REMOVING THE IMAGINARY BOUNDARY BETWEEN SCORE AND WORK: INTERACTIVE GEOMETRICAL NOTATION

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ABSTRACT

In many notational practices in late 20th- and early 21st-century music, the score has a visual artistry all its own. Nevertheless, even heavily graphical *Augenmusik* scores are often experienced only by the composer and performer, and are not part of the audience's visual experience of performance. Because elements from non-auditory modalities (especially visual) seem essential to many musical works, I argue for a multimodal understanding of such pieces, removing the imaginary boundary between score and work. I discuss a type of aleatoric, flowchart-like geometrical notation that I frequently use in my own compositions, using hybrid notation combining standard musical notation with geometrical forms. This kind of notation helps clarify the analogy between visual and auditory modalities. In my piece *simple geometries*, I integrate geometrical notation into performance with the projection of an interactive, animated score that uses movement and changes of zoom perspective to make the logic of the work's open form accessible to the audience.

1. SCORE AND WORK: *A FRONTIÈRE IMAGINAIRE*

The traditional model of production in Western art music keeps the composer at a mysterious distance: neither she herself nor the object that she directly produces—the score—is typically encountered by the audience during performance [1]. Although the composer is considered the "author" of the work, the most immediate fruit of her labour is taken to be curiously external to the work itself (except in the score's heuristic role of teaching the performer how to mediate the work to the audience). The composer is a kind of shadow-puppeteer, the contortions of whose hands are valued as a means to the end of the projected shadow-image but not as aesthetic ends in themselves. It matters what the score looks like, but only insofar as its appearance affects its clarity in instructing the performer, who in turn delivers the work to the audience through the medium of sound. That the audience does not see the score in performance is assumed not to impoverish their experience of the work, for a successful performance will have transmitted through sound everything essential about the work. The underlying principle is that music exists within the singular modality of the auditory domain, and the score—while necessary as a vehicle for the creation or transmission of the work—is fundamentally distinct from the work itself: a subservient, pragmatic entity that is aesthetically inessential. Gérard Grisey expressed such a conception by comparing the score to "*the map*" and musical sound as "*the lie of the land*" [2], as did Brian Ferneyhough in stating that the adequacy of musical notation—which occupies "a strange ontological position: a sign constellation referring directly to a further such constellation of a completely different perceptual order"—is determined by its efficacy as a method of specifying sounds [3]. Some authors have distinguished between "descriptive" notation, which conveys information about musical sound, and "prescriptive" notation, which conveys information about methods of sound production [4], but both notational concepts ultimately assume sound to be the essence and *telos* of the musical work, with the score serving a supporting, didactic role.

The putative ontological divide between score and work is inconsistent with the practices of some composers in the late 20th and early 21st centuries. The shapes and symbols in scores such as Cornelius Cardew's *Treatise* (1963-67) and George Crumb's *Makrokosmos* (1972-79) are clearly artistic elements in and of themselves, not aesthetically inert instructions for sound production. These practices find precedents in the works of much earlier composers such as Baude Cordier (1380-1440; Figures 1 & 2).

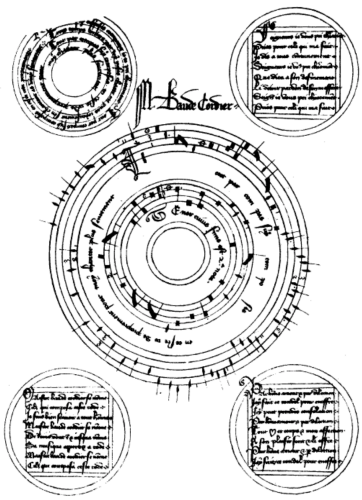

Figure 1. B. Cordier, *Tout par compas suy composes*.

