

PITCH AND TIMBRE AS MORPHOLOGICAL SPACES

Musical space as a metaphorical inside/outside

Musical spaces within spaces

While the musical space metaphor typically describes a seeming up and down-ness to melodic contour, it seems no less a metaphor for a kind of “inside/outside” to music. This chapter explores the music-space metaphor in terms of boundaries or oppositions—inside and outside morphological spaces—that composers and listeners might imagine pitch and timbre to exhibit in pieces of new music. After exploring in the last chapter how avant-garde works emphasize the *outer morphological* space of location as a kind of ultimate *form-extrinsic* space, this chapter looks “more inward” at boundaries between pitch and timbre. Pitch and timbre form *inner/outer* boundaries in the *morphological* domain and are experienced as separate, but open to comparison. Using the terms I have adopted (and in this context my terms also echo Tarasti’s), the separable status of pitch and timbre hinges on the juxtaposition between inner and *outer* spaces.

Outer Morphological

Timbre

Inner Morphological

Pitch

Scruton wrote that notes played by two different instruments in a Beethoven symphony are capable of “answering” each other “in a space of their own.” In contrast, Scruton

observes that notes behave in Stockhausen's *Gruppen* as events in a purely "material" space. In Beethoven, the notes of an oboe can finish the melody started by a flute, their implications independent of timbral changes that seem outside the "space of the tones." In the Stockhausen, pitch and timbre are intentionally organized as separate parameters collaborating in the behavior, size, and intensity of a "group" event in the *outer morphological* space of location. In both musics, though, pitch and timbre are conceptually separable, independent and complementary. Both musics reveal timbre space (i.e. a palette of timbres) to be an intersection between real space and imagined, abstract organizations of sound.

In the Stockhausen, the dimensions of real space constitute the *extrinsic* plane, in which various kinds of designs are rendered. The sound of an audience member coughing during *Gruppen* might easily blend into the swirl of composed events in *outer morphological* space.¹ With the Beethoven, on the other hand, the cough (or even a wrong note) strengthens a sense of what registers as *inside* or *outside* the musical space of the piece. The cough and the wrong note actually confirm two boundaries, one among timbres and another among pitches. It could be argued, that despite a serial approach with which Stockhausen seeks to organize timbre and pitch as independent parameters, that a sense of pitch and timbre as separate spaces is greater in the Beethoven. This is due in large part to the greater divide between what seems, in a spatial sense, *inner* and *outer*. The works that I explore later in the chapter are more like the Stockhausen in their emphasis on the *outer morphological* space. But these works still engage what I think of

¹ To be fair, this would be truer of a piece like *Momente*, in which various extraneous noises that humans can make (like coughing sounds) are among the palette of timbres for the piece.

as a kind of charge, a potential difference between pitch and timbre as separate spaces that can nevertheless relate or be compared in some fashion. This means searching for ways that pitch and timbre can make analogous changes along separate continua, or *form-extrinsic* spaces.

Both composers and listeners engage in a listening game that produces a kind of imagined inside/outside. At the same time, this basic opposition raises some very fundamental, perhaps unanswerable questions. Is timbre-space a space in which pitches create forms, or is it the other way around: is form a space for timbre? Which is the space and which is the space within a space? Which is inside/outside? I do not see this as a conundrum of perception to be definitively decided upon as much as I see it as a choice between imaginative strategies for listening, interpreting, or composing. We can generalize, for example, and propose that in tonal music, such as that from the baroque or classic era, form (e.g. genre) is a space containing timbre space. In contemporary music, with forms referring less to outside genres, timbre space would seem to have become the containing space. Thus, when as listeners we anticipate hearing a Haydn string quartet, we have expectations about the form of the piece as well as the sound world of the piece. With contemporary music, on the other hand, our expectations *begin* with the sound world. Form is our journey through the sound world.

Timbre and pitch as compositional spaces

What Robert Morris has termed “compositional spaces” (whether it is called such or not) is a rather common apparatus that differentiates pre-compositional materials from their

specific realizations within a piece.² Abstract pitch spaces, for example, adopt a concept of “potential interactions” within, or “paths” through a “terrain” of pitches. Though once music is performed, the idea of a compositional space seems problematic. A listener does not necessarily imagine a space of potential interactions. From the listener’s standpoint, a pitch space is static and conceptual; it suspends the temporal unfolding of elements required for the listener to establish such interactions. But unmade pieces unfold to the frequently arcane timings of compositional acts. Composers produce spaces or potential interactions, limitations, boundaries, etc. before making processes, or methods, with which to realize pieces. Sometimes the composer wants this spatializing concept to influence the way the piece is *heard*, as Steven Mackey does, for example, when he writes about pitch in his piece, *Deal*:

As it is, the recurrent common tones recall, foreshadow and cross reference each other and thereby facilitate a non-teleological continuity. The fact that the referential common tone cells are recolored by their surroundings in different collections and the common tone cells themselves are constantly changing, helps project a sense of a wide and varied landscape. Having seeded the landscape with potentially sensible features (common tones), the process of composition was freed to invent a fantasy – turning collections of notes into flavorful musical events and a series of events into a plausible but complex continuity.³

Even once the temporal flow of the piece is determined, Mackey desires that the character of a ‘landscape,’ or something ‘non-teleological’ will remain a quality heard in the work. This recalls the “imaginary landscape” sense of the music-space metaphor touched on in earlier chapters. Mackey’s landscape begins as an arbitrary collection of pitch sets. These sets are *extrinsic* to subsets derived from common tones among the original sets. The “common tone cells” order the pitches by forming of bridges from one

² Robert Morris, “Compositional Spaces and Other Territories,” *PNM*, vol. 33, 1 and 2, 1995, p. 328-358.

³ Steven Mackey, “Music as an Action Sport” www.stevemackey.com

set to another. Nevertheless, in the compositional process *and* in the finished piece, these compositional pitch spaces retain an unformed, indefinite quality. An improvised guitar is scored as a principal force and is given simply a chart to play from. In many ways, the central problem posed by *Deal* juxtaposes a realization of a compositional space (the orchestra part) and the “raw” compositional space itself.

The *a priori* kind of “musical space” that composers construct, raises to my mind one of the central paradoxes of compositional strategy and recalls the earlier question about timbre space. Does a composer think more in terms of using sounds to build a composition or using composition as a means to organize sounds? In other words, what comes first: the “space” or the “objects” in it? This is a kind of loosely theoretical question about process that I might ask of another composer or myself. The answer will be different from composer to composer, or piece to piece. More than likely, it will tend towards a simple reconciliation: “they are two sides of the same coin.” But when it comes to making specific decisions at any given point, process will most likely land the coin on one side or another. Take, for example, making decisions about timbre. Timbre will function slightly differently in either scenario. On one hand, timbre is in the service of rendering relationships between other elements, such as connections between pitches, motives, texture, etc. On the other hand, timbre “comes first” and determines ways of organizing register or dynamic balance, etc. In instrumental composition, one traditionally starts out by deciding on an overall instrumental combination, but in contrast, many composers have written open scores. In electronic music, composers have started by building timbres, the quality and shape of which influence or are directly

mirrored in the overall form of a resulting piece. But others, like Xenakis for example, have started with shapes and forms first, drawn them on an architect's drafting table and found timbres and changing timbral properties to correlate with the shapes afterwards.

In either scenario, qualities of musical space are largely determined by timbre. It can appear as if timbre provides a kind of plane or surface for activity. Ligeti refers to a quality he calls "permeability," in which the individuality of timbre and interval becomes difficult to distinguish, and complex textures result.⁴ This creates a kind of field of activity, effecting a built-world that emphasizes the statistical behavior of group rather than individual activity. Timbre can define musical space in terms of figure/ground relationships maintained by an opposition between the specific sound and the blended complex of sounds. In *Imaginary Landscape*, the radio's speakers and the static resulting from moving up and down the dial allow the different programs, songs, spoken text, etc., to blend—to appear together in a unique world. The world-building nature of timbre space hinges on the comparison and contrast of sounds making up the unique world.

Boulez distinguishes between the ability of instruments, particularly those of the modern orchestra, to blend on one hand and to contrast on the other. There is in chamber music, for example, a tendency for timbre to articulate difference or separate identity, whereas in larger ensembles the question of identity involves hierarchy and the ability of the instruments to fuse and/or appear separate from the group. In the large orchestra of the 19th century, timbre space depends in large part on the potential for neutrality as

⁴ Gyorgy Ligeti, "Metamorphoses of Musical Form," *Die Reihe*, ed. K. Stockhausen and H. Eimert, trans. by C. Cardew (Bryn Mawr: Theodore Presser, 1965) 7, pp.5-11.

instruments became more standardized. In the baroque era, in contrast, smaller instrumental ensembles create unique worlds—unique timbre spaces. Boulez suggests that the development of musical forms relates to contrasting timbre spaces: a unique world model versus those derived from a sound world emphasizing “fusibility.”

Contemporary music, on the other hand, allows sounds into the orchestra that challenge fusibility. Among these less characteristic instruments are the instruments of the percussion section, many of which come from musical cultures foreign to the orchestra, and sound exotic, or “alien” as Boulez put it, “to the dominant hierarchy.” John Cage had also speculated that the increased interest in percussive timbres signaled a changing timbral paradigm in contemporary music from tone to noise as the dominant feature of timbre space. Atypical instruments, unusual instrumental combinations, and extended techniques, etc. all work to both enlarge the compass of timbre space and/or define a unique sound world, and with it, new possibilities for form.

It is generally accepted that the modern orchestra was a creation of the 19th century. Effectively it was born as a result of a flexible use of instruments: timbre was to model itself upon various aspects of form. But with the growing size of the orchestra, the role of the instrument becomes not blurred but flexible, multifarious and correspondingly the forms expand. Even in large-scale baroque works one sees an accumulation of relatively small-scale forms. In the period when the orchestra developed, from Beethoven to Mahler, forms increased in scale, based on transitions and multiplicity. In the same way, timbre took on a multiplicity of uses and instrumental characteristics ... the instrument is exploited for something beyond its individual qualities: its potential for fusion, for being neutral, for losing its individual quality, the latter quality naturally impeding the phenomenon of fusion.⁵

⁵ Pierre Boulez, “Timbre and composition—timbre and language,” *Contemporary Music Review*, 1987, Vol. 2, p. 164.

Like Ligeti's 'permeability', Boulez goes on to explain how in modern music instruments "...become increasingly considered as being part of a texture, or constituent elements in varied textures. The identity of sound is no longer seen as being the basis of the language, but instead, this identity is progressively created from the needs of the language; it is created by the needs themselves."⁶ The opposition between fusion and independence provides a *form-extrinsic* continuum within which *form-intrinsic* details are situated and related to pitches, which themselves form an *inner morphological* space with a different kind of extrinsic backdrop.

Differences and similarities between timbre and pitch as spaces

Pitch as "morphophoric"

Roger Shepard summarizes conclusions from a variety of psycho-acoustic research experiments on the perception of scales and pitch that are relevant to my model of hybrid spatialities. Confirming the intuition and practice of musicians, pitch has form-giving properties that lend to it a spatial quality characterizing 'the phenomenal space of tones.' This allows for transposition and familiar operations to be perceived as relational. Shepard calls pitch in this context a "morphophoric" (form-defining) medium similar to visual space. Visual space is a morphophoric medium for human perception in that an object may be rotated in space but remains recognizable even as the shape in a two

⁶ Boulez, p. 167.

dimensional plane changes. Shepard refers to experiments that seek to isolate “dispensable” and “indispensable” attributes for morphophoric mediums.⁷

The controls that he used to demonstrate pitch’s similar role to space in the auditory domain are pitch and color. Pitch and color are often considered analogous because both are waveforms, but in terms of human perception, particularly in terms of spatial perception, there are some striking differences. Spatial position in vision is what Shepard calls an *indispensable* attribute. This is demonstrated by the fact that projecting two lights of different colors on the same spot will not render two separate objects, but a single blended spot of colored light. Two projections of the *same* color, on the other hand, will appear as two separate objects if separated in space. Color is therefore *dispensable* as a form-giving attribute.

With pitch, however, spatial position is a *dispensable* attribute because two pitches coming from the same location remain distinguishable. The same pitch, however, played simultaneously from two locations will *not* appear to be two distinct forms (unless juxtaposed in time, i.e. musical time is morphophoric). Shepard concludes “[that] the indispensability of space in vision, and of pitch in audition is parallel to both of those attributes being morphophoric media. So the analog to visual space is not auditory space, but auditory pitch.”

⁷ Roger Shepard, “Pitch Perception and Measurement,” from *Music, Cognition, and Computerized Sound: an introduction to psychoacoustics*, ed. Perry Cook (Cambridge, Mass: MIT, 1999)

If a pianist plays the “acrophobia chord” from the *Vertigo* score, it is likely that I will recognize its form, its intervals, as distinct, even though the piano is in one place.

Sherman’s point is that the tones do not have to be coming from different points in space in order for us to distinguish between them, which is not the case with the projected colored lights. I may even identify the chord as the “acrophobia chord” without the brass and harps that characterize its timbre in Herrmann’s score. Timbre and spatial location are auxiliary to the basic morphological conditions allowing me to recognize the chord as a simultaneity of distinct pitches.

Shepard’s observation clarifies the difference between *inner* and *outer morphological* spaces. The *inner morphological* space of pitch allows us to recognize different pitches in a piano chord. The *outer morphological* space provides precisely those effects that Sherman’s experiment seeks to remove as a control to the experiment. Differences in timbre will make the same pitch projected from *two* locations sounds as two distinct forms. While space is what Sherman calls a *dispensable* attribute for distinguishing between pitches, the *outer morphological* space is all the more important for giving form defining characteristics to certain types of musical gestures that pitch alone cannot.

Think of the *hocket* for example: the interlocking of figures are displaced in time (time is morphophoric) but they are also displaced in space, preventing the interlocking figures from appearing as a single continuous line even if the instruments are duplicates in terms of timbre. In *New York Counterpoint* (for layered clarinets), by Steve Reich, the *outer morphological* space of live performance (analogous to the stereo field in recording) allows the repeated, overlapping figures in each part to appear distinct.

Timbre-space and real space

The timbre of an offstage instrument presents the listener with an instrumental timbre altered by the resonance of a space removed from a recognizable resonance (the original space). The acoustic characteristics of contrasting rooms are interwoven into a musical texture for aesthetic or expressive purposes. Often this will function in a dramatic, narrative, or symbolic fashion. There are many examples of this: horns offstage announcing, for example, the proximity of an attacking army in a dramatic narrative. More recently, John Corigliano's *Symphony No. 1* includes an offstage piano citing Albeniz's *Tango in D*. In this case the offstage timbre represents a fading memory of the composer's pianist-friend who passed away because of an AIDS-related illness. The altered timbre uses an alternative resonance to symbolize memory, distance and loss. The Albeniz quotation removes the piano's harmonic language from that of the symphony, and this difference is mirrored by the removed sound quality of the offstage resonance. The affect of this technique has its roots in an Ivesian sensibility, allowing an instrumental timbre a quality that only space can give. Ives wrote in 1929:

Experiments, even on a limited scale, as when a conductor separates a chorus from the orchestra or places a choir off the stage or even a remote part of the hall, seem to indicate that there are possibilities in this matter that can benefit the presentation of music, not only from the standpoint of clarifying the harmonic, rhythmic, thematic

material, etc., but of bringing the inner contents to a deeper realization (assuming, for argument's sake, that there is an inner content).⁸

Ives' search for a transcendent meaning in such an experiment finds justification in Thoreau's remarks about how natural environments transform musical sound and achieve 'a certain vibratory hum as if the pine needles in the horizon were the strings of a harp.' "A horn over a lake gives," Ives writes, "gives a quality of sound and feeling that is hard to produce in any other way."⁹

While the effects of this technique are achieved by means of physical characteristics in real space, they are an example of an artistic effort *to make space musical*. Their meaning comes from context. The offstage resonance is significant because it can be contrasted with an original performance space, one with presumably different acoustic features. Secondly, the offstage timbre participates in the sound world of a piece of music, thus Albeniz's *Tango* means something different in Corigliano's symphony than if we happen to hear someone playing it just off stage. Scruton writes, "...the dialogue between cor anglais and oboe in the third movement of Berlioz's *Symphonie Fantastique*, in which the oboe is placed off stage so as to create the effect of shepherds answering each other across the valley, is not a dialogue in physical space, even if it uses a perception of physical space, in order to remind us of the sense of distance. Musically speaking, there is no distance at all between the oboe and the cor anglais, both of which

⁸ Charles Ives, "Music and its Future," *American Composers on American Music*, ed. H. Cowell (Palo Alto: Stanford Univ. Press, 1933) pp. 191.

⁹ *Ibid.*, p.192.

float in the same musical empyrean.”¹⁰ The effects of space in this case are real, in the sense that they are created by the circumstances of real space, but they participate in an abstract musical space. Because an offstage instrument sound is only recognized as such because of a listener’s familiarity with the sound of that instrument in close proximity, the offstage instrument participates in an associational relationship. Such relationships allow for the potential of greater abstraction in imaginary timbre spaces.

Abstract timbre spaces: Lerdahl’s associational versus hierarchical structures

In considering the importance of comparing and contrasting timbres when listening to music, many theorists have speculated on ways in which qualitative differences may be understood quantitatively. I see this as an effort to bring the *inner morphological* qualities of pitch space to elements more typically associated with the *outer morphological*. We might imagine, for example, a unique world in which individual timbres participate, interact, articulate difference, etc., and this would be a containing space. If comparisons and contrasts could be quantified such that the degrees of difference and sameness could be recognized as units separable from a given realization, then we may be able to speak of intervals or spatial relations between instances. We would then have abstract spaces within the general timbral world.

¹⁰ Scruton, *The Aesthetics of Music*, p.12.

Psychological theories about how the mind perceives differences tend to refer one way or another to differences along a nominal ($a=b$) or ordinal ($a<b$, $a>b$) scale of degree. More complex theories attempt to quantify the ordinal degree of difference by a perceivable amount, as units of definable intervals. Many of these theories seem more convincing in a controlled environment where the ability to perceive nominal and ordinal differences within specific parameters can be tested. In the “wild,” that is, in a piece of music, ordinal differences between certain parameters can be difficult to perceive. The morphophoric character of certain parameters (particularly pitch and rhythm) can obscure a perception of abstract intervals between timbres. In the reverse case, as with what Ligeti called “impermeable textures,” texture can obscure the individual clarity of pitch intervals. Nevertheless, perception of an abstract spatiality seems strongest in phenomena where an ordinal scale of differentiation can be perceived. Lerdahl views the nominal vs. ordinal scales of degree in terms of *associational* and *hierarchical* types of structure. *Associational* structures are less complex though perhaps more easily perceived. A nominal scale of degree is basically *associational*. A given phenomenon is simply like another or it is not. With the ordinal scale of degree, the potential for *hierarchical* structures exists. Something is either greater than, or less than another. More complex *hierarchical* structures can include the ability to differentiate by degree, by perceptible units of difference as with pitch intervals. Lerdahl, in an article on *hierarchical* structures in musical timbre, suggests that not only might such structures resemble pitch structures, but they also facilitate the perception of spