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Composing for guitar orchestra: Challenges and advantages of homogeneous orchestration

Jason Noble
Université de Montréal, Canada

Steve Cowan
McGill University, Canada

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Abstract

The term orchestration tends to invoke heterogeneous combinations of instruments, especially those of the symphony orchestra. But homogeneous ensembles, comprised of combinations of the same kind of instrument, also make up an important part of the musical and music-pedagogical landscapes. As we argue in this paper, orchestrating for homogeneous ensembles is grounded in the same perceptual principles as orchestrating for heterogeneous ensembles, and may be analyzed using the same taxonomy of orchestral effects. In general, effects based on perceptual similarity between sounds are facilitated in homogeneous orchestration, while effects based on perceptual difference require greater attention to detail on the part of the orchestrator to be achieved effectively. Orchestrating for homogeneous ensembles also offers an unparalleled opportunity to delve into specific features of particular instruments, multiplied to symphonic proportions and unlocking new potentials. Focusing on the first author's composition fantaisie harmonique, which was recorded in studio multitrack by the second author, we demonstrate our approach to composing for guitar orchestra, touching on more general considerations of homogeneous orchestration along the way. Among the specific features of guitars and guitar ensembles that we examine are complex scordatura, natural harmonics and open strings, attack qualities and degrees of asynchrony, and timbral and dynamic variation.

Keywords

guitar orchestra, homogeneous, composition, orchestration, scordatura

Cover Page Footnote

Lecture given at The 21st Century Guitar Conference 2021 under the title: A Case Study of the Challenges and Advantages of Composing for Guitar Orchestras: fantaisie harmonique (2019).

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Composing for guitar orchestra: Challenges and advantages of homogeneous orchestration[1]

Jason Noble
Université de Montréal, Canada

Steve Cowan
McGill University, Canada

The term orchestration tends to invoke heterogeneous combinations of instruments, especially those of the symphony orchestra. But homogeneous ensembles, comprised of combinations of the same kind of instrument, also make up an important part of the musical and music-pedagogical landscapes. As we argue in this paper, orchestrating for homogeneous ensembles is grounded in the same perceptual principles as orchestrating for heterogeneous ensembles, and may be analyzed using the same taxonomy of orchestral effects. In general, effects based on perceptual similarity between sounds are facilitated in homogeneous orchestration, while effects based on perceptual difference require greater attention to detail on the part of the orchestrator to be achieved effectively. Orchestrating for homogeneous ensembles also offers an unparalleled opportunity to delve into specific features of particular instruments, multiplied to symphonic proportions and unlocking new potentials. Focusing on the first author's composition *fantaisie harmonique*, which was recorded in studio multitrack by the second author, we demonstrate our approach to composing for guitar orchestra, touching on more general considerations of homogeneous orchestration along the way. Among the specific features of guitars and guitar ensembles that we examine are complex scordatura, natural harmonics and open strings, attack qualities and degrees of asynchrony, and timbral and dynamic variation.

Orchestrating for guitar ensembles is both exciting and daunting. The abundant timbral possibilities of the guitar are multiplied to symphonic proportions, unlocking emergent textures and timbres with the potential of transforming the instrument's character into something new. But the notorious challenges of composing for the guitar—which, as we have described elsewhere, may be particularly acute for non-guitarist composers (Noble & Cowan, 2020)—can seem even more forbidding in a large ensemble context. And more generally, homogeneous instrumental ensembles—groups of the same kind of instrument, as opposed to heterogeneous instrumental ensembles such as the symphony orchestra—may seem to require a different way of thinking about orchestration.

We present one of the first author's compositions as a case study, addressing some of the challenges and advantages of composing for guitar orchestra and touching on issues of general interest to composers, orchestrators, conductors, and guitarists. In focusing on the guitar orchestra (or, in this case, double-orchestra), this paper will invoke concepts that equally apply to other homogeneous ensembles. Such ensembles make up a significant portion of the musical and music-pedagogical landscapes but are rarely considered in scholarly discussions of orchestration, which tend to focus on heterogeneous combinations of instruments. An aim of this paper, then, is to make a case for the vast creative potential of homogeneous orchestration, which, as we will demonstrate, is grounded in the same perceptual principles that underlie heterogeneous orchestration.

[1] Lecture given at The 21st Century Guitar Conference 2021 under the title: A Case Study of the Challenges and Advantages of Composing for Guitar Orchestras: fantaisie harmonique (2019).

The focal composition of this paper is *fantaisie harmonique* (2019) for an orchestra of classical guitars and an orchestra of electric guitars. It was premiered at the first edition of the 21st Century Guitar Conference in Ottawa (2019) and later recorded in studio multitrack by the second author.[2] The full score is provided as supplemental material to these proceedings.

This paper will situate homogeneous orchestration within a broader theory of orchestration developed by Stephen McAdams and colleagues (ACTOR, n.d.; Bouliane & McAdams, 2019; Goodchild & McAdams, 2018), demonstrating that homogeneous orchestration can be analyzed using the same taxonomy of orchestral effects as heterogeneous orchestration (Noble, 2021). It will then discuss some particular features of the guitar which provide the foundation for *fantaisie harmonique*, including timbral variation, scordatura, natural harmonics, attack quality, and degrees of synchronicity. Spatialization will also be discussed, as this was an important aspect of the piece's realization in 3D audio. Finally, the piece will be analyzed section by section, in light of these themes.

Theory of orchestration

Orchestration, as we use the term here, is conceived very broadly as "the choice, combination or juxtaposition of sounds to achieve a musical end" (McAdams, 2018). In theory, this definition encompasses all possible sounds. In practice though, orchestration has usually been conceived in terms of the instrumental sounds of the symphony orchestra, and orchestral effects have usually been conceived in terms of the result of instrumental combinations (e.g., Read, 2004; Rimsky-Korsakov & Shteĭnberg, 1964). For example, with respect to the orchestral effect of Blend, it would be commonplace to think that the horn and the cello blend well together. But such statements about instrumental combinations are highly reductive: both the horn and the cello are capable of producing an enormous range of timbres in different registers, dynamics, and playing techniques, and for any given sound of the horn, only a subset of the available sounds of the cello will blend with it. In fact, the same is true for instruments of the same kind: not all sounds produced by cellos will blend with one another, only those with commensurate sound qualities will (e.g., similar timbres and dynamics). For this reason, we believe that orchestrational effects such as Blend are best conceived not in terms of instrument combinations but in terms of sound qualities, and therefore that they are grounded in the same principles whether one is thinking of homogeneous or heterogeneous contexts.

Homogeneous orchestration is addressed practically in most orchestration textbooks and treatises, which typically introduce the instrument families one at a time and discuss orchestrating within families before addressing combinations across families. But much remains to be said about the perceptual principles underlying homogeneous orchestration, and similarities between homogeneous and heterogeneous orchestration. One recent study (Fischer et al, 2021) draws on empirical findings to demonstrate the role of instrumental differences in orchestral effects: to the best of our knowledge, this is the only study to date directly comparing heterogeneous and homogeneous orchestration from a perceptual point of view. Fischer et al had participants rate heterogeneous orchestral excerpts for perceived segregation between musical layers. They then had the same excerpts digitally reorchestrated for homogeneous ensembles consisting of string instruments only, using the orchestral simulation software OrchSim (from OrchPlayMusic[3]). They then had a different group of participants repeat the ratings task using the homogeneous excerpts. Their hypothesis, that decreasing timbral difference by homogenizing

[2] Recording available at https://www.guitarfoundation.org/page/SbS06-Noble-Cowan

[3] Available from https://orchplaymusic.com

instrumentation would decrease perceived segregation between musical layers, was supported by their results. However, they noted that there are still timbral differences between instruments of the same family and within single instruments, covarying with other parameters such as register, playing techniques, and dynamics. So, although homogenizing the instrumentation may tend to decrease perceptual segregation, the timbral relations underlying this segregation cannot be reduced to instrumentation alone. The total musical context must be considered.

Orchestral effects taxonomy

Blend, of course, is only one of many different orchestrational goals a composer may wish to achieve. An attempt to exhaustively categorize the range of possible orchestrational effects is provided in the Orchestral Grouping Effects Taxonomy by McAdams and colleagues (ACTOR, n.d.). This taxonomy applies perceptual principles, especially those of Auditory Scene Analysis (Bregman, 1990), to the ways that sounds are grouped together or separated apart at various levels in our experiences of musical sound. Figure 1 shows a detailed hierarchical diagram of the taxonomy. At the first level, Concurrent Grouping, events are formed when simultaneous sounds either group together or do not. For example, notes played simultaneously by different instruments may group into a single perceptual event (blend) or may retain their individual identities (non-blend), depending on the specifics of the acoustical combination. At the second level, Sequential Grouping, streams are formed when successive events either integrate into single streams/textures or segregate into multiple simultaneous ones. For example, depending on various musical and timbral factors, a string section may either group into a single musical layer (e.g., unison or aleatoric massed sonority) or divide into several concurrent layers (e.g., contrapuntal divisi, heterophonic texture). At the third level of Segmental Grouping, segmental units of streams/textures either contrast in various ways or progress in coordinated orchestral gestures. For example, a musical layer may be progressively enriched by gradually adding more instruments, or a dramatic change in instrumentation may indicate the end of one stream and the beginning of a new one at a section break. At each level, in a nutshell, some orchestral effects are based on similarity or cohesion, and others are based on difference or separation.