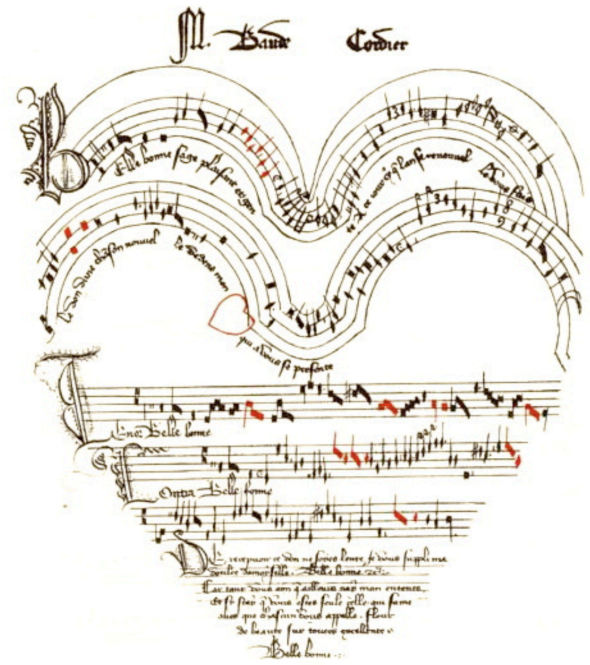

Figure 2. B. Cordier, *Belle, Bonne, Sage.*

Jason Freeman considers "concrete" scores such as these to "visually depict programmatic elements in the music through novel graphic design" [1]. Their visual appearance conveys information, ideas, and aesthetic effects difficult or impossible to infer from sound alone, and as such one could argue that an experience of these works that does not involve seeing the score is incomplete. They force us to either dismiss the visual elements as inessential to the musical work on the grounds that they do not reside in the auditory modality, or to adopt a multimodal concept of musical works that no longer assumes that everything essential is transmitted through sound. I would like to make a case for the latter position.

I contend that the score is not—or at least does not have to be—merely an elaborate sonic recipe, an externality in the service of the work proper. As Ferneyhough says, notation is "an explicit ideological vehicle (whether intended as such or not from the point of view of the composer)" [3] (pp. 2-3). The appearance of the score can be an essential artistic constituent of the work, an aesthetic deliverance in its own right, a symbiotic visual counterpart that can clarify, recontextualize, enrich, and reinforce the concepts presented through musical sound. A parallel situation is seen in concrete poetry, in which the visual layout of the words makes a distinct aesthetic contribution that complements the poem's linguistic meaning. A familiar example is "The Mouse's Tale," from Lewis Carroll's *Alice's Adventures in Wonderland* (Figure 3). In his piece *Adventures Underground* (1971-77), which sets this poem of Carroll's, David del Tredici creates a similar "*Augenmusik*" effect in his score [5].

In his Oxford Music Online entry, Thurston Dart describes *Augenmusik* ("Eye Music") as "[m]usical notation with a symbolic meaning that is apparent to the eye but not to the ear," and stipulates that "[s]ince its effects are derived from notation it is the concern of composers and performers rather than listeners" [6]. Dart goes on to

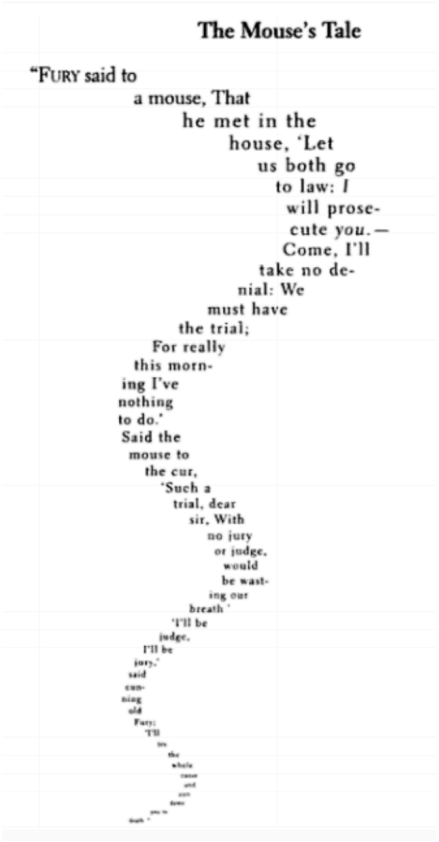

Figure 3. L. Carroll, "The Mouse's Tale" from *Alice's Adventures in Wonderland* (1865).

distinguish two simultaneous interpretations derived by performers of *Augenmusik*: one symbolic and the other "purely musical." Similarly, David Kim-Boyle acknowledges that "graphic scores often have a visual appeal that goes beyond a purely musical function" [7]. These authors address the multimodal nature of such works by distinguishing their musical functions from other functions. I want to offer another reading, interpreting the musical work as *inherently multimodal*. On this reading, works such as those listed above are not "purely" musical structures onto which inessential signs from the visual modality are appended, but rather are musical structure that are multimodal in their very conception.

