Perceptual Facets of Orchestration in *The Angel of Death* by Roger Reynolds: Timbre and Auditory Grouping

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One of the most mysterious and enchanting aspects of music is the use of instrumental timbre to shape musical structures and to impart affect through techniques of orchestration. Timbre is the set of auditory qualities that distinguishes sounds emanating from different instruments or their fused combinations. Orchestration is the judicious selection and combination of instruments—sounding at different pitch heights and with a variety of nuances and articulations—toward achieving a desired sonic event. The history of orchestration, as evidenced in treatises, can be seen as an evolving collection of strategies for structuring sound by invoking and manipulating perceptual grouping mechanisms in the listener. Yet despite its rich if enigmatic history, a true theory of orchestration has never been gleaned from these treatises (with the partial exception of Charles Koechlin’s *Traité de l’orchestration*, 1954-1959) due to their singular focus on descriptions of how composers employ groupings of instruments rather than a satisfying explanation of why what they did failed or succeeded to satisfy a largely indescribable sonic goal.

Taking examples from Roger Reynolds’ *The Angel of Death*, this chapter proposes several achievable short-term objectives that will help develop the elements necessary for a theory of orchestration, which

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2 *The Angel of Death* is the artistic end-product of a large-scale collaboration between composer Roger Reynolds, psychologists Emmanuel Bigand, Stephen McAdams, Bénédicte Poulín-Charronnat, and Sandrine Vieillard, and musicologists Philippe Lalitte and François Madurell. The project followed the conception, composition and creation of the piece, conducted perceptual experiments on the musical materials and the final piece in live-concert experiments at the world premier in Paris and the North American premier in San Diego, and developed musicological analyses of the process, the piece, and the piece’s place in the composer’s œuvre. The results were
are in turn based on the psychology of timbre perception and music analysis. In *The Angel of Death*, Reynolds makes an interesting choice of instrumentation that allows for both timbral contrast and blend: solo piano, four woodwinds, four brass, five strings and three percussion. In particular, the choice of (non-doubling) pairs of instruments (F1 / Picc, C1 / BCl, 2 Tp) opens up a host of possibilities for intra-family timbral blending, which is more difficult to achieve when a one-of-a-kind instrumentation that calls for solitary members of instrumental families is used. One might think here of the standard *Pierrot Lunaire* ensemble, where blending is, at best, difficult. Finally, Reynolds deploys a variety of orchestration techniques related to auditory grouping, including some that we had to add to our catalog, which was developed mainly through analysis of romantic and classical music (Goodchild & McAdams, 2018).

**Perception theory and orchestration theory**

**Toward a psychological foundation for a theory of orchestration**

Theoretical considerations of orchestration are hampered by two historical realities. First, orchestration has for the most part been both practiced and taught implicitly: implicit in the sense that the many facets of orchestration are based on rules and conventions that operate intuitively without being explicitly formalized. This reality has been made evident to generations of composers who, while studying orchestration, have encountered the ubiquitous admonishment made by their professor: “This is an orchestration error.” Remarks like this are made to students without recourse to a pre-existing predictive theory. That is to say that the reasons leading to the identification of an error are largely unavailable to the novice prior to attempting to orchestrate and must be taken by students on faith. What then might be wrong? And without access to a solid theoretical foundation, how can students learn to both conceptualize and identify a host of “errors” before they happen again?

Second, scholarly discourse surrounding the role of timbre in music has been relatively absent up to the 1990s, and although important articles, chapters, and books have been to appear in the last 30 years or so (e.g., Barrière (ed.), 1991; Cogan, 1998; Solomos, 2013), it remains understudied more generally in music theory and musicology, particularly in North America. There are several factors that contribute to the diminished state of research concerning timbre and orchestration (for which, incidentally, no professional
journals exist). As Jean-Jacques Nattiez (2007) remarked, influential thinkers such as Leonard Meyer (1989) have traditionally relegated timbre to a secondary position in the classification of musical parameters. This unfortunate situation, coupled with a systematic lack of training in orchestration for musicologists and theorists, has resulted in a rather large and seemingly obvious gap in music research.