The similarities and differences upon which these effects are predicated can arise in many different ways. As noted above, in music for heterogeneous ensembles like the symphony orchestra, similarity and difference are often based on differences of instrumentation. Analyzing orchestral scores may involve annotating groupings between instruments, often using different colours to indicate different orchestral segments or layers. In Figure 2, the purple boxes indicate one timbral group, predominantly woodwinds, and the green boxes indicate another group, consisting of strings. The call/response quality in the alternation between the two groups creates the orchestral effect of Antiphonal Contrast.

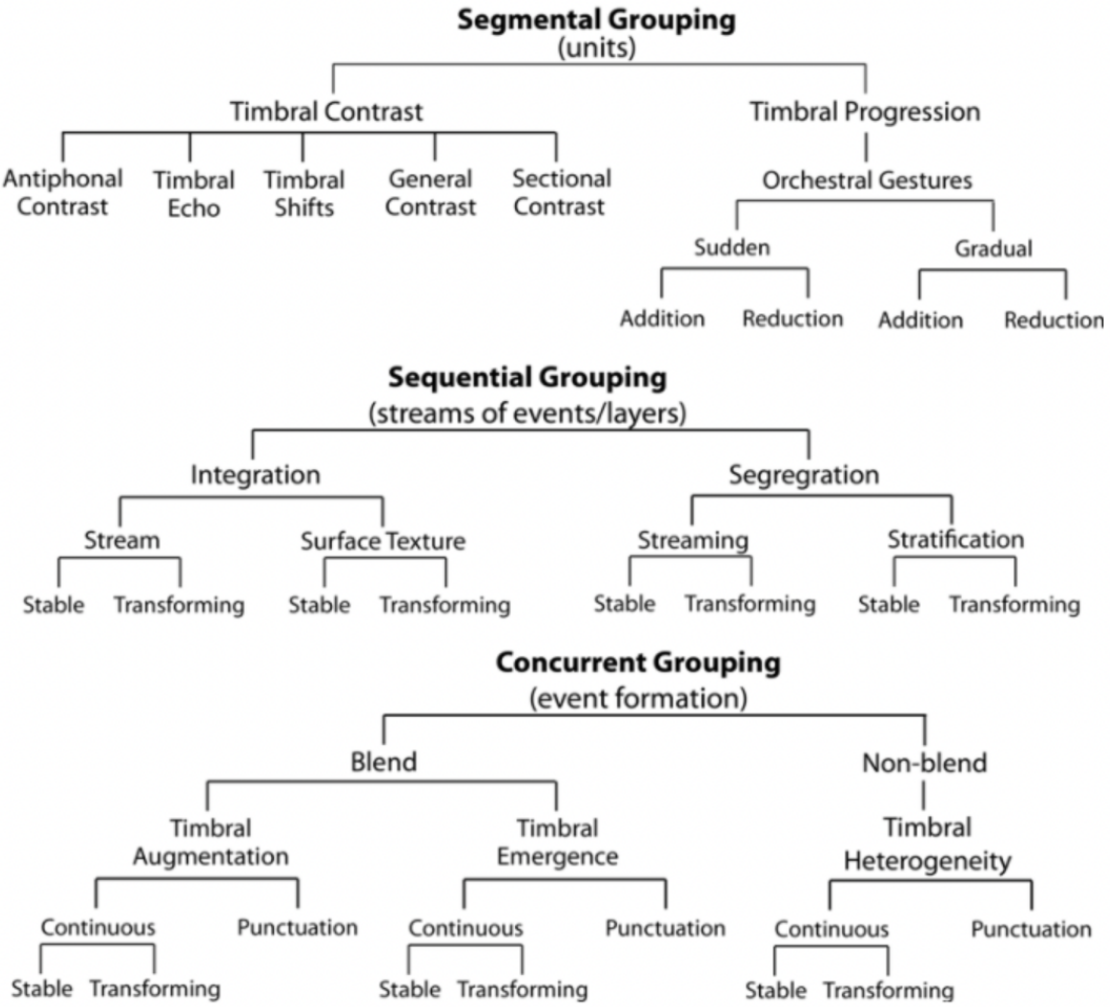


Figure 1 The Orchestral Effects Taxonomy. Retrieved from https://timbreandorchestration.org/tor/modules/taxonomy/orchestral-grouping-effects/introduction. Reprinted with permission.

In the context of a homogeneous ensemble such as the guitar orchestra, it is obviously not possible to create this kind of timbral contrast simply by employing different families of instruments, so it must be achieved by other means. The orchestral effects named in the taxonomy can all be produced in homogeneous ensembles as well, but homogeneous ensembles have a natural disadvantage for orchestral effects based on difference. This disadvantage can be overcome with careful crafting of timbres by the orchestrator: since similar timbres will naturally tend to group together, sound qualities must be clearly differentiated where segregation is the goal. This can be achieved by registral separation, contrasting articulations and/or dynamic contours, timbral modifications such as pluck positions (e.g., sul ponticello, sul tasto), and in various other ways, with the orchestrator responsible for ensuring that the differences will be great enough to yield perceptual segregation. For effects based on similarity, on the other hand, homogeneous ensembles have a natural advantage, because similar instruments are well-suited to produce similar timbres that easily group together in perception.

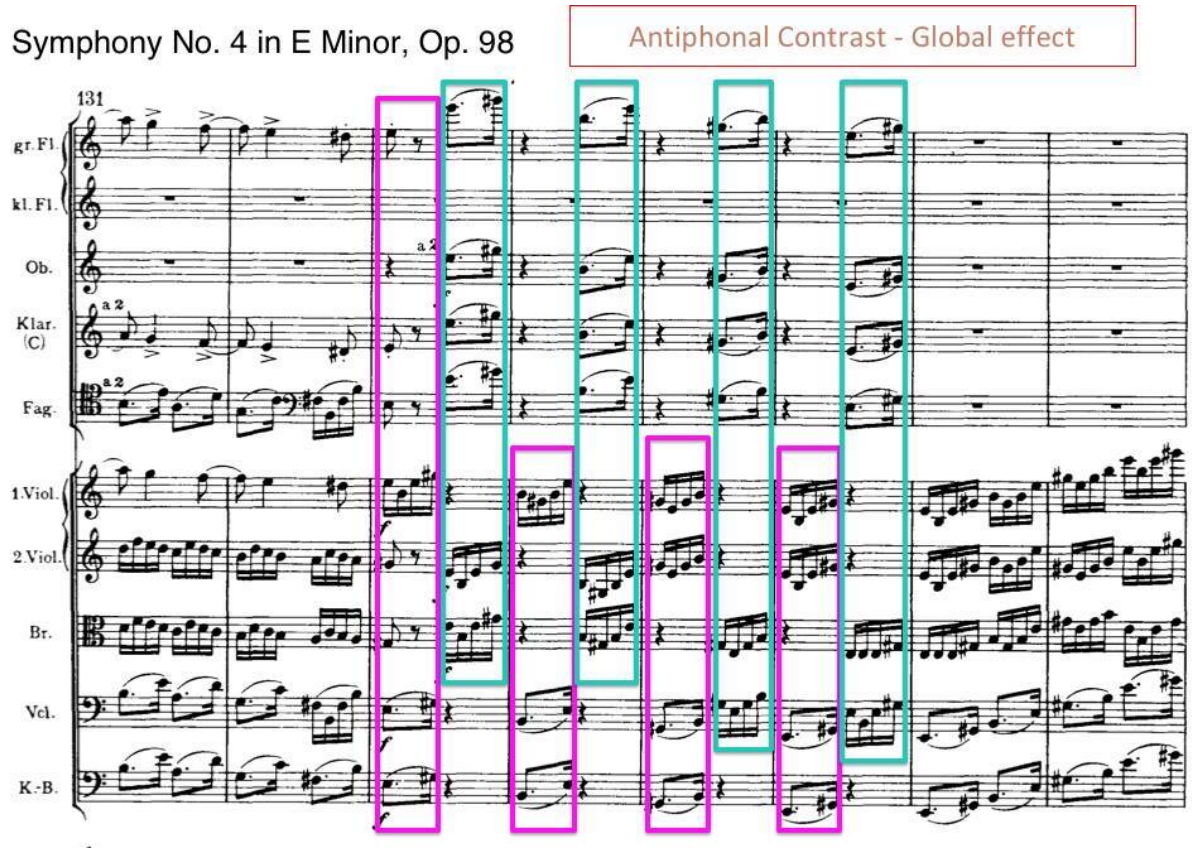


Figure 2 Excerpt of an analysis of Symphony No. 4 in E Minor (third movement) by Johannes Brahms. Retrieved from https://timbreandorchestration.org/tor/modules/taxonomy/orchestral-grouping-effects/examples/segmental-grouping/antiphonal-contrasts. Reprinted with permission.

We note that while orchestral effects categories may be distinct in theory, the situation is much more continuous and fluid in real music. The composer may gradually move from one category to another, or may introduce competing cues that might suggest one or another depending on how the listener directs their attention. These categories may be used creatively and with varying degrees of clarity, just as in tonal music a composer may either firmly establish tonal centres or may vaguely and ambiguously imply them.

