). Performers record their parts independently of one another and combine them afterwards using editing software. While this process yields a final product that sounds like an ensemble, the actual act of simultaneously playing music together is lost.

Exploring these approaches with my students was a fascinating creative process and it was exciting to co-construct new forms of musicking with them. I realized, however, that I was missing the feeling and sonic output of performing a set piece of music live in a cohesive ensemble. Thus began a compositional project that resulted in *The Hour of Lead*, a large-scale work for mixed ensemble. Rather than attempting to minimize latency through technology, ignore latency by playing music without established structure or avoid latency by creating an ensemble through editing, this piece provides structure

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and cohesiveness in light of variable latencies through a blend of three key compositional strategies: the use of video notation, cohesive improvisational cells and deliberate latencies. This composition dovetails these strategies together not only to solve practical issues around performing at distance but also to explore how different strands of performance research may complement one another through practice. In short, the development of this piece illustrates the interconnectedness between research on networked music performance, improvisation and video notation as well as the intrinsic relationship between musicians' contexts and creative practices.

COMPOSITIONAL TECHNIQUE

The Hour of Lead is a large-scale composition made up of seven movements with five spoken interludes.[1] The piece is scored for any combination of voices with melodic, harmonic and percussive instruments, spoken voice and pre-recorded audio. There should be preferably at least sixteen performers (four on each part) although the piece will function with three performers to a part. The composition is designed to be played by musicians who are distant from one another either in online or physical spaces. Thematically, each movement of the piece explores a possible metaphor for grief, reflecting both the communal grief that existed during the COVID-19 pandemic (Berinato 2020) and my personal circumstances at the time.[2]

A key consideration in the initial development of *The Hour of Lead* was around how to maintain large-scale synchronization of performers yet allow small-scale variations in timing. In other words, although variable latency is a given the musicians should progress through the piece in a coordinated manner. When working in online ensembles using Latency Accepting Approaches, I often longed for the structured development found within composition as opposed to free improvisation. While free improvisation is a key part of my musical practice, it is just one of many ensemble activities I participate in (McCaleb 2014). The solution I arrived at was to devise harmonically and melodically curated improvisational cells that when combined make a larger piece. Video recordings for each part include a mix of standard Western notation, altered notation and written instructions. Performers are provided with only one musical instruction at a time – what they are meant to be doing at that specific moment in the composition. Using a video with set timings allows for performers' instructions to be synchronized without adding time keeping to their cognitive load (for example, having each musician coordinate their performance using a timer). Thus, the composition functions through a balanced flexibility between different musical parameters.

As with many other pieces in Western classical and popular canons, *The Hour of Lead* has clear-cut tonalities and form. However, rhythms and phrasing are, by and large, left to be decided by performers in the moment. This strategy has many parallels with work done by Hajdu (2016), who describes how he wanted musicians to

> be involved in scenarios in which clear instructions as to how to fill time had to be given. John Cage's number pieces … held promise in that they feature scores in which musical events are supposed to be performed within *time brackets* allowing a certain amount of indeterminacy as to their onsets. (Hajdu 2016: 263)

Each movement of *The Hour of Lead* involves a large degree of performer agency when making rhythmic decisions. Most significantly, performers are not given any particular speeds with which they should work through the improvisational prompts given to them in each cell. While I occasionally use language that alludes to speed such as 'cautiously emerge and explore' (all parts, 7:08) or 'leave space between phrases' (Voice, 17:36) this wording yields a broad range of possible tempi. In practice, giving performers agency over rhythmic decisions results in a soundworld where musical content is shared across the ensemble yet stretched across time in unique patterns within each performance. Wilson refers to the greatest effect of latency as 'the unavoidable – and possibly unstable – counterpoint caused by both the network and the result of humans attempting to synchronise remotely' (2023: 1,879). *The Hour of Lead* embraces that counterpoint, making synchronization more a unique happenstance

[1] For performance materials for *The Hour of Lead*, as well as a filmed performance, see McCaleb (2025).

[2] My father died in 2018 and my mother in 2019. The complexity of my grief was increased through the large geographical distance of my present life from my childhood home and the birth of my first son in 2018.

or simultaneity than a goal. Performers have remarked on how liberating this rhythmic flexibility can be (particularly as they often have space to repeatedly explore the same musical prompts) and the surprising poignancy of unexpected alignments with other musicians.