The larger goal this paper supports is therefore to initiate a formalization of the principles of orchestration on the basis (at the outset) of underlying perceptual and cognitive processes by adding new knowledge through analysis and, eventually, through experimentation to determine both how composers conceptualize, and how listeners perceive the analyzed phenomena. Additionally, this project seeks to elucidate the musical parameters and acoustic realities that are responsible for these perceptions, and to demonstrate how they might depend on the variables controlled by conductors and performers. Our approach should be useful for a principled pedagogy of orchestration. But a true theory in the scientific sense must be predictive, and so the hope is that such an approach could also point to new paths in the scholarly study and creative deployment of orchestration.

This paper will focus on an issue related to the perception of orchestration: the role of timbre in perceptual grouping, as these mechanisms are essential to the objectives of orchestration. Of course, grouping structures do not encompass all that composers do with orchestration, but they are a solid starting point for developing a psychological foundation for a theory of orchestration that asks the question: what is it that is regarded as successful in the musical qualities that emerge from certain instrumental combinations or sequential juxtapositions?

**Auditory grouping and the perception of timbre in orchestral music**

The perception of timbre is rooted fundamentally in the processing of physical properties of incoming sound signals. In attending to orchestral music, we receive a variety of auditory information from a large number of sources, and it is the task of the auditory system to make sense of the many sources and sounds, parsing and encoding the signal into a coherent and intelligible set of auditory streams. Although auditory streams are an everyday aspect of living in an acoustic environment, the processes that we have evolved for negotiating the world around us are also operative in the perception of music, and especially in music that has many sources of complex timbral information, such as orchestral music. Underlying an aesthetic listening experience, there are perceptual grouping processes working to organize the many different sounds found in the symphonic repertoire. Three basic grouping processes, concurrent, sequential, and segmental, collectively referred to as auditory scene analysis, result in the perceptual attributes of events, streams of events, and groups of events that form musical patterns. Concurrent and
sequential grouping systems interact with each other in the segregation and integration of musical material played by several instruments, whereas segmental grouping delineates timbral units over time.

The analysis of scores and treatises over the last few years reveals that many orchestration objectives are related to the principles of auditory grouping. In terms of the analysis of auditory scenes, these grouping processes organize the acoustic environment and determine:

1. which sounds are grouped together into musical events in concurrent groupings,
2. the timbre that emerges from the perceptual fusion of acoustic components into a single auditory event,
3. whether the events formed in (1) are connected as musical streams in sequential groupings,
4. how timbral similarity is involved in the integration of events into auditory streams and how timbral dissimilarity that could signal the presence of multiple sound sources is involved in the segregation of events into different streams within which events are similar in timbre,
5. how the interaction of concurrent and sequential groupings is responsible for stratification into different orchestral layers, which are separated perceptually into foreground and background based on timbral salience (among other things),
6. how listeners segment streams into musical units such as patterns, phrases or themes, and
7. how timbre is involved in the segmental grouping—timbral discontinuities influence the fragmentation of a stream into musical units, such as antiphonal contrasts with the variation of orchestration, while a succession of timbres that change only gradually creates a sense of continuity.

Figure 1 illustrates the organization of complex instrumental sound signals into perceptual grouping structures and their resulting perceptual and orchestral effects. The top part of the figure shows the three kinds of auditory grouping, the middle shows the resulting perceptual qualities, and the bottom shows which facets of the perception of orchestration they contribute to.
Figure 1: Auditory grouping processes [from Goodchild & McAdams (2018), figure 1].

Figure 2 shows the individual categories of orchestration effects found in *The Angel of Death*.

**Note about the analysis process**

This chapter reports the results of an analysis undertaken as part of the Orchestration and Perception Project being conducted at the Schulich School of Music of McGill University. One of the goals of this project is to develop new methods of score analysis and annotation designed to better reflect both the structuring and phenomenological experience of timbre in music. Thus far, dozens of symphonic works...
have been analyzed. We have kept all of the Project’s analytical protocols in place. Analyses are performed independently by two analysts (the two co-authors) based on intensive listening to a recorded performance and score study. The recording was by the group that premiered the piece, Court Circuit, with pianist Jean-Marie Cottet and conducted by Pierre-André Valade. Individual results are then compared over the course of several meetings, where divergences and discrepancies are argued over, using empirical and score-based arguments to support each analytical decision. The two analysts then reach consensus, producing a final annotated score.