Spatialization as orchestration

Spatialization is another means by which perceptual groupings of sounds may be invoked: sounds that originate from the same spatial location, or that move in similar patterns, are more likely to group together, and sounds that originate from different locations or move in different patterns are more likely to segregate apart. The distribution or movement of sound sources in space thus provides new grouping cues that can influence the perception of orchestrational effects, in addition to adding a new layer of aesthetic interest to the composition. Spatial cues can interact with other perceptual cues, either reinforcing them or contradicting them in interesting ways. For example, if the Antiphonal Contrasts described above are complemented with a spatial separation of sound sources (as in the original sense of antiphony), the sense of contrast may be strengthened. Conversely, if an otherwise-integrated musical stream is divided between several spatial locations, the sense of integration may be weakened, potentially leading to an interesting ambiguity between competing orchestrational cues.

Features of the guitar

Having discussed some theoretical principles of orchestration in general, we now turn to a more specific consideration of homogeneous ensembles, focusing on the guitar orchestra. Orchestration for homogeneous ensembles offers the opportunity to dig deeply into the particularities of an instrument, as in solo writing, but with vastly expanded possibilities for textural and timbral combinations, as in symphonic writing. The results may be truly unique, with sonorities that may be difficult or impossible to realize in any other way. The musical character of *fantaisie harmonique* came from extensively exploiting specific features of the guitar, including: 1) its propensity for scordatura, 2) its facility for natural harmonics and open strings, 3) its wide range of attack qualities and degrees of asynchrony, and 4) its wide range of timbral and dynamic variations.

Scordatura: Guitar-specific tuning

We call the tuning system guitar-specific because it is meant to work idiomatically for the guitar and is not necessarily transferable to other instruments. It may well be possible for other instruments to produce all of the same pitches, but it is doubtful that any other instruments could produce them with the same accuracy and ease because they are all realized as open strings and natural harmonics. It would therefore be very difficult to re-orchestrate this piece for any other ensemble.

The guitar, perhaps more than other Western string instruments, is highly amenable to scordatura: retuning the strings is relatively easy, and guitarists are called on to do it frequently. The scordatura in this piece is unusual in its complexity, dividing each orchestra into six groups which each have a distinct tuning, as shown in Figure 3. The system keeps the strings of the guitars reasonably close to their standard tuning, in particular keeping upward re-tunings small to avoid creating excessive tension in the instruments.

Each of the six groups tunes its six open strings to two different major triads. For example, Group 3, which uses the same scordatura as the first author's earlier solo piece *Shadow Prism*, retunes the open strings from the standard E-A-D-G-B-E to Eb-A-C#-G-Bb-E, which works out to an Eb major triad and an A major triad. The thirds of the triads (G and C#) are just-intoned to the roots (Eb and A) by specifying which harmonics on each pair of strings should precisely align. In this case, the fourth-fret harmonic on the low E-flat string and the twelfth-fret harmonic on the G string need to match. This results in microtonal deviations from equal temperament for the strings of the thirds. Each orchestral group is treated similarly with two different triads, resulting in a global tuning system that covers all twelve major triads in root position and just intonation, as shown in Table 1.

An interesting result of this system is that no two groups have exactly the same tuning for any string. The total pitch collection within the system consists of the open strings shown in Figure 3 plus natural harmonics on the twelfth, seventh, fifth, and fourth fret of each string (i.e., the first five harmonics in the series of each string). This results in a total of 30 pitches per guitar group. The collection affords considerable musical resources, including major triads on not only all of the equal-tempered pitch classes but on the first five harmonics of each of their series, and an asymmetrical, 180-note microtonal scale across the entire orchestra, with virtually limitless possible combinations.

Table 1 Six-part scordatura used in *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars and an orchestra of electrical guitars (the arrow represents a just intonation of the string to the corresponding partial on the string tuned a major third apart)

String (standard tuning)	Orchestral group (triads)					
	Group 1 (D♭ + G)	Group 2 (D + A♭)	Group 3 (E♭ + A)	Group 4 (E + C)	Group 5 (F + B)	Group 6 (F# + B♭)
1 (E)	F (↓)	E♭	E	E (↓)	D# (↓)	D (↓)
2 (B)	B (↓)	A	B♭	B	C	A# (↓)
3 (G)	A♭	F# (↓)	G (↓)	G	F#	F
4 (D)	D	C (↓)	C# (↓)	C	B	C#
5 (A)	G	A♭	A	G# (↓)	A (↓)	B♭
6 (E)	D♭	D	E♭	E	F	F#

Natural harmonics and open strings

Natural harmonics and open strings on the guitar are easy to perform and highly effective. Because the left-hand fingers only need to touch the node at the moment of plucking and are then free to move to the next position, harmonics minimize fingering complications while maximizing the potential for resonance. Needless to say, fingering complications are reduced even more for open strings, in which the left hand is not involved at all. As noted above, the potential for combinations of harmonics within the tuning system of *fantaisie harmonique* is vast: the guitar orchestra makes possible much greater densities of harmonic combinations than are available in a solo or chamber context, enabling an extensive exploration of this harmonic potential.

Attack qualities and degrees of synchronicity

Since guitar tones are produced by plucking, usually with the fingernails or picks, their most characteristic dynamic envelope is percussive in character, with a sharp attack followed by a long decay. This sharpness of attack, combined with the instrument's polyphonic character, may lead to certain challenges of synchronicity within the guitar orchestra: trying to get the onset of a chord perfectly together between the players may be difficult because the attacks are so pronounced, and also divided between multiple strings for each player. But the attack quality is not invariantly sharp: softer, rounder attacks are possible if the strings are plucked with the flesh of the fingers, for instance. In the case of the electric guitar, using volume control even makes a niente attack possible if the string is plucked with the volume on zero and then a crescendo is effected with the volume knob or pedal. Finally, togetherness of attack between the ensemble is not a necessary goal: it is possible to use degrees of asynchrony as an aesthetic element in itself, as we have tried to do in *fantaisie harmonique* (more on this below).

Timbral and dynamic variation

Although harmonics may often be described as "a particular colour" of the guitar, they are far from monochrome: by varying articulations, dynamic profile, and register—along with real or virtual spatial position—the orchestrator can in fact produce an extensive range of colours and textures using only harmonics. In the case of open strings, timbre can be varied enormously by changing the pluck position (e.g., sul tasto, molto sul ponticello). The combination of electric and classical guitars also affords considerable timbral and dynamic variation, in particular through the use of distortion and amplification in the electric guitars. It must be acknowledged that the combination of electric and classical guitars in the

ensemble diminishes the homogeneous character of the orchestration, since there is a strong argument to make that classical and electric guitars are fundamentally different instruments. This is nevertheless in keeping with the practice of other (more-or-less) homogeneous ensembles such as the flute choir, clarinet choir, saxophone quartet, and string orchestra, all of which typically include different versions of the "same" kind of instrument. Such ensembles highlight the fact that the homogeneous-heterogeneous distinction, like so many deconstructed binaries before it, is in fact a continuum of degrees rather than a simple opposition. For the purposes of this paper, we consider *fantaisie harmonique* to be an example of homogeneous orchestration because its instrumental forces consist entirely of guitars.

fantaisie harmonique : context

Before demonstrating the compositional applications in *fantaisie harmonique* of the ideas of orchestration theory discussed in Section 2 and the specific considerations of the guitar discussed in Section 3, it will be helpful to mention a couple of other relevant aspects of the piece: its notation and its recording.

Notation

The piece employs a distinct style of geometrical notation. As shown in Figure 3 and in the full score (see supplemental material to the conference's proceedings), the music is often presented in flowchart-like networks rather than in standard linear format.

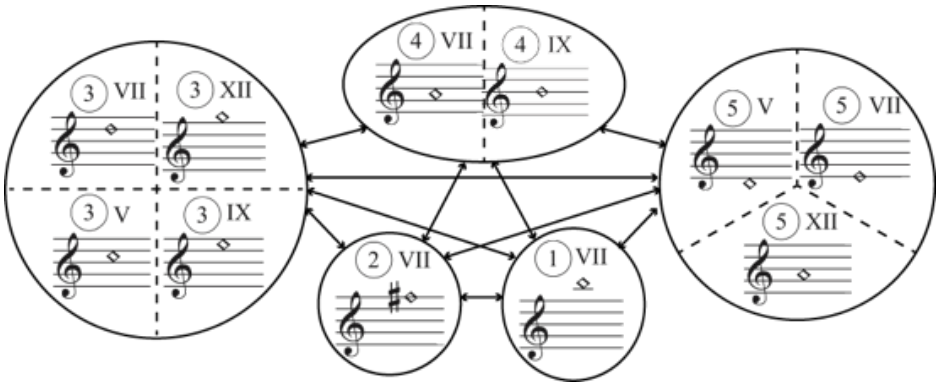


Figure 3 Example of geometrical notation *in fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars and an orchestra of electrical guitars. Reprinted from *fantaisie harmonique* (p. 8) by J. Noble, Supplemental material to these proceedings.