In addition to the improvisational prompts, several other pieces of contextual information are provided in the video notation. First, light grey writing indicates the text spoken in the performance (where present) and the name of each movement. Second, along the bottom of the video is a light grey timeline to give a sense of progression through the piece. Performing from video notation requires an intensity of concentration not normally found in static notation. As Oram proposes, 'a video score exists in a constant state of disappearance: each frame disappears the moment it appears' (2016: 11). This forces performers to focus purely on the instruction immediately in front of them, unable to know how long they are meant to follow that instruction. Likewise, they are unable to read ahead and mentally or physically prepare for the next cell. Thus, providing some contextual information on the progress through the piece is useful for performers to situate and pace themselves. Further work on this style of notation could include countdowns to allow performers to know how long they are meant to follow their current instruction; however, the technical demands of incorporating this into the video for this project outweighed the practical impact on the performers.

In contrast to the majority of ensemble compositions in Western musics, *The Hour of Lead* does not require players to empathize or respond to one another's performances. While there may be glimpses of interaction between players, these are chance meetings or coincidental relationships rather than pre-planned moments of cohesion. This has both technical and thematic implications. On a practical level, the piece can be played even if musicians can't hear one or more of their co-performers. Given the potential for performers' Internet connections to fail or glitch, making parts that progress in parallel with (but not contingent upon) one another allows the piece to still function as intended. Thematically, the lack of planned interaction between performers could be viewed as a metaphor for grieving; many people may experience grief at the same time but in parallel (and perhaps uncommunicated) with one another. Thus, they are individually negotiating a ubiquitous, shared experience.

The multi-movement structure of *The Hour of Lead* not only allows a large-scale thematic evolution of musical ideas but also a number of creative opportunities to test the use of improvisational cells. In particular, different harmonic uses are explored, with movements ranging from entirely dissonant ('4. the PAPERCUT' and '6. the POOL') to the polytonal ('2. the FRUIT') to the tonal ('1. the VOID', '3. What will separate us?', '5. Fly Away', and '7. the Removal of Grief'). In the majority of the piece, performers are limited to the melodies, pitch sets or chords within the improvisational cell. At any given time, there is a finite set of pitches that exists across all the parts that contribute to an overall sense of harmony. The pitch sets used are at times consonant and at times dissonant; being able to vary them over time allows for the harmonic tension and release commonly found in Western musics. Within *The Hour of Lead*, I have chosen to make a number of harmonic progressions incremental, where each subsequent chord generally adds, alters or subtracts only one pitch to the prior. The subtle pivots of harmonic material allow for flexibility in timing between parts. Even if two performers' videos are seconds apart from each other, there is little risk of clashing harmonic content. This blurring of harmonic motion is similar to what Wilson refers to as post-vertical harmony: 'embracing a time-shifted skewed listening experience [where] the harmony you are hearing is the result of network latency' (2023: 1,875).

COMMENTARY ON *THE HOUR OF LEAD*

The last section of this article explores how the compositional techniques discussed above are used within individual movements of *The Hour of Lead*. Each analysis will explore the design and relationship of the improvisational cells used to maintain harmonic and structural cohesion while providing capacity for rhythmic variability.

Above and beyond the technical considerations needed to make performance functional, the compositional strategies used throughout reinforce the thematic nature of the piece; each movement explores a metaphor for grief and thus draws on different creative processes.

1. the VOID. 'Sometimes, grief is recognising that something has been lost.'

This movement demonstrates how a measured and paced modification of improvisational cells may provide a clear thematic trajectory to networked music performance. In the movement, each part gradually loses a pitch or sound from an initial group of phrases yet maintains the space where that tone once was. The notation illustrates this by incrementally greying out pitches; thus, the process of losing sounds is sonically and visually accentuated by the void revealed where those sounds once were. The material for all the pitched parts (voice, melody and harmony) draws from the same set of seven pitches, initially creating a wash of sound in C major. As pitches disappear, however, the tonality gradually shifts until only a D remains. At this point, the text to Emily Dickinson's poem 'After great pain, a formal feeling comes – ' (1929) is read aloud by a speaker.

2. the FRUIT. 'Sometimes, grief is finding a rotting piece of fruit at the bottom of the fruit bowl.'