Our analysis of Roger Reynolds’ *The Angel of Death* is the first analysis of so-called contemporary music within the larger project. *The Angel of Death* is composed in two primary instrumental parts with electroacoustic solo sections that function both as bridge between sections and as a coda at the end of the piece. The two sections were conceived as Sectional (S) and Domain (D), with different ways of integrating the basic thematic materials in each. They can be played in either order and the electroacoustic layer always accompanies the second half. Our analysis focuses exclusively on the instrumental writing in the S half given its more clear organization in sections of contrasting materials, by opposition to the more fluid and organic writing in the D half.

**Concurrent Grouping**

**Perceptual fusion**

Perceptual fusion occurs when sounds played by several instruments combine to give the auditory illusion of a single unified sound emanating from a solitary source. Here one might think of the individual instruments of the brass family (horns, trumpets, trombones, tuba, etc.) playing simultaneously—their fused sound gives the sense of one large instrument. The human perceptual system organizes and represents such fused sounds as a singular auditory event played by a “virtual” sound source, although several conditions must be satisfied for fusion to occur. First, the onsets of notes from the individual sources must be nearly simultaneous, within a window of approximately 40 milliseconds. Furthermore, the multiple sounds of a fused event must share some form of harmonic relationship or shared periodicity, as increased inharmonicity and asynchrony lead to less fusion or even complete decoupling. Similarly, once fused, any changes to pitch or dynamics must progress in parallel in order to retain a sense of unity, reflecting the Gestalt grouping principle of common fate.
Blend

Composers use timbre and timbral changes in order to achieve many sonic and musical goals. They may employ the sound of an English horn to express sadness or the power of the brass section to magnify a climactic crescendo. The string section, if large enough, can be used to create lush, almost tactile, sonorities. Underlying these diverse uses of orchestral sonority lie two basic perceptual realities that govern much of orchestration: the blending of sounds and their segregation. Timbral heterogeneity—the absence of blend—is employed by composers for sonic goals that may include contrapuntal textures, the distinguishing of a melody from its accompaniment, or the superimposition of many layers of music. Conversely, instrumental blend, which is the result of perceptual fusion, can be separated into two broad types. First, *timbral augmentation*, as identified in the symphonic literature by Gregory Sandell (1995), is the use of a subordinate timbre to embellish or highlight a dominant timbre. Sandell’s other category of blend is *timbral emergence*: the simultaneous fusion of several constituent timbres, resulting in the formation of a novel timbral complex. Simply put, augmentation retains the timbral identity of a particular instrument, whereas emergence eviscerates recognizable instrumental identity, creating instead a sound for which there is no easily identifiable source, as noted empirically by Kendall & Carterette (1993), who found an inverse relation between degree of blend and identifiability of constituent instruments.

Timbral Augmentation

The augmentation of the timbre of one instrument by additional instruments functions as a structural use of orchestration in *The Angel of Death*. **Example 1** details a striking moment early in the work (mm. 31–35) where Reynolds lays bare one of the more prominent techniques in his orchestrational toolkit: the timbral augmentation of notes played by the solo piano. First, using flutter tonguing, the flute and piccolo augment pitch classes E♭ and D, each one octave higher than the piano (blue and red shading in Example 1). Similarly, trumpet 1 (orange shading), again using flutter tonguing, traces an ascending line (B-F-B-E-B♭). In measure 33, trumpet 2 and the trombone augment a widely spread dyad (A-G) spanning a minor seventh plus an octave (green shading), again continuing the fluttered articulation. This is followed by a somewhat softer articulation of a major third (B♭-D) taken by the violins, cello, and contrabass, spread across more than five octaves, and reinforced by a low-register octave doubling (yellow shading). The earlier dyad (A-G) is then rearticulated with a new augmented timbre formed by the two violins and viola playing on the bridge, combined with the clarinet and bass clarinet (dark red shading). Finally, almost as an afterthought, the contrabass reinforces the closing low E in the piano. This “highlighting” technique, as Reynolds refers to it, serves an expressive function. In the two halves (S and D) of the work, thematic
materials played by the piano in one half are taken up by the ensemble in the other half. In this example, excerpted from Theme 1, the piano is the primary carrier of the music, but is being highlighted by the ensemble to expand its timbral palette and sculpt its expression in diverse ways not possible with the piano alone. Note also that in many cases, the durations of the notes played by the ensemble instruments are much longer than those of the piano. This is a technique often used by Reynolds, which we have termed “timbral resonance,” a sort of timbral variant of piano pedaling.