The large circular or ovular shapes in the network, which we call *nodes*, each contain one or more natural harmonics. For each of these, the string (circled Arabic numeral), fret position (notated with a Roman numeral), and notated harmonic (diamond notehead, written in standard tuning regardless of scordatura) is presented. The fret position and notated harmonic are redundant presentations of the same information, giving the performer the possibility to choose which notation they find the most intuitive. If there are multiple harmonics available within a single node, they are separated by dashed lines. The nodes themselves are separated by double-headed arrows, representing the possible pathways that the performer may freely follow through the network. The only rule for event order is that the performer must play consecutive harmonics on different strings: this is in order to maximize resonance, so that the harmonics have time to ring before being dampened by another harmonic on the same string. The

harmonics within a single node thus group together all of the options on a single string for that network. The performer chooses any one of these to play before moving to another node. This process continues for the duration of the network, specified in seconds above the staff.

All possible pathways between nodes are permitted: the arrows provide a visual reminder to the performer of the many options available, in the hopes of overriding any default tendencies such as always moving to a consecutive string. Similarly, the network itself is an attempt to override the strong learned tendency to read from left to right. It would be possible, as many composers have done, to simply put all of the elements on a single staff with the indication "play in any order," which should theoretically achieve the same result. However, we have found in practice that such notation, while it may be closer to standard and more familiar to most performers, tends to produce certain orders more often than others, especially those that move from left to right. By visually representing the many possibilities in an intuitive way, geometrical networks attempt to achieve a more authentically random distribution.

fantaisie harmonique also includes passages in standard notation, or in repeat cells that specify the order of events but leave the tempo to the free choice of the performer. Sometimes these different kinds of organization are presented simultaneously in different parts or orchestras, as will be shown in the analysis below.

Recording

The piece was composed for live performance, and it was realized in this way at the premiere. Later, the second author proposed to create a multitrack recording in studio, in which he would record all twelve parts individually in 3D audio. The result is the recording linked in Footnote 2. Only two guitars were used in the production of this recording: one acoustic and one electric. As such, the homogeneity within each orchestra is nearly perfect, since the parts were recorded by the same person on the same instrument during the same recording session. This is an idealized situation, achieving a higher degree of timbral consistency than could be attained in live performance.

Animated spatialization in the recording was added during the studio session. It involves virtual positions and movements that are physically impossible for live musicians. These were obviously not part of the original conception of the piece, which was composed for concert performance, but they were all added by the composer and became part of the concept of the piece's orchestration in the 3D recording.[4]

An additional aspect of the piece which is not the focus of this paper is its integration of visual elements. The premiere performance featured projection art by German light artist Kurt Laurenz Theinert, who also later produced the animated video that accompanies the recording linked above. We are in the process of creating a 3D video and virtual reality experience that will combine this abstract animation with images of the human performer.

fantaisie harmonique : analysis

The piece is organized in four main sections. Some features of each will be discussed below, with reference to orchestral effects categories outlined in Figure 1 and the subsection on scordatura.

[4] This is not to preclude the possibility of future live ensemble performances, which would be welcome even if they would exclude the new spatialization element. We are also considering ways to integrate live performance with spatialized audio, such as having one or two of the parts performed by live guitarists while the other pre-recorded parts are diffused with spatial animation.

Section 1

The opening section of *fantaisie harmonique*, inspired by sound mass works such as Ligeti's *Lontano* (1967) and Xenakis's *Metastaseis* (1953-54), creates the illusion of a distant landscape that gradually subsumes the listener. Beginning on a single pitch, adding the pitch a major seventh below, and gradually filling in that interval with all of the available harmonics in between, the two orchestras introduce the same pitches at the same time (an example of the orchestral gesture of Gradual Addition). But as shown in Figure 4, the electric guitars are synchronized with niente attacks in a regular 4/4 metre, while the classical guitars are in free, ametrical time, playing from geometrical networks. There are thus competing cues in the orchestration: the sounds might all integrate into a single layer if the listener attends to the pitch content, or might segregate into two distinct strata if they attend to the temporal-timbral layering. That is to say, the guitars in each orchestra group together through Surface Texture Integration, and the orchestras may or may not separate perceptually through Stratification depending on how the listener directs their attention.

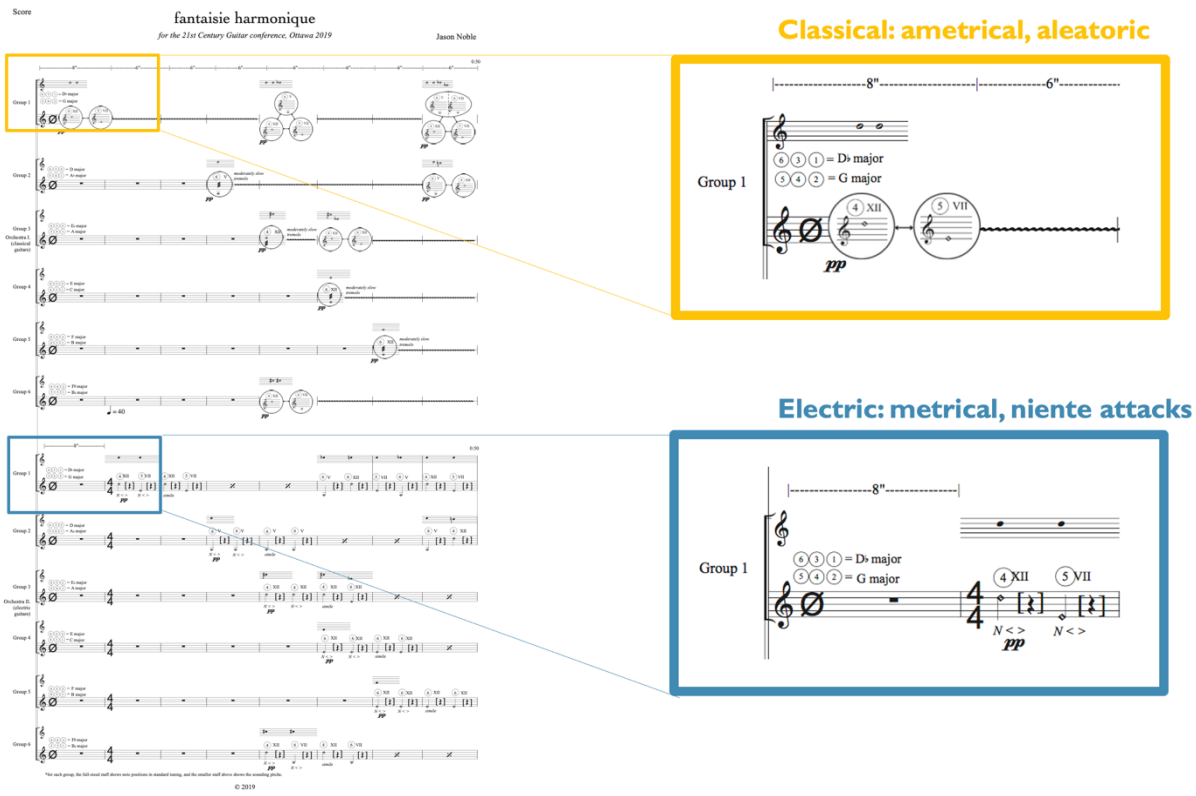


Figure 4 Competing orchestrational cues in the opening of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted and adapted from *fantaisie harmonique* (p. 1) by J. Noble, Supplemental material to these proceedings.

Other cues are provided by spatialization in the 3D audio, with segregation cues enhanced by spatial design. As shown in Figure 5, the classical orchestra begins at a distant position in front of the listener and gradually splinters off and surrounds them, creating the illusion of drawing closer and immersing. At the same time, the electric guitar orchestra is reduced to a point-source with all of the guitars appearing to occupy the same spatial location, beginning high above the listener and gradually spiralling down

towards them. Both orchestras thus follow an overall trajectory of drawing nearer to the listener, but they take different paths to get there. This is visible in a video of the spatialization automation, available along with the recording linked above.

These two complementary processes, gradual addition and gradual convergence / immersion, unfold over slightly more than two minutes. At Rehearsal C there is an abrupt change, as open strings are introduced for the first time sul ponticello and fortissimo, the electric guitars switch to distorted tone, and all instruments in both orchestras play repeat cells of ascending patterns. This is one of the clearest examples in the piece of Sectional Contrast, in which a clear and distinct change of timbre marks the end of one section and the beginning of another. Following this break, the texture slowly thins out and the timbre returns to a smoother, softer tone for Section 2.