When the score's visual appearance "becomes of primary formal importance" and is invested with "aesthetic and musical significance" [7], the question of what in the work is "purely" musical and what is not becomes academic. Also, as many have noted, the notion of musical "purity" is deeply suspect. Responding to Peter Kivy's concept of "music alone," Nicholas Cook states that "music never *is* 'alone' ... it is always received in a discursive context ... it is through the interaction of music and interpreter, text and context, that meaning is constructed" [8]. Cook describes how musical meaning arises through interpretive mappings between musical and extramusical domains. I want to suggest that such mappings may also operate *within* musical works (conceived multimodally). Similar to mappings between musical gestures and physical gestures, which invite what Arnie Cox describes as

"mimetic motor imagery" and "mimetic motor action" as sources of embodied engagement in musical experience [9], visual structures in musical notation and auditory structures in musical sound may also invite homologous mappings that yield satisfying ways to engage with the work. For musically literate musicians accustomed to score-reading, this is a truism: even after hearing a work performed, musicians often feel their understanding of a piece is incomplete until they have seen its score, as the score's visual presentation of musical information vastly enriches their understanding of the musical work. Composers spend untold hours obsessing over the visual appearance of their scores—even scores that are not "graphical" in the conventional sense—and there is little doubt that the experience of reading scores is often an aesthetic visual experience for them (distinct from and complementary to aesthetic experience of hearing with the "mind's ear"). Nevertheless, visual charms of notation are conventionally assumed not to belong to the music proper, perhaps at most providing extramusical decorative addenda.

Works of *Augenmusik* make more explicit than standard musical notation the impetus to recognize the distinct and complementary contributions of different modalities as equally essential, to overcome the *frontière imaginaire* between score and work. My suggestion is that the modal divide between score and work is ideological and not ontological, and that there may be good reasons to reconceptualize the musical work to include multimodal components. By offering visual elements that require little or no special training to understand (unlike conventional musical scores, which require an idiosyncratic literacy), *Augenmusik* scores make illuminating and enriching visual experiences accessible to nonmusicians and musicians alike, "stimulated by a desire to realize broader social and political ideals of engagement" [7]. Frequently these visual experiences reveal important conceptual and aesthetic aspects of the work, as well as privileged insights into the work's structures and functions that would be lost on many listeners (including many musicians) in "monomodal" listening situations. Perhaps the satisfying act of recognizing relations between notation and sound may parallel the satisfaction of similar cross-domain mappings in concrete poetry, word painting, and incidental music for film, theatre, and ballet. Perhaps the contextualizing visual complement provided by graphical scores may provide an entry point to audiences unfamiliar with contemporary music, and may thereby broaden the reach of our art.

Incentives such as these may have become apparent to contemporary composers, as many have begun to explore innovative, integrative, multimodal practices that unite visual elements of notation with the deployment of sounds in time. Such works frequently incorporate "liveness," with score and performance co-evolve continuously in real-time [10], inviting a heightened sense of engagement in a responsive, real-time interaction [11]. In this kind of "live" context, dynamic relations between score and performance become a major source of aesthetic interest for composers, performers, and audiences alike: "[n]otation becomes a vehicle for expressing the uniqueness of each performance of a work rather than a document for capturing the commonalities of every performance of that work" [1]. In such scenarios it seems unintuitive to conceive of the score as an antecedent or externality to the work: musical sound is neither conceived nor encountered as an isolated entity, and the symbiotic, unfolding interaction between notation and sound is a an aesthetic end in itself, not a mere means to the realization of a "purely" musical (*qua* sonic) work. In this spirit, my own artistic work has gravitated towards multimodal integration and diminished boundaries between score and work, as discussed below.

2. GEOMETRICAL NOTATION

I make frequent use of geometric, flowchart-like aleatoric notation which provides an intuitive and visually pleasing vehicle for musical expression. The use of geometrical forms in musical composition and notation has many precedents. As noted above, George Crumb made use of circular and spiral forms in some of his scores. Iannis Xenakis used geometrical forms as the basis for both architectural design and musical composition, in some cases using the very same forms for both purposes: a famous example is his translation of the contour lines from the Philips Pavilion, which he designed with architect Le Corbusier, into glissando lines in *Metastaseis* (1953-54). Barry Truax's work *Riverrun* (1986), realized entirely with real-time granular synthesis, has no score in the traditional sense but deploys very brief sound events ("grains") according to complex geometrical distribution that is revealed by spectrographic analysis (Figure 4).