Example 1: Timbral augmentation, mm. 31–35.

Taken individually, each of these six timbral augmentations point to a structural conception of timbre and orchestration. Taken together, however, these augmentations cohere, forming yet another underlying and structural use of timbre. Note the dynamic markings in this example: the augmenting instruments swell out of the piano sound and then fade away in various time scales. Example 2 shows the same four
measures (mm. 31–35). Here, by highlighting the peak moment of the dynamic envelope in each augmentation, we demonstrate a second and more diachronic function of Reynolds’ orchestration. The moments highlighted in the previous example, now combine to create an emergent *Klangfarbenmelodie*—a kaleidoscopic progression of shifting timbral coloring provided by the fluctuating dynamics, which forms a sustained background articulation of the solo piano’s melodic material.

Example 2: *Klangfarbenmelodie* in the peak crescendi of the background layer, mm. 31–35.

**Progressive Timbral Augmentation**

Further instances of timbral augmentation are quite numerous throughout *The Angel of Death*. **Example 3** demonstrates the continuous modification of a melodic line whose primary timbral identity is presented in the violin. Although other instruments modify the melodic line by embellishing its simpler sustained notes with contrapuntally more complex figurations, the perceived timbral result is that of a progressive
augmentation of the violin line. First, the initial two-bar phrase (mm. 381–382) is augmented by the clarinet and the marimba. On the triplet of the last beat in measure 382, a muted trumpet replaces the clarinet, lending this augmentation its first progression in terms of timbre. In the second half of measure 384, the first violin is doubled by the second violin (low G) and augmented progressively, first by the marimba and clarinet, then in the following measure on the pitch Eb (a lower semitone to the violin’s harmonic on E♭) by the muted trumpet and clarinet, followed on pitch B in measure 385 by the staggered entries of the piccolo, flute, and bass clarinet. Here the two violins split from each other so that the first violin sustains the pitch B, while the second violin plays a low C, augmented by the flute, bass clarinet, and trombone. The aural outcome is very much less complicated to an auditor than the score would have the reader believe. But despite the relative simplicity of the audible result, the quality of the timbre is noticeably different—and remarkably more pronounced—than that of a solo violin.

Example 3: Progressive timbral augmentation, mm. 380–386. The black boxes on the first violins indicate that it is the timbre of these instruments that dominates and is augmented by the other instruments.
Timbral Emergence

Whereas timbral augmentation is a type of concurrent grouping in which the principal sonority retains its identity in the process of being augmented by the addition of timbral information from other instruments, timbral emergence describes an instance of concurrent grouping in which all individual timbral identity is suppressed by a new emergent timbre that is, in essence, more than the sum of its parts. Example 4 demonstrates a rare case of strong timbral emergence. The Orchestration and Perception Project has documented many cases of emergence in the symphonic repertoire, and most of the examples demonstrate a similar approach to timbral fusion by way of sustained tones. The following example breaks with this norm, showing that under certain circumstances, strongly fused emergence can occur via rapid articulation. Here most of the ensemble plays a largely homorhythmic gesture, minus the electroacoustic layer, the piano, and the contrabass. The figure is a series of rapidly re-articulated tenuto notes (as opposed to staccato) that undergo a uniform and rapid decrescendo. Sustained tones in the violins and viola provide a brief chordal rendition of the outer pitches of the gesture. This special case of emergence is used several times by Reynolds and is characterized by the inharmonic relationship between its chord tones, its relatively short-lived duration, and by synchronous sforzando attacks. The perceived outcome of this type of gesture is that of a novel emergent timbral complex.