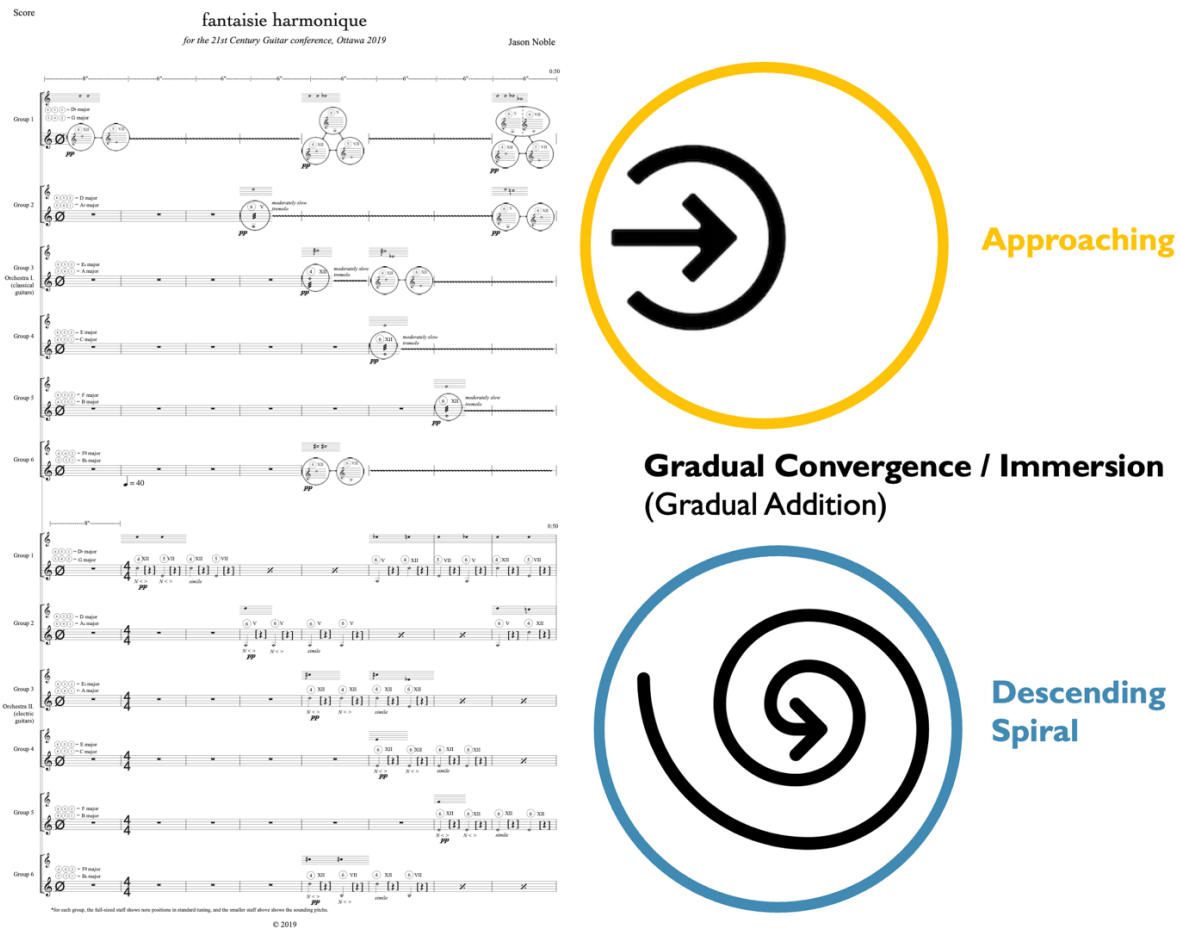


Figure 5 Automated spatialization in the opening of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted and adapted from *fantaisie harmonique* (p. 1) by J. Noble, Supplemental material to these proceedings.

Section 2

This section begins with a kind of exposition of the piece's tuning system. An ostinato figure in Electric Guitar 4 sounds its just-intoned E major and C major triads on the twelfth-fret harmonics in a repeating pattern and a central spatial position. As shown in Figure 6, the other electric guitars—playing from

geometrical networks—take turns in fading in and out with their own twelfth-fret harmonics, allowing their distinct tunings to be heard before ceding again to the ostinato. The durations and dynamic peaks of these interjections from the other guitars vary to prevent the pattern from becoming too predictable. Additionally, they are spatialized, each one entering from a different point and passing through the center at varying angles, rather like airplanes passing overhead from different directions.

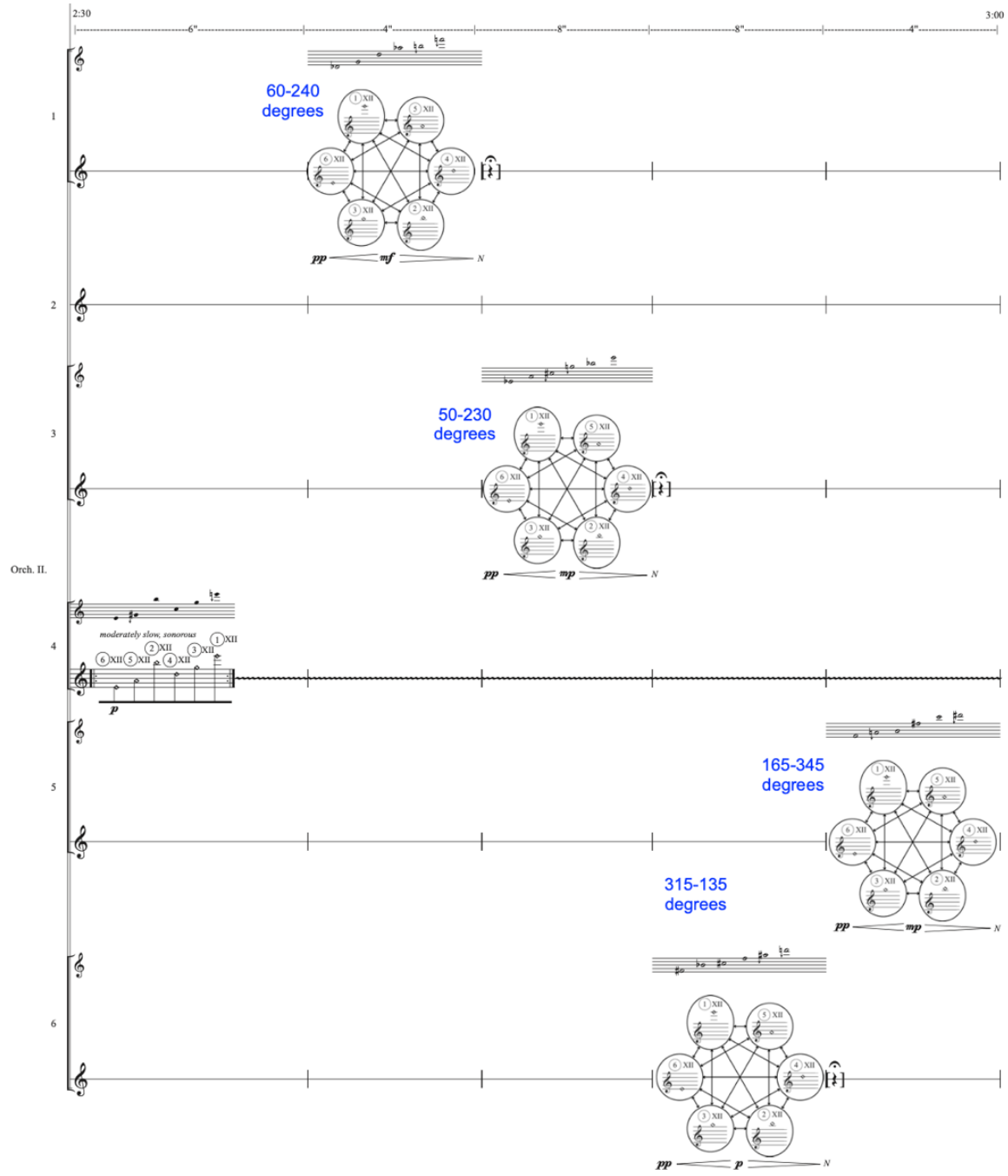


Figure 6 Pitch organization and spatialization in Section 2 *of fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted and adapted from *fantaisie harmonique* (p. 5) by J. Noble, Supplemental material to these proceedings.

A highly complex developmental process follows, with many different superposed patterns and a gradually ascending overall trajectory. Perhaps more than anywhere else in the piece, this process exploits "paradoxical complexity" in playing on the listener's capacity for perceptual integration and segregation, with various rhythmic, dynamic, and timbral profiles causing groups to emerge into the foreground as figures and then re-submerge into the mass of the ground (Noble, 2020). For example, Figure 7 shows a crossfade effect with a diminuendo-crescendo shaping in Group 1 coinciding with a crescendo-diminuendo shaping in Group 2. Figure 8 shows a parallel process in the rhythmic domain, with an accelerando in Group 2 coinciding with a rallentando in Group 3.