An opposite pattern of thematic development happens in this movement. Here, each part begins from the same pitch – the last remaining D at the end of '1. the VOID'. As the movement progresses, each part adds a pitch or sound to their set of possible improvisatory materials. However, the pitched parts build different tonalities, shifting the overall soundworld of the movement from tonal to polytonal: the voice part around the key of G, the melody part around B flat and the harmony part around D minor. When overlaid with one another, the consonance within each individual part becomes increasingly dissonant in relation to the others, mimicking how what may be ostensibly positive life experiences might be surreptitiously tainted by grief.

Interlude: 'I miss…'

This is the first of five spoken interludes between movements that provides aural contrast to the surrounding music and moments of reflection for both performers and audience. These interludes are inspired by the compositions of Pauline Oliveros – in particular, her piece 'We Could' (2005). The key instruction of that piece is for each person within a group to finish a sentence beginning with the words, 'We could…' Given the thematic exploration of grief within *The Hour of Lead*, its interludes are prompts for performers to finish sentences beginning with 'I miss…' The video notation provides a total of seventy-seven anonymous statements collected from students and staff at York St John University during the COVID-19 pandemic lockdowns. In *The Hour of Lead*, performers are invited to say either the statements given in their notation or respond in a more personal manner in the moment. These statements are not synchronized or coordinated but are spoken randomly. In practice, these oases in the surrounding music can be the most empathetic moments between performers who, stripped of their instruments, simply reflect in the presence of others.

3. What will separate us? 'Sometimes, grief is pushing back.'

In this movement, the improvisational cells change at predetermined intervals in conjunction with the progression of spoken text adapted from St Paul's Letter to the Romans (Romans 8: 35–9):

> What will separate us?
> Will anguish, or distress, or persecution, or famine,
> Or nakedness, or peril, or the sword?
> No, in all these things, we conquer overwhelmingly
> Through him who loved us.
> For I am convinced that neither death, nor life,
> Nor angels, nor principalities,
> Nor present things, nor future things,
> Nor powers, nor height, nor depth,
> Nor any other creature will be able to separate us.

Each of the pitched parts contributes to the melodic and harmonic progression of this movement. The phrases in the voice part arc increasingly higher with greater intervals. Similar to previous movements, the melody part

improvises around an increasing pitch set. The harmony part gradually adds pitches to each subsequent chord, creating a clear progression. Imitating the sounds of waves, the percussion part mirrors the melodic and harmonic growth of the other parts. Coordinating the changes within each part with the text allows for a cohesive confluence of character and tone between spoken word and accompaniment.

4. the PAPERCUT. 'Sometimes, grief is having a papercut on the webbing between your fingers.'

Within *The Hour of Lead*, this movement moves most quickly from one musical idea to the next. Its overall structure comprises three bouts of tension and release with increasingly accentuated climaxes. Each part plays a different role in these large gestures: the voice part is involved in the build-ups and releases, the melodic part in the climaxes, the harmonic part in the build-ups and climaxes and the percussion part in the climaxes and releases. Although not necessarily quick in comparison to the pace of musical development in more conventional Western compositions, the turnaround time of improvisational cells is fast in relation to the rest of the piece as the climaxes and releases are as brief as 10 seconds long. Compared to the languid large-scale rhythmic motion found in the rest of the piece, the brisk series of instructions is rather aggressive and shocking. Performers have remarked how this movement is particularly stressful as, without warning, they are given potentially complex instructions, with some musicians going so far as to compare their physiological experiences to panic attacks. In mimicking how a somewhat-forgotten paper cut may suddenly jump back into consciousness when the skin moves a certain way, the movement provides a metaphor for how grief may suddenly and unexpectedly move to the forefront of one's mind.

5. Fly Away. 'Sometimes, grief is realising that things may be better sometime, but not now.'

This movement is unique among the rest of *The Hour of Lead* for two reasons. First, all of the performers sing – no instruments are played. Second, the movement is more of an arrangement than an original composition. The premise is simple: a melody is insidiously overwhelmed by an unstoppable force. In the first part of the movement, one performer sings a reinterpretation of the hymn 'I'll Fly Away' by Alfred E. Brumley. Once they finish, the remaining performers sing the song albeit (in the fashion of the rest of *The Hour of Lead*) in their own time. As they are singing, a low drone slowly appears on the backing track, getting louder and louder until it drowns out all of the singing. By the time the drone has reached full force, the performers shift from singing the entire song to just fragments: first repeating 'I'll fly away' then 'When I die'. The B flat drone disrupts the D major tonality of the song – pulling what may be interpreted as a hopeful musical gesture to a despondent one.