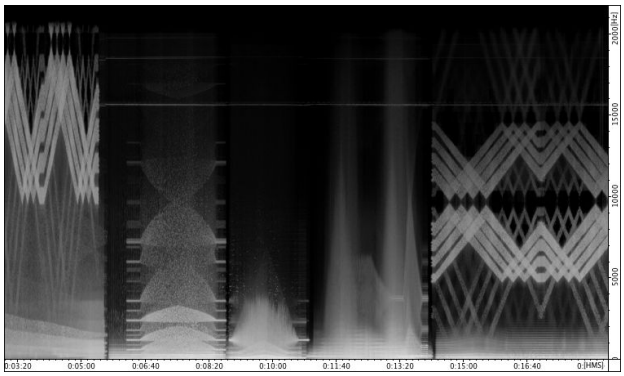

Figure 4. B. Truax, spectrograph of *Riverrun* (1986). Produced with permission.

Indeed, Truax's compositional process involved what he called "tendency masks," stochastic distributions of sonic parameters controlled with programmed geometrical shapes [12].

I find geometrical notation appealing for several reasons: it is elegant in its simplicity; it reveals the logic of some kinds of musical patterning in a straightforward, readily comprehensible way; and it supports mappings to a variety of cross-modal and extramusical domains, via the shared image-schemata of geometrical reasoning. My first experiments with geometrical notation followed from considerations of how to effectively notate the aleatoric deployment of defined sets of musical elements or values to performers. A standard solution is to do this with musical elements notated on a single staff with prescriptive textual instructions such as "play in any order" (e.g., Figure 5).

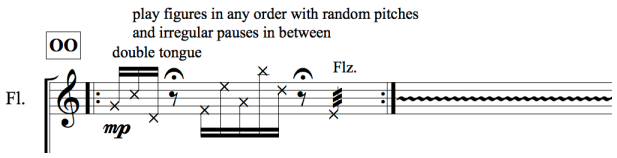

Figure 5. J. Noble, excerpt from *The Sphinx and the Garden Gnome* (2015).

But I found this kind of representation unsatisfactory because of the cognitive dissonance between the linear representation of elements on the staff and their non-linear deployment, and because of the reliance on textual instructions to convey ideas that should be diagrammatically communicable. Furthermore, for readers conventional Western music notation (as well as English and most Western languages), there is a strong learned tendency to read from left to right, and as a result performers tend to unintentionally favour left-to-right orderings between consecutive elements, skewing the distribution of the sounding result. Geometrical notation provides a more suitable visual representation of the desired distribution, positioning each element at a vertex on a geometrical figure and using unidirectional or bidirectional arrows to indicate the possible pathways (e.g., Figure 6).

Geometrical notation is versatile: the number and type(s) of elements in a given network may be chosen freely by the composer. In some cases the elements I have used are single notes or sound events, while in others they are longer sequences, such as melodies in the folksong pastiche in *One Foot in the Past* (2016; Figure 7).

Superposing multiple layers of carefully selected but indeterminately distributed elements creates a generative situation in which random coincidences of events produce emergent harmonic, rhythmic, and textural properties that come to temporary perceptual prominence and then dissolve. The characteristics of these emergent properties depend greatly on the constituent elements that make up the musical layers—whether they are timbrally homogeneous or heterogeneous, whether or not they are structured metrically or periodically, what potential intervallic relationships exist within their referential pitch structures (if any), etc. Different textural roles may be assigned to different

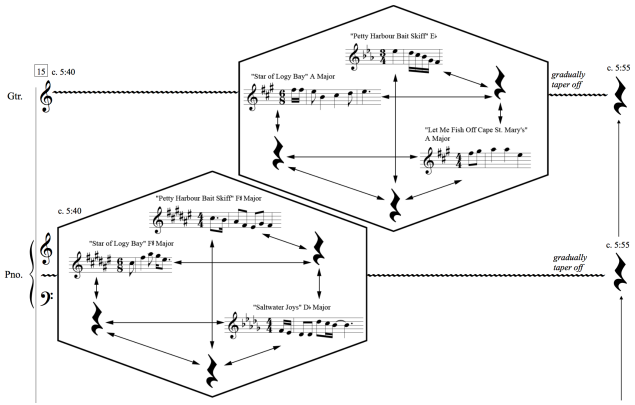

Figure 7. J. Noble, excerpt from *One Foot in the Past* (2016).

musical layers, with varying degrees of linearity (e.g. melodic content), periodicity, harmonic complexity, and so forth (e.g., Figure 8). It is also possible to alternate linear sections (using conventional notation or a close approximation thereof) with distributional sections (using geometrical notation), and/or to superpose linear and distributional sections in different orchestrational layers.

An attractive aspect of geometrical notation is that the formal organization of musical materials is not concealed beneath a linear realization (as is frequently the case in combinatorial music, for instance), but is rather laid bare on the surface of the score. Of course, any given performance takes a linear form as sound events are realized sequentially in time, and these could theoretically be notated more-or-less conventionally. However, geometrical notation makes clear that no particular realization is prioritized over any other: an indefinite number of potential combinations exists within the distributional networks, and a great deal of the fascination of the music comes from the coincidentally emergent properties of random samples of those combinations as they unfold indeterminately. Even viewers not equipped with the musical literacy to make sense of the content of the musical elements can still appreciate the multiplicity of possible pathways through the networks, as well as the visual beauty of simple geometrical forms.

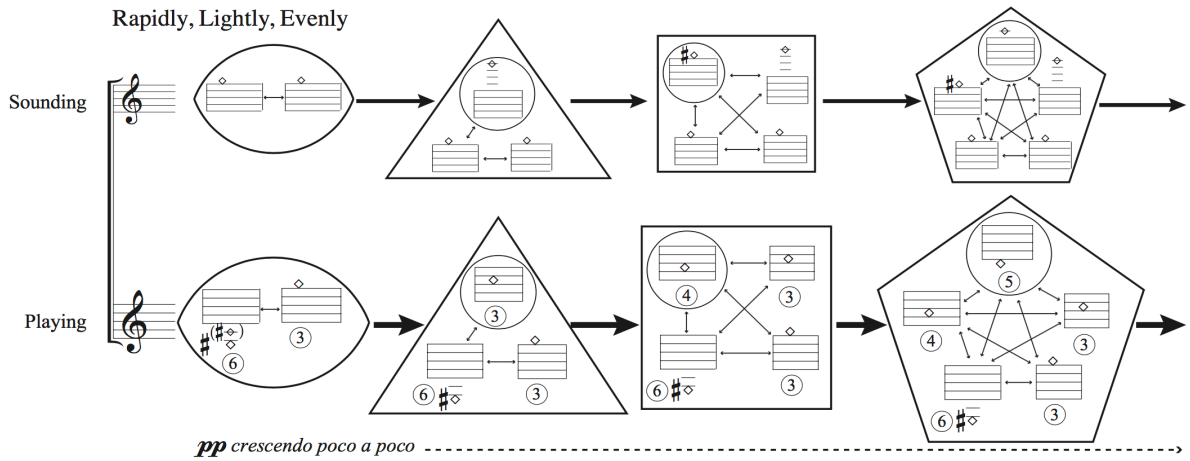

Figure 6. J. Noble, excerpt from *Shadow Prism* (2015).