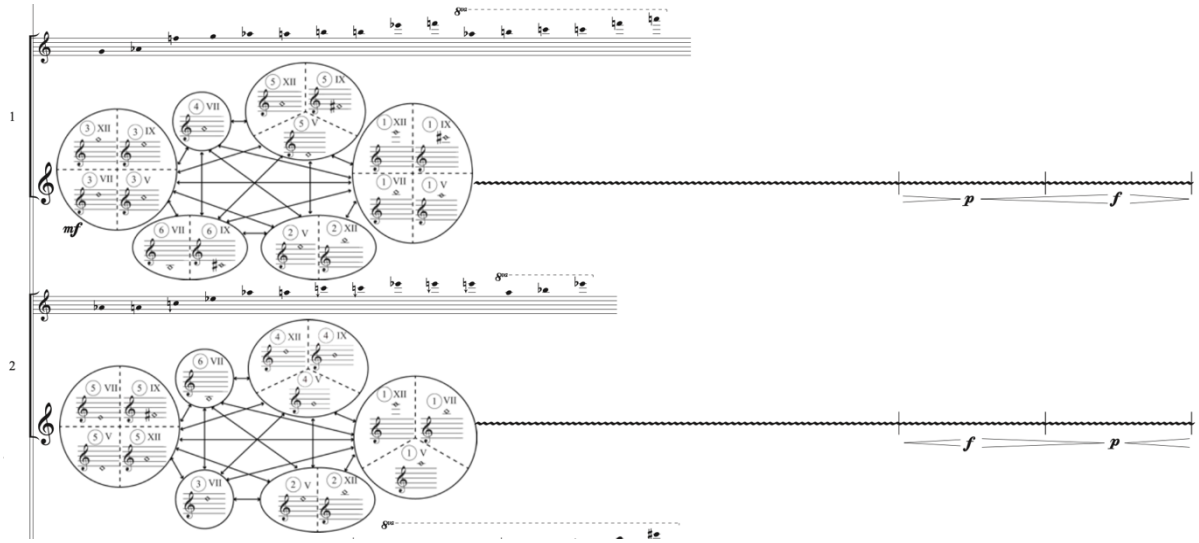


Figure 7 Dynamic crossfade in Section 2 of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted from *fantaisie harmonique* (p. 8) by J. Noble, Supplemental material to these proceedings.

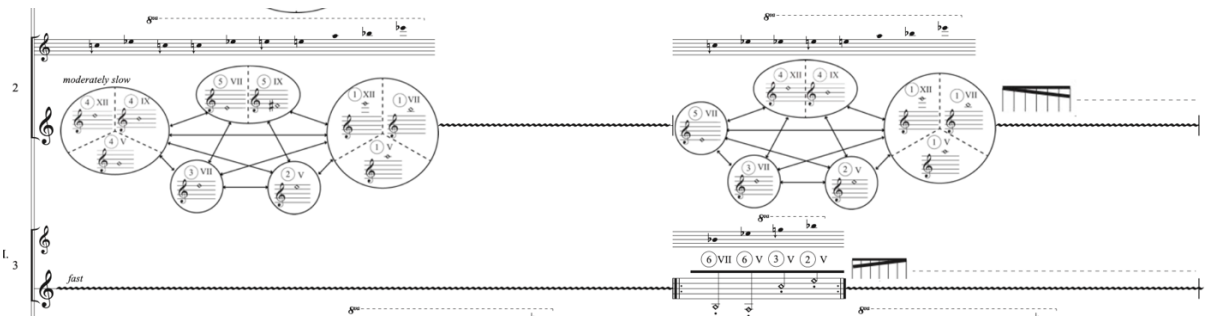


Figure 8 Rhythmic crossfade in Section 2 of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted from *fantaisie harmonique* (p. 10) by J. Noble, Supplemental material to these proceedings.

In a heterogeneous context, emergence-resubmergence may be affected simply by adding and removing different instruments, perhaps relying on their differing degrees of timbre salience to drive the effect. In a homogeneous context, such as the one presented here, the effect can still be achieved, but as the examples in Figures 7 and 8 aim to show, they must be carefully managed by the orchestrator by manipulating attributes of the musical sound.

The ascent in pitch space is complemented by a simultaneous (but asymmetrical and asynchronous) ascent in the virtual space of the 3D audio. The process is gradually arrested with the very high tremolos that come to dominate the texture at Rehearsal I, which then begins to cede to the next major section at J.

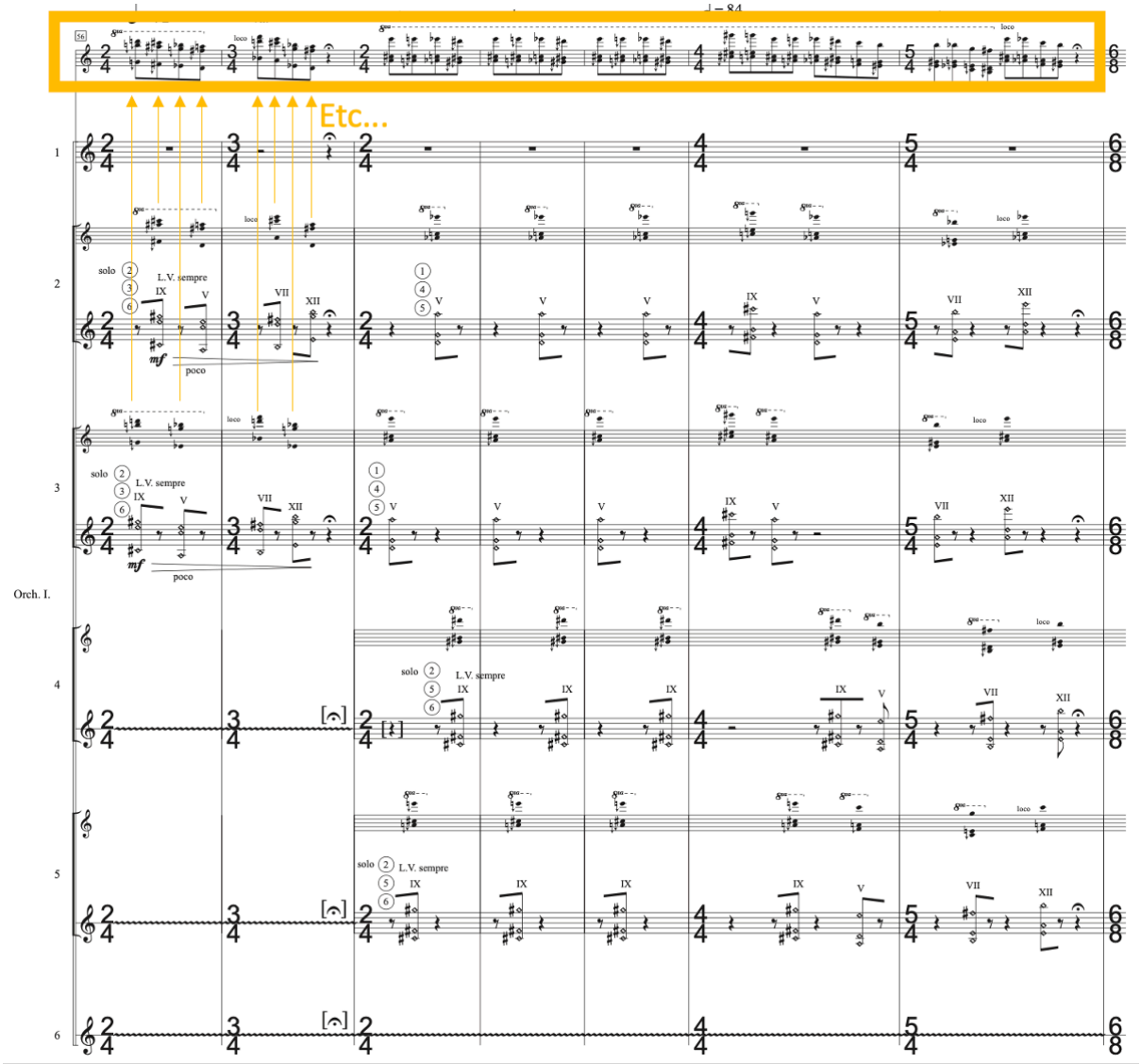


Figure 9 Harmonized hocket pattern in Section 3 of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted and adapted from *fantaisie harmonique* (p. 14) by J. Noble, Supplemental material to these proceedings.

Section 3

In Section 3, the melodic potential of the tuning system is foregrounded with an extended hocketing pattern in which smooth, microtonal melodic lines are divided between six solo guitars. These appear first as harmonized melodies, presenting the just-intoned major triads on which the tuning system is founded in parallel patterns, as shown in Figure 9. In addition to showing the harmonic position and the sounding pitch in each part, a pitch reduction is provided in the top staff to help the conductor and performers see how all the notes fit together. Following this, the hocketing pattern continues monophonically at an accelerated tempo and with shorter, more varied excerpts of the microtonal scale, as shown in Figure 10.

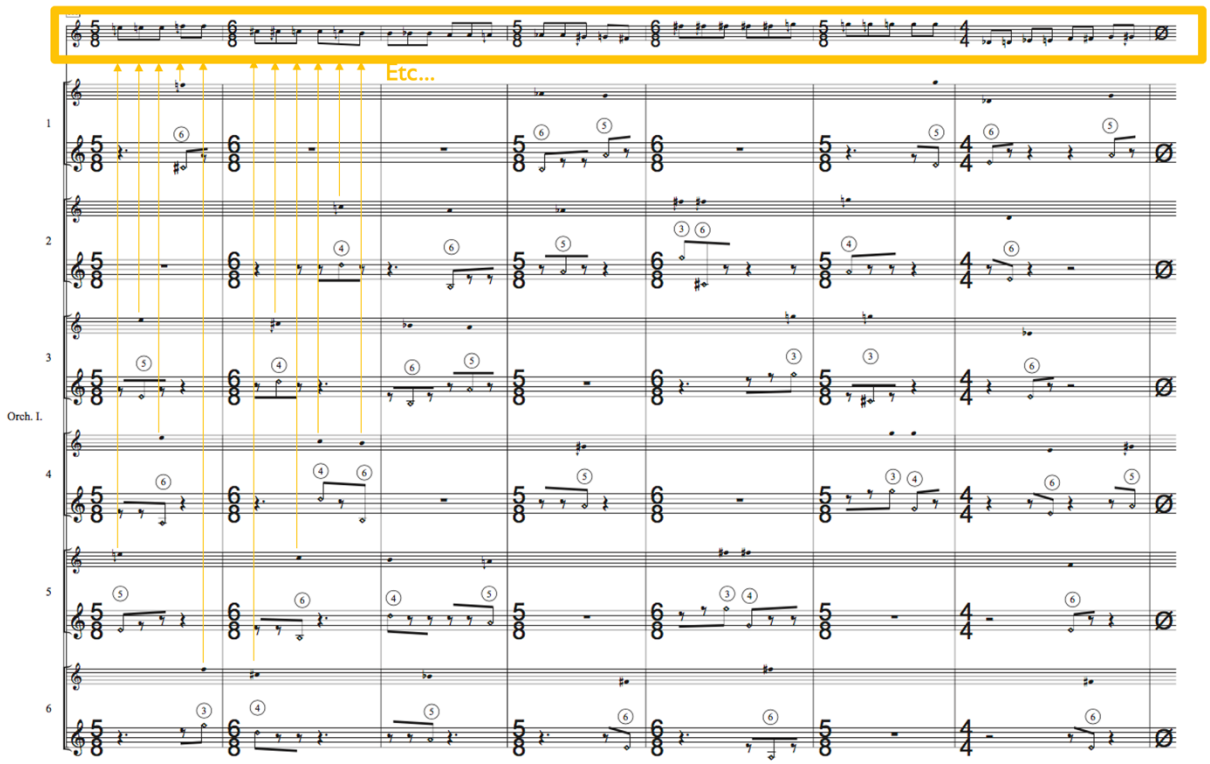


Figure 10 Monophonic hocket pattern in Section 3 of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted and adapted from *fantaisie harmonique* (p. 18) by J. Noble, Supplemental material to these proceedings.

Spatialization in this section is used at cross-purposes with other orchestrational cues. The near-perfect timbral homogeneity of the sounds from the six guitars, combined with the smooth conjunct motion of the melodic patterns, make an overwhelming perceptual case for Stream Integration, in which sequential events group perceptually into a musical stream or line. However, as shown in Figure 11, the guitars in the 3D audio recording virtually surround the listener, and their audibly distinct spatial positions provide strong cues for the opposite effect of Segregation (to some extent, this mirrors the experience of the performers themselves, who would be more acutely aware of the notes in their own part than of the seamless integration of the whole). The perceptual ambiguity between these competing cues for integration and segregation enhances the aesthetic interest of this section.

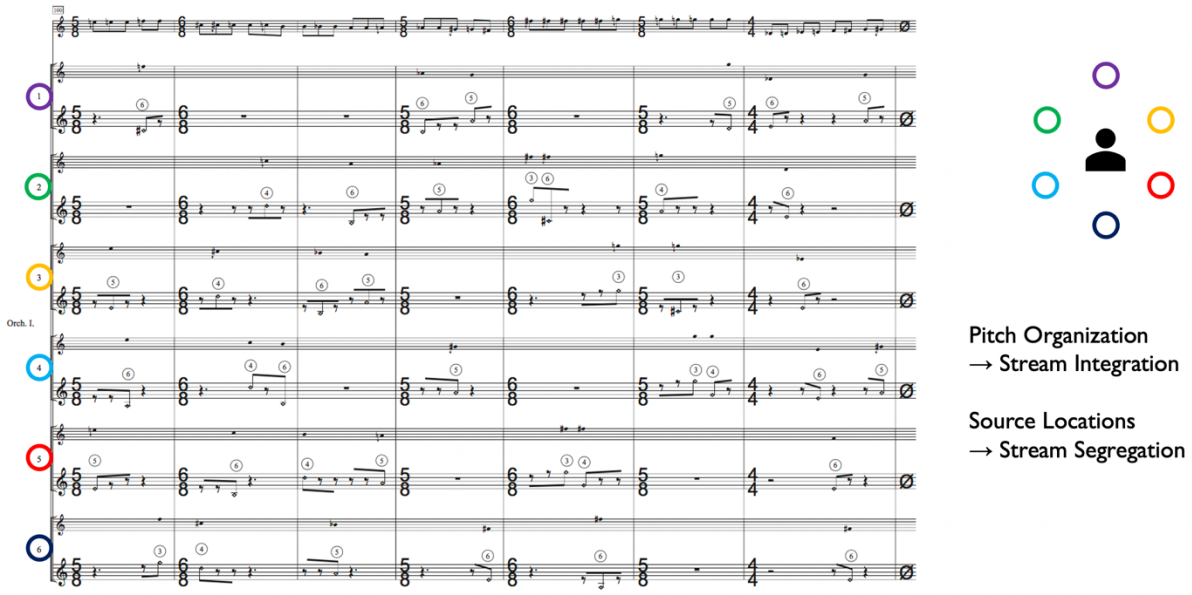
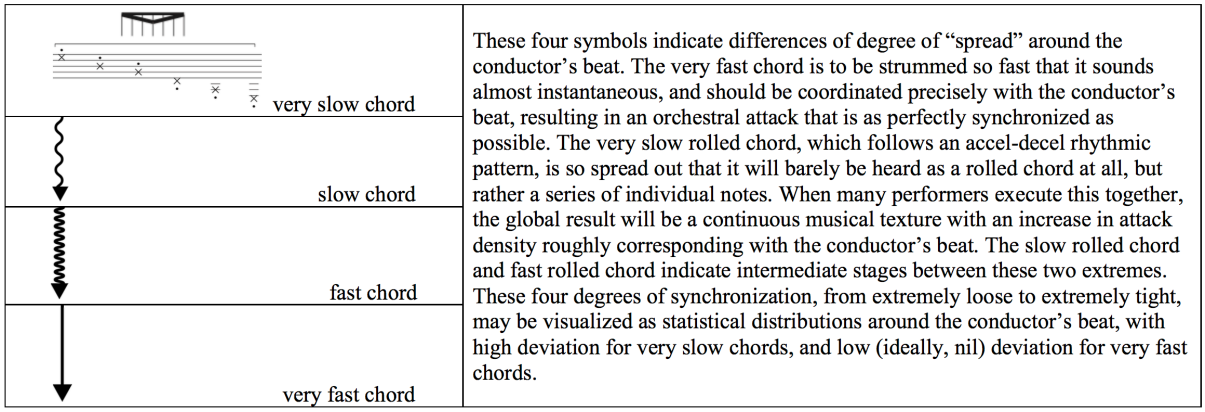


Figure 11 Spatialization in Section 3 of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted and adpated from *fantaisie harmonique* (p. 18) by J. Noble, Supplemental material to these proceedings.

Section 4

The final section presents a different kind of ambiguity, in which the two orchestras initially have similar aleatoric textures likely to integrate into a single layer, but gradually diverge to create segregation. Following another abrupt Sectional Contrast at Rehearsal N, roughly 9 minutes into the piece, all parts move to free-time patterns, notated either in geometrical networks or in repeat cells. The pitch content initially consists of all open strings, and gradually ascends into the higher harmonics as the section progresses. The electric guitars remain in free time until the very last attack of the piece which is synchronized between all parts, but the classical guitars gradually progress from complete asynchrony to perfect synchrony (or as close as possible) over the course of the section. That is, the classical guitars begin with a random distribution of attacks with no underlying meter, and then gradually they organize around a tactus, like a bell curve of attacks that gradually grows tighter and tighter until the notes all unify into single irreducible events: in orchestration theory terms, there is a gradual transition from Textural Integration to Punctuation Blend. This plays on the challenge noted above of synchronizing attacks within guitar orchestras, by treating the asynchrony initially not as an undesirable flaw but as a source of aesthetic interest in the composition. As shown in Figure 12, this is notated first with aleatoric rhythm, then with chord roll symbols of varying grains, and then a straight arrow. The muted but still pitched sounds in the classical guitars also provide a timbral contrast with the ringing harmonics in the electric guitars, which progressively ascend both in pitch height and spatial position. Eventually, segregation between the two orchestras becomes obvious, but the point at which that occurs may vary from listener to listener.

(a)



(b)

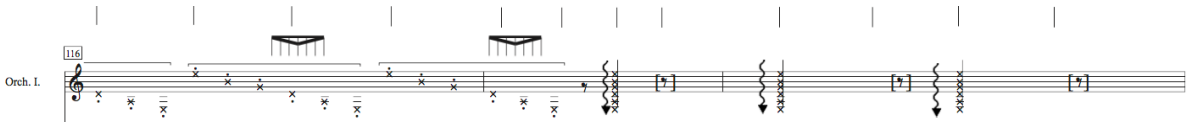


Figure 12 Gradual progression from asynchrony to synchrony in Section 4 of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II), as shown in (a) the performance notes and (b) the score. Reprinted from *fantaisie harmonique* (n.p. and p. 21) by J. Noble, Supplemental material to these proceedings.

The piece ends with a final chord consisting of all open strings from all guitars. The classical guitar sounds naturally die away much faster than the electric guitar sounds, which are synchronized with a rhythm of swell-shrink dynamic contours, pulsing slowly in and out as the sound gradually dies away as shown in Figure 13. This parallels, and is in the same tempo as, the niente attacks with which the electric guitars began in Section 1. This close-by-return motif is reinforced by having the electric guitars spatialized in a spiral pattern, similar to that in the opening but in reverse, gradually drawing farther away from the listener.

Conclusion

In this paper, we have described some of the challenges and advantages of writing for guitar orchestra, grounded in the theory of orchestration advanced by McAdams and colleagues (ACTOR, n.d.), as summarized in Table 2. These challenges and advantages have been demonstrated through a case study of one of the author's compositions, *fantaisie harmonique*. We have shown that orchestrating for homogeneous ensembles is grounded in the same perceptual principles and categories of effects as orchestrating for heterogeneous ensembles, even though the two may appear superficially different. We also discussed some specific qualities of the guitar, and how they might be magnified in a large ensemble context. The guitar orchestra presents a rich field of possibilities: some of those exploited in *fantaisie harmonique* include guitar-specific tuning systems, open strings and natural harmonics, varying attack qualities, timbral and dynamic differences between classical and electric guitars, and spatial design made possible by 3D recording.

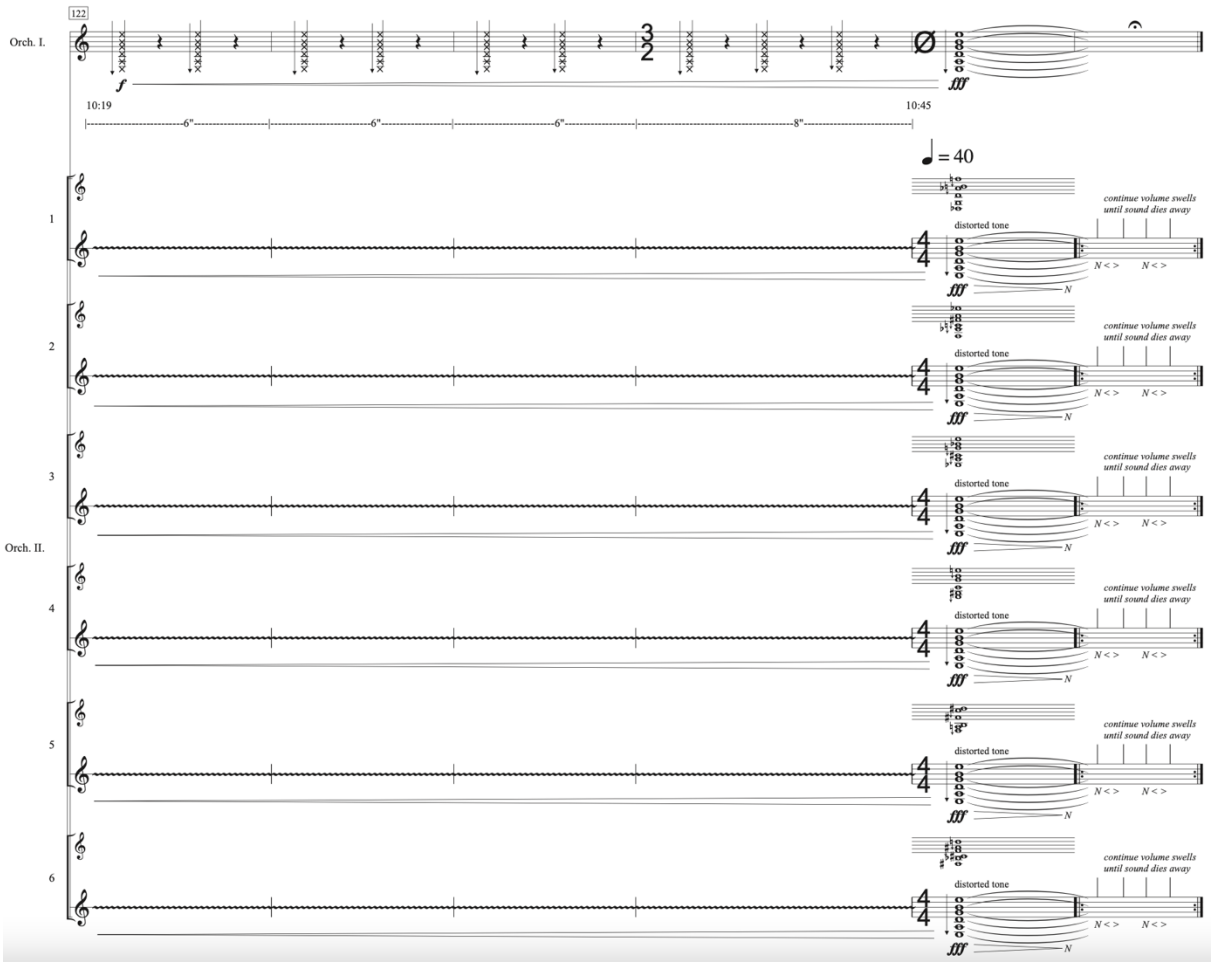


Figure 13 Conclusion of *fantaisie harmonique* (2019) by Jason Noble, for an orchestra of classical guitars (Orch. I) and an orchestra of electrical guitars (Orch. II). Reprinted from *fantaisie harmonique* (p. 22) by J. Noble, Supplemental material to these proceedings.

Table 2 Summary of challenges and advantages of homogeneous orchestration discussed in this paper

Challenges	Advantages
Little existing perceptual research to ground practice	Opportunity for a more detailed and nuanced exploration of particular instruments
Orchestral effects cannot be based on differences of instrumentation alone	Expands possibilities for textural and timbral combinations within single instrument families to symphonic proportions
Effects based on difference or separation (e.g., segregation of layers, segmentation between sections) harder to achieve	Effects based on similarity or cohesion (e.g., blend into uniform events, integration into surface textures) easier to achieve
Sound qualities must be specified with greater precision to achieve perceptual differences (e.g., registral separation, contrasting articulations and/or dynamic contours, timbral modifications such as pluck positions, spatialization)	Enables new musical languages to emerge from instrument-specific properties and sound qualities (e.g., propensity for scordatura, facility for natural harmonics and open strings, wide range of attack qualities and degrees of asynchrony, wide range of timbral and dynamic variations)

Homogeneous orchestration forces the composer to think about the qualities of the sound every step of the way, crafting sameness or difference carefully without assuming them as basic properties of instrumentation. It also unlocks and multiplies the timbral potential within a single kind of instrument, opening up possibilities that the composer might never have considered in a mixed ensemble. In the examples discussed in this paper, homogeneity of instrumentation created different advantages and challenges that were exploited creatively in the piece. In some cases, such as a seamless stream integration in the hocketing section that would be almost impossible to achieve in a heterogeneous ensemble, timbral homogeneity was a great advantage. In other cases where segregation was desired, the homogeneous ensemble necessitated different strategies than a heterogeneous ensemble might, requiring differences to be crafted in sound qualities that may be enhanced by incorporating spatialization into the orchestrational design. The potential for ambiguity created by competing orchestrational cues was also exploited, allowing the music to morph between integration and segregation in a way that would be more difficult to achieve in a heterogeneous ensemble.

We hope to have made a case for the creative potential of homogeneous orchestration in general, and of orchestrating for guitar ensembles in particular. We are proud of the work we have done but we feel that the surface has only begun to be scratched, and that there is immense potential for future research and creation in this field.

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The authors would like to thank Amy Brandon, Rita Torres, and The 21st Century Guitar Conference for commissioning and premiering *fantaisie harmonique* for its 2019 edition, and for featuring the presentation on which this paper is based in its 2021 edition. We would also like to thank the ACTOR project (Analysis, Creation, and Teaching of Orchestration) for funding the postdoctoral position held by the first author during the piece's creation, as well as the Strategic Project and Research Creation grants that funded the recording. We would also like to thank the team of artists who helped produce the audio and video realizations, including audio engineer Denis Martin, digital animator and light artist Kurt Laurenz Theinert, video and virtual reality artist Simon Rouhier, acoustician Caroline Traube, Tonmeister Martha de Francisco, and recording assistants Nicolas Pelletier and William Sylvain.

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Jason Noble is currently a postdoctoral fellow at Université de Montréal. He has composed extensively for the guitar, with pieces having been performed around the world by many guitarists, published by Les Productions d'Oz, and released on several commercial recordings. Noble was co-director of the inaugural 21st Century Guitar Conference in Ottawa, 2019. His research has been published in leading journals including Music Perception, Music Theory Online, Journal of New Music Research, and Organised Sound. He is an editor of the forthcoming Oxford Handbook of Orchestration Studies. For more information, visit www.jasonnoble.ca.

Email: jason.noble@umontreal.ca

Steve Cowan Prize winner of 10 national and international competitions, Steve Cowan has performed and taught throughout Canada, the United States, and Europe. He has commissioned several new works for guitar and given world premieres in major cities such as Paris, Toronto, and New York. His solo and ensemble recordings include albums with Analekta, Atma Classique, and EMEC Discos. Steve holds degrees from Memorial University of Newfoundland, the Manhattan School of Music, and McGill University, and is currently a guitar instructor at the Schulich School of Music of McGill University in Montréal. For more information, visit www.stevecowanmusic.com.

Email: steven.cowan@mcgill.ca