Example 4: Strong timbral emergence, mm. 112–113.
**Timbral Cross-Swell**

Timbral cross-swell is another example of an aurally striking orchestration effect employed by Reynolds throughout *The Angel of Death*. Although short-lived, this effect audibly replaces one augmented timbre with another by employing a dynamic “cross-fade” between groups of instruments, creating a rapid timbral flux that gives the fused event a lively dynamic quality. The result of this procedure is the sense that one sound “swells” into existence out of another, which dies away. In Example 5, the orange boxes highlight two instances of augmented brass timbres, and correspondingly, the red boxes highlight two instances of augmented string timbres. In each case, Reynolds begins with a pronounced brass sound, played *fortissimo*, that quickly fades in dynamic intensity to *niente* over the course of a quarter note (here the quarter-note equals 60 bpm). Although both groups of instruments begin the effect playing together, the difference in initial dynamic between them ensures that the first sound is understood as belonging to the category “brass.” As the brass dynamic diminishes, that of the string group swells from *mezzo-forte* to *fortissimo*, perhaps akin to the aural equivalent of the magician’s sleight of hand, replacing one timbre with another in the blink of an eye. Reynolds augments the string group slightly with the use of vibraphone tremolos that are halted with a percussive “dead” stroke, as well as with a quickly decaying single note in the xylophone.

![Example 5: Cross-swell, mm 87–91.](image_url)
Timbral Resonance

Much like the *Klangfarbenmelodie* underlying **Example 2**, Reynolds uses timbre to highlight and extend pitch classes presented in one instrument by using the sustained timbre of another instrument, much in the same way a pianist uses the pedal to prolong particular pitches in the piano. It is important to note that in the case of *timbral resonance*, an alternate timbral identity performs the function of tone prolongation and coloration, rather than that of an independent structural parameter, as is the case with *Klangfarbenmelodie*. The Angel of Death (S) opens with Theme 1 presented by the piano (**Example 6**). Here the sparse texture of the two-part writing for the solo piano is thickened by the timbral resonance of the other instruments, which prolong key pitch material. Although many of the instances of timbral resonance found in this example follow the precise pedalling indications found in the piano part, the dynamic envelopes of most prolongations—a crescendo followed by a decrescendo of equal length—add a swell in loudness that is impossible to duplicate in the piano without some form of rapid re-articulation. In our analysis, the light blue boxes link the timbral resonances to their initial tones in the piano part, while the dark blue ovals track the dynamic peaks of the individual crescendi.

**Example 6**: Timbral resonance in Theme 1, mm 1–8.
Sequential Grouping

Segregation

Timbral segregation involves two or more clearly distinguished voices whose perceptual prominence in the auditory scene is considered nearly equivalent. The voices in this case are segregated perceptually in part by way of audible differences in terms of timbre or by differences in register or dynamics, which also have concomitant changes in timbre. Within segregated sound events, the sounds emanating from similar sources tend to fuse, so that sounds from the same instrumental family tend to belong to the same segregated stream, although multi-family instrumental blends can also form unified streams that are segregated from other streams. Nevertheless, given a timbrally complex auditory scene, the perceptual system tends to bind sounds from similar sources performing similar musical functions into shared auditory streams. Inversely, timbral differentiation can cause the segregation of streams (McAdams & Bregman, 1979). Normally segregation occurs with individual instruments, although totally texturally integrated instrumental pairings or groupings can also constitute individual streams.

Example 7 demonstrates an instance of stream segregation drawn from the beginning of a long section where Reynolds uses timbral differences to progressively differentiate streams over the course of several minutes (mm. 178-220). The red box shows the first stream—a series of high-pitched double stops played by the first violin. This stream fails to fuse with the other strings by virtue of its distance in pitch as well as the difference in rhythm, articulation, and pattern of attack. The other strings (orange box) combine with the trombone, when playing glissandi, to form a second stream. A third stream is formed by the percussion instruments (vibraphone, xylophone, and marimba), with the addition of the flute in measure 186 (yellow box). The streams are, generally speaking, segregated by instrumental family, with the addition of extra-familial instruments capable of mimicking some aspect of the larger family, as with the trombone glissandi or the flute rapid and fading re-articulations. Notice, for example that the brass family (blue box) punctuates the overall texture with an emergent ‘brass’ blend, while also merging into the onset of the trombone... by way of elision.

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3 Texture in the sense of the feel, appearance or consistency of a surface or substance, rather than the usual meaning in musicology that distinguishes homophony, heterophony and polyphony.
Stratification

Stratification, like segregation, involves two or more layers of perceptually differentiated groups. Two things distinguish segregation and stratification in the sense in which we use these terms. First, segregation is the separation of “voices,” a voice being either an individual instrument or two or more instruments that are fused into a “virtual voice” that gives rise to a unique timbre. Individual stratified layers can have several instruments that are not fused, but which group together by contrast with the materials being played in other layers, including timbral differences. A layer can contain a single voice, two or more co-equal voices in counterpoint, or two or more instruments that, while not blending together, created an integrated texture. Second, unlike the relative equality of layers that characterizes segregation, stratified streams are unequal in prominence. These differences are reflected in perception as occupying either the foreground, middleground, or background of an auditory scene.

The piano layer in Example 8 (highlighted in red) stands out dynamically as the foreground of a simple two-part stratification. The dry, repeated sixteenth-note figures, varied rhythmically in groupings of 4, 5, or 6 to the beat, span approximately four octaves, and are punctuated rhythmically as the score calls for
staccato articulation. In the background (highlighted in orange), light glissandi played \textit{molto sul ponticello} by the two violins, viola, and cello, outline key structural tones articulated rhythmically in the piano, and are treated here as sustained lines connecting points in pitch space. Although the dynamic markings in the score are equal for both groups (save for \textit{sforzandi}), the combination of the timbrally more prominent piano layer relegates the string glissandi to the background, creating a clearly audible segregation of instrumental layering.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{Example8.png}
\caption{Example 8: Stratification, mm. 310–315.}
\end{figure}

\textbf{Stratification with Nested Textural Integration}

So far, we have exemplified orchestral effects, one by one, in isolation from each other. One of the more intriguing aspects of Reynolds' approach to orchestration is his ability to merge two or more of these effects into complex evolving structures. As demonstrated in \textbf{Example 9}, these hybrid instances are constructed from the more discrete perceptual effects mentioned above. Here a tripartite stratification is constructed by nesting several types of timbral augmentation together with an independent layer of textural integration. The foreground of the auditory scene, colored in red, is occupied primarily by the piano, though for the first few beats of the example, the clarinet doubles the right hand of the piano, forming an augmented piano timbre. Wonderfully blended brass chords punctuate the middle ground, highlighted in green, and are eventually augmented by the clarinet and bass clarinet beginning in measure 216. Note that the homorhythmic parallel motion in the middle ground (m. 215) helps to preserve a unified and coherent blend. Finally, the background layer, highlighted in orange, is a rhythmically complex textural integration between the strings, percussion, and woodwind sections.
Segmental Grouping

The final grouping structure, *segmental* grouping, involves timbral changes and oppositions that occur diachronically, as opposed to the predominantly synchronic relationships between timbres found in *concurrent* and *sequential* grouping structures. This is not to say that concurrent and sequential groupings are limited to mere instances rather than occurring over time, but that the structural differences between timbres tend to have very limited temporal windows, and more often than not, the relationship between timbres remains relatively constant, regardless of duration. For example, while progressive augmentations necessarily evolve over time, the dominant timbre that is being augmented is sustained across time, so that there is no temporal separation between the two structural components (i.e., dominant and
embellishing timbres). The same is true of sequential groupings, where stratification and segregation, while taking place across time, nevertheless retain the basic relationships between timbral components. Segmental groupings, on the other hand, are defined by their differences over time, and involve two important timbral structures: contrastive orchestration effects, which are somewhat sudden changes in timbral configuration that are juxtaposed with one another, and progressive orchestration effects, which involve sequential or graded changes in orchestration that comprise several stages or steps in their evolution over a larger-scale segment. As we have found in our analyses of the broader symphonic literature, contrastive and progressive changes to orchestration can be brief, as when sudden and distinct changes highlight quickly repeated and brief musical patterns, but timbral contrasts and sequences can also progress over longer spans, often in discrete steps.

**Contrastive Orchestration**

**Timbral Delineation of Formal Boundaries**

The delineation of formal boundaries is a key structural component used by composers in order to clearly demarcate the large-scale sections of a musical form. Analysts are familiar with the roles of key area, harmony, rhythm, meter, and surface texture as form-bearing elements in music, but the notion of timbre as an agent of formal delineation is perhaps more remote in the literature. As Stephen McAdams (1989, 2013) has shown, timbre also plays a structural role in articulating musical form. Furthermore, our analyses of classical and romantic era symphonic works reveal that composers regularly use discrete changes in orchestration and timbral texture to mark formal boundaries, as noted by Meghan Goodechild and Stephen McAdams (2018). The notion of timbre as a delineator of form is built in to *The Angel of Death* at the conceptual level. As Reynolds (2001) states in the program note on page two of the score:

I laid out a formal shape in relation to five strongly characterized thematic elements, along with their combinations and also transitions between them. This landscape of musical circumstances is traversed twice in a performance of *Angel*. One passage through it (in effect, the first half) involves a sectional approach, where contrasted identities and the boundaries between them are carefully observed. The second, alternative, journey proceeds in a continuous, organic fashion that avoids seams, flowing smoothly across the domains of thematic identity. So the two halves of *Angel* cover the same materials with the same chronological spacing, but experience them from contrasted perspectives. Either (sectionalized or domain-centered) version can begin a performance. . . My central concern with alternate possibilities enters the picture in other ways. The instrumental partners—soloist and ensemble—trade roles from one “half” to the other, so that each partner takes on different responsibilities depending upon the outlook of the music.

The main difference between the two sections (S and D) is the role of instrumental timbre in terms of both embodying the thematic material, and in delineating the formal differences between the sections.
Timbral Contrasts

In *The Angel of Death*, Roger Reynolds constructs several clear cases of timbral contrast in order to juxtapose material by using kaleidoscopic musical textures and gestures. In **Example 10**, a musical gesture is enhanced by the use of sudden, overlapping timbral contrasts. The primary melodic line is played by the solo piccolo, highlighted in pink, whereas blended brass and string chords (highlighted in green) provide both rhythmic and timbral syncopation. It is important to note the multifaceted role played by the percussion section. First, in descending order, the vibraphone, xylophone, and marimba initiate the gesture with a short but rapid flurry played with the loudest possible dynamic (blue highlight). The marimba and xylophone then switch roles (red highlight), joining the strings in a rather soft chordal vamp. Next, the percussion join in on a short cascading figure involving all instruments save the piccolo (orange highlight), before reprising their initial role (final blue highlight). The counterpoint here is not only pitch and rhythm oriented; but both are intrinsically linked with timbral contrasts in order to successfully articulate a sonic counterpoint.

**Example 10:** Timbral contrasts, mm. 102–107.
Progressive Orchestration

Timbral modulation as a compositional device was first proposed by Arnold Schoenberg in his treatise on harmony in 1911 (Schoenberg, 1949). Though the interpretation of Schoenberg’s Klangfarbenmelodie has been contentious, one way of understanding the term is as a sound-color-melody—the progression of timbral color, from instrument to instrument, as a primarily timbral-melodic function. Similarly, Russian composer Alfred Schnittke (2006) proposed that beginning in the twentieth century, composers turned increasingly to timbral modulations as a structural process for orchestral compositions. Like contrastive effects, progressive orchestration effects are defined by their changes in timbre over time. Modulation of timbre can occur in two distinct ways, either by clearly demarked steps or stages, or by gradual and continuous evolution. Following Schnittke and Schoenberg, the Orchestration and Perception Project identifies two forms of progressive orchestration: timbral modulations and Klangfarbenmelodie.

Klangfarbenmelodie

Although the precise definition of Klangfarbenmelodie continues to be discussed in the literature since its inception by Schoenberg (1949), two broad categories are generally accepted with regard to instrumental sonority and orchestration: the Schoenbergian and Webernian types (De Thorne 2014). The Schoenbergian approach “deemphasizes individual pitches, melodic voices, and individual instrumental colors in favor of homogenous sonorities” (ibid, 144). In this conception, changes in blended sonorities are foregrounded, while the melodic progression of pitches is either completely neutralized or at the very least relegated to the background of an auditory scene (see Example 12) (Cramer 2002). Webernian use of Klangfarbenmelodie, on the other hand, foregrounds the concurrent change in pitch and timbre as co-equal, creating a less nuanced and more direct “tone-color-melody.” Here both the individuality of instrumental timbre, as well as the progression from one discrete timbre to another become the focal points of ordered changes by step or by degree. However, as Burkhart (1973-74) and Solomos (2013, pp. 45-56) note, in Schoenberg’s "Farben" movement of the Five Pieces for Orchestra, op. 16, although the majority of the progressions of sonorities are of the first type, there is a central passage of the movement that has a more "melodic" character of the second type.

In The Angel of Death, Reynolds makes much use of both types of Klangfarbenmelodie structures. Example 11 illustrates one of the more striking and beautiful instances of Webernian Klangfarbenmelodie in Theme 5. The piano version is nearly completely monophonic, with the exception of the core element of this theme, which is chorale-like (see Example 12). The aim of the ensemble version was to introduce additional perspective with linear changes through multidimensional timbre
space made possible by the instruments and their combinations. The melodic progression is highlighted with the coloured boxes. However, instead of passing from instrument to instrument, the passage has many overlapping instruments, so the melodic sequence is of continuously varying blended timbres. The vertical lines in Example 11 indicate blends. The passage moves from violins and vibraphone, joined by clarinet, to marimba joined successively by viola then cello, to clarinet and xylophone, to xylophone and flute and so one. Note also the use of timbral resonance to extend certain notes in this melodic passage by instruments not in the orange boxes.

**Example 11:** Webernian *Klangfarbenmelodie*, mm. 364–373.

**Example 12** demonstrates Reynolds’ use of timbral modulation in the more Schoenbergian sense of *Klangfarbenmelodie*. This example is the core element of Theme 5, a choral-like harmonic progression serving as a convergence point near the end of this otherwise rather melodic and linear theme. The subtly modulating instrumental voicing of the chords (indicated by the rotation through blue, red and orange boxes), with some notes lingering into the next chord, provide dimensional extension of the piano version, which occurs solo, without instrumental elaboration in near identical form in the D half of the piece.
Example 12: Schoenbergian *Klangfarbenmelodie*, mm. 374-380.

**Conclusions**

This chapter serves as a demonstration of a novel approach to the combined score- and listening-based analysis of orchestration effects based on the psychological principles of grouping. We have demonstrated that timbre has several properties and musical functions in the organization of orchestration. First, timbral identity can be enhanced or created anew in the perceptual fusion of sonorities based on perceptual qualities that emerge from the recombination of acoustic properties across instruments. Timbre is a key component in distinguishing orchestral layers, as well as in the identification of these layers as occupying several levels of perceptual prominence. In complex textures, composers use timbre to distinguish and delineate polyphonic strands from one another. Timbre’s diachronic functions include the delineation of contrastive structures, reinforcement of formal structures at sectional levels, and, via modulation, the structured progression of orchestral sonority. Auditory grouping processes condition what is heard as perceptual properties of musical events, streams and layers of events, and the structuring of materials into
spans of similar materials that are contrasted with adjacent spans or that evolve continuously within that span. These perceptual properties acquire musical functions within the context of a piece and a compositional style, and it is these properties and functions, and the processes by which they arise in the minds of listeners as a function of orchestration decisions that can be the starting place to lay the psychological foundations for a theory of orchestration.

**References**