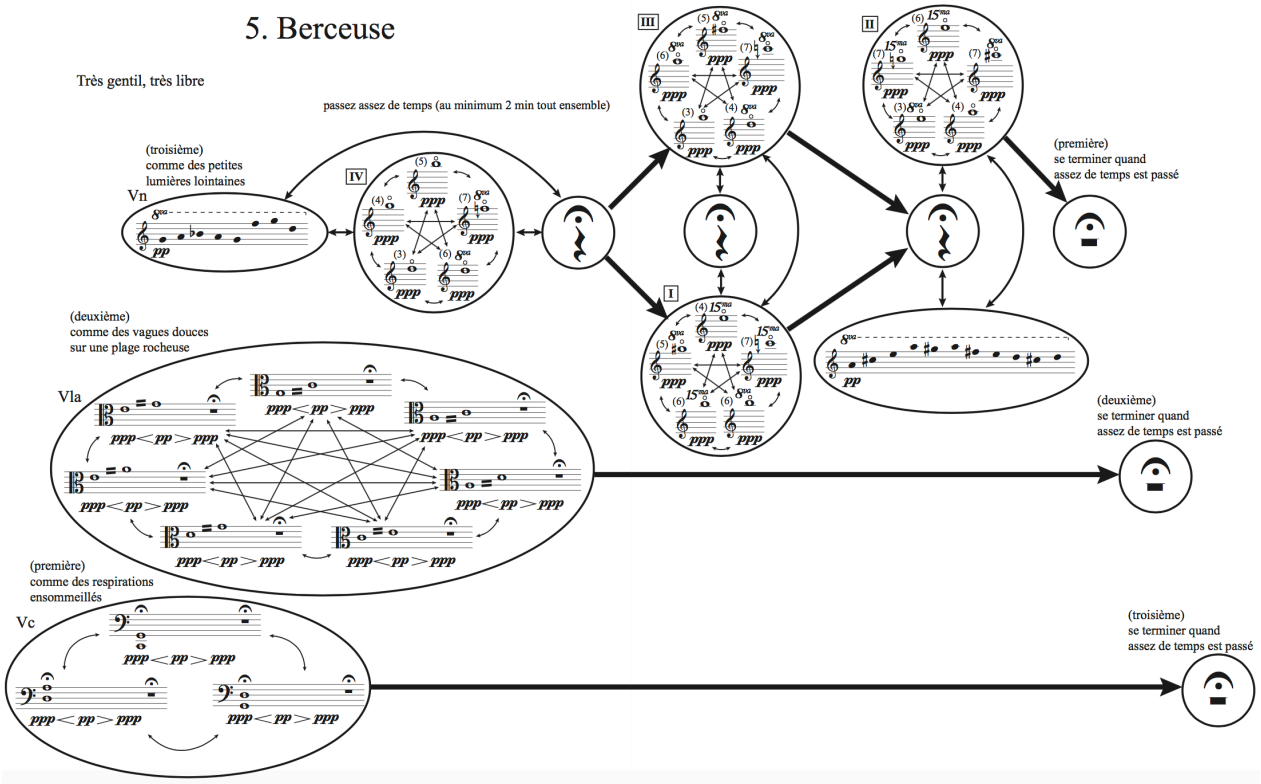

Figure 8. J. Noble, "5. Berceuse" from *Bathurst Suite* (2016).

Although the above-listed examples are multimodal in conception (and likely to be experienced as such by performers), they do not yet directly address the problem articulated in the first section of this paper: how can graphical notation be incorporated into performance, making the artistic visual qualities and their meaningful relations with musical sound available to audiences? My first serious attempt to answer this question was in *simple geometries* (2017) for cello, electronics, illuminated glass harp, and video projection.[1]

3. SIMPLE GEOMETRIES (2017)

simple geometries consists of seven musical layers (I – VII) organized approximately concentrically, through which the performer moves according to a bidirectional spiral pattern dictated by common elements between consecutive layers (indicated in the score with large two-headed arrows connecting the common elements; see Figure 9). The pitch content of the piece consists entirely of open strings and natural harmonics (which themselves follow a simple geometrical pattern dictated by simple numerical ratios), along with indeterminate pitches provided by idiophonic accessory instruments.

Layer I includes a singing bowl or very large crystal glass, layer II includes two large crystal glasses, layer III includes three medium crystal glasses, and layer IV includes four small crystal glasses. In layers I–IV, the specified pitches and accessory instruments for each layer may be played in any order; as such, there are no arrows within the dotted rings delineating these layers. However, transitions between layers must take place by way of shared elements indicated with dashed boxes and large bidirectional arrows (a kind of "common-tone modulation"). The idiophonic instruments are physically arranged on a table in front of the cellist in a spiral pattern, with the singing bowl (or very large crystal glass) in the centre. Each crystal glass is illuminated from below by LEDs activated by contact microphones when the glass vibrates.

Layers V–VII are executed only on the cello, and consist of cyclical ordered sequences containing 5 – 7 phrases, respectively, notated in ring patterns. The patterns are modelled on simple geometrical patterns: sinusoidal waves in V, sawtooth patterns in VI, and exponential expansion in VII. These same patterns provide models for suggested paths through the score, represented in the form diagram in the top left of the score. Durations and rhythmic patterns of elements are improvised within approximate ranges defined in the legend in the bottom left of the score, with the longest durations in layer I and the shortest in layer VII. Additionally, articulations, rest durations, bow placements, and contours are specified for the layers, and the performer may freely choose values within the given ranges for each of these parameters.

It is important to emphasize that the geometrical patterns in the score (spirals, concentric circles, polygons,

[1] A video recording of this piece may be viewed at: https://www.youtube.com/watch?v=rin-zdcgEjo

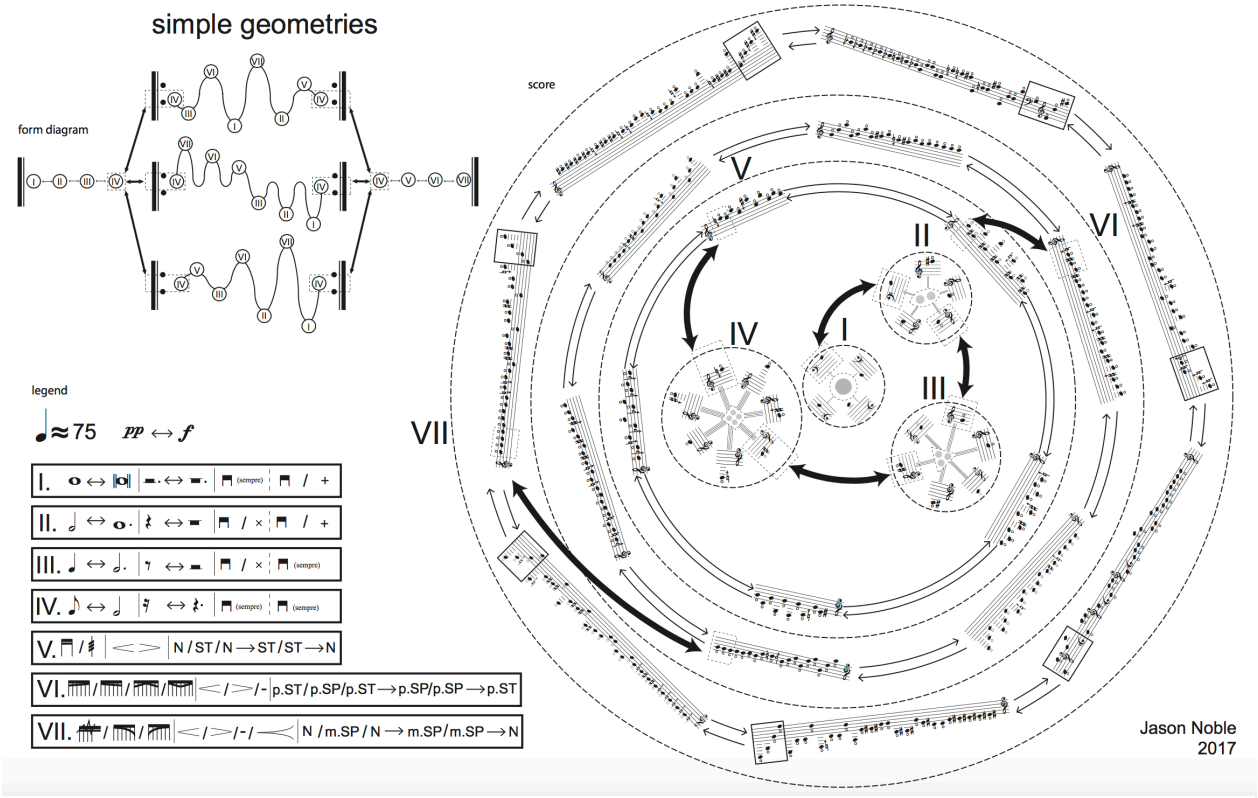

Figure 9. J. Noble, score of *simple geometries* (2017).

simple waveforms) directly reflect the piece's musical organization. Subsequent pages of the score provide sample realizations of each layer in standard, linear notation, but these are heuristic devices only and are far less adept at representing the work's musical logic. To make the multimodal conception of the piece explicit to the listener, an adapted version of the score (realized with MaxMSP/Jitter) is projected on a screen behind the performer (Figure 10).

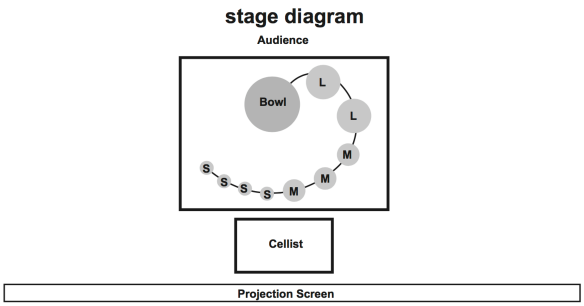

Figure 10. J. Noble, stage layout of *simple geometries* (2017).

At the beginning of the performance, all seven layers may be seen, three-dimensionally organized so that layer VII is closest along the z axis and layer I is farthest away (Figure 11).

When the performer plays a given layer, he uses a foot switch to zoom to that layer in the projection. A second switch may be used to trigger playback of a pre-recorded or live-captured sound files for that layer. When a given layer is sounding in the electronics, its associated notational layer moves in the projection: layers I – IV undulate irregularly, and layers V – VII rotate in the direction the performer chooses to play (following the ring sequence either clockwise or counterclockwise).

There are many possible paths through the layers of the score (including the suggested routes form diagram, as noted above). Within each layer, there may be considerable variation as per the free choices of the performer within the specified musical values. When layers are superimposed with the playback of sound files, the possibilities for variation are greatly multiplied as the chosen combinations, phase alignment, and (if live-captured recordings are used) the sonic content of the layers will also vary with each performance; the emergent properties of the music will vary commensurately. Although the specific

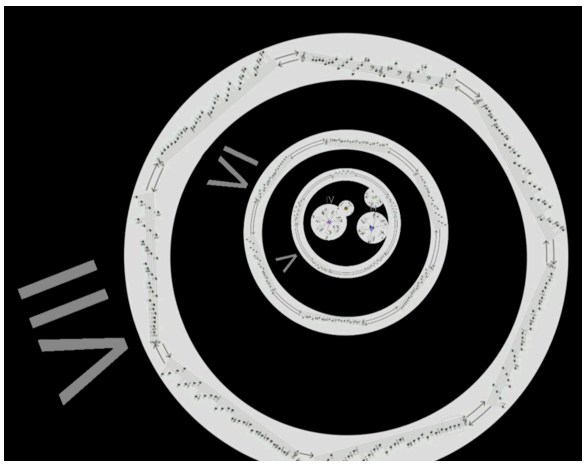

Figure 11. J. Noble, first projection image of *simple geometries* (2017).

configurations that emerge in each performance are subject to tremendous indeterminate variation, harmonic coherence is guaranteed by the derivation of all of the cello's pitch material from open strings and natural harmonics, and transitory pulses and metres are guaranteed to emerge from the periodic rhythmic organization of layers V – VII. It is likely that sound alone would fail to convey the relatively simple, layered organization of the piece, as superposing more than two or three layers at a time would likely overwhelm the listener's ability to perceive them as distinct strata (especially given the timbral and harmonic continuity between them). But the visual appearance of the score, especially when animated by motion corresponding to the activation of layers, makes the musical organization much clearer. The sounds and the dynamic projected score are equally important to the aesthetic of the piece, and it is only when both modalities, and the analogies between them, are perceived that the work is complete.

4. CONCLUSION

In this paper, I have argued for a multimodal conception of musical works that includes not only sound but also manifestations in other modalities (focusing here on the visual). This is consistent with practices such as *Augenmusik* and word painting, as well as theories such as embodied cognition and cognitive semiotics. It is inconsistent with the "music alone" ideology of formalism and "absolute" music. I believe that that ideology's manifestation in the Western concert tradition, in which musical sound is isolated as much as possible from other sign structures while audience members are expected to devote their undivided attention to the auditory modality, is a major contributing factor in the perennial alienation of popular audiences from contemporary music. Presenting audiences with multimodal experiences of works by integrating accessible features of notation into performance may help engage broader audiences in contemporary music. Graphical scores—already so visually and symbolically meaningful for composers and performers—represent an opportunity to reimagine performance practice in ways that overcome the imaginary boundary between score and work. My piece *simple geometries* attempts to do this by integrating the geometrical conception at the heart of the piece into the layout of its score, the pitch content and gestures of its musical materials, the physical setup of its performance forces, and the animated projection of its score.

5. REFERENCES

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