6. the POOL. 'Sometimes, grief is a deep pool, inviting you to sink deeper and deeper.'

In contrast to the compositional techniques used throughout the rest of *The Hour of Lead* this movement decidedly avoids harmonic motion. In it, performers slowly work through a single improvisational cell against the backdrop of a glacial Shepard tone – an ever-descending pitch with no end (see Shepard 1982). The voice part imitates the fall of the Shepard tone by prompting performers to slide from an unspecified high pitch in their range to a low one. The melody part plays fragments from an atonal six-note pitch set in whichever order they chose. The harmony part slowly plays a Möbius strip-like pattern through the pitch set from the top of their instrument's range to the bottom. The percussion part, simply put, plays slower and slower. The combination of these musical features with no particular tension or release and a disorienting, featureless backing track yields an unsettling and nauseating soundworld paralleling some people's experience of a perceived inescapable grief.

7. The Removal of Grief. 'Sometimes, grief feels natural, organic, and inevitable.'

The final movement marks the return of several

compositional techniques used previously in the piece. As with '3. What will separate us?', music underscores spoken word, this time taken from the Tlingit Speeches for the Removal of Grief:

> The river would swell, the river.
> In the river, in the lake, the rain would fall on the water.
> When the river had swollen, it would flow under the tree.
> The earth would crumble along the bank.
> That's when it would think of breaking.
> When it had broken, down the river it would drift, down the river.
> It would think of going out into the world.
> On this great ocean it would drift.
> From there the wind would blow over it.
> After the wind would blow over it;
> it would begin to roll with the waves to a fine sand.
> When it rolled on the waves to the sand it would drift ashore.
> It would be pounded there by the waves
> it would be pounded there.
> Here the tide would leave it dry, would leave it dry.
> It would lie there.
> In the morning, sun would begin to shine on it in the morning.
> After the sun had been shining on it, it would begin to dry out.
> My hope is that you become like this from now on, my brothers-in-law, whoever is one. (Dauenhauer and Dauenhauer 2003: 34)

As found earlier in the piece, the improvisational cells are timed so that the movement evolves in a cohesive manner. Starting from a three-note phrase, the voice part gradually adds more phrases until it becomes a rather long melody. Only at the end does it revert to a two-note fragment. The melody part is similarly additive: an initial single tone becomes an increasingly large pitch set to improvise with. The harmony part moves through a sequence of five chords, recalling the progression found in '3. What will separate us?' Similarly, the percussion part plays phrases with increasing numbers of sounds, only to fade away at the end.

CONCLUSIONS

In this article I explore how practical constraints around latency and coordination in networked music performance may act as a constructive foil for creative decision-making in composition. Within *The Hour of Lead*, I have developed a range of compositional strategies to shape the progression of each musical idea to the next (and each movement to the next) while releasing the moment-to-moment shaping of each part to the performers themselves. Small-scale rhythmic disparity such as that resulting from latency may therefore be disregarded while the continuity of more conventional Western compositions is retained. Videos that incrementally provide notation to performers allow the piece to have a coordinated thematic development. The resulting piece can thus be performed at great physical distances or online.

More broadly, the process of composing this piece illustrates the degree to which creative practices can emerge directly from artists' lived experiences and contexts. Although I may have experimented with networked music performance at some point in my practice, such a choice would have been rather arbitrary had it not been for the physical and technological constraints I experienced within the COVID-19 pandemic. Likewise, workshopping this piece week in and week out with my students addressed my personal obligation to continue making their university experience constructive and engaging even when we were working remotely. The creative strategies developed in this piece were not only a means of keeping me engaged in music-making but also helping them think critically about how their musical practice could still evolve when so many social structures had changed. On a personal level, creating musical metaphors for grief was part of a larger cathartic process. Just as the compositional strategies employed in the piece sit at the intersection of research on networked music performance, improvisational cells and the deliberate use of latencies, the piece itself sits at the intersection of global, pedagogic and personal contexts. The music, the music-making processes and the musician are contingent upon one another and, ultimately, contribute to a larger evolution of musical practice.[3]

[3] I would like to express my warmest thanks towards all of the students (past and present) who have contributed to the workshopping, performing and analysing of this piece.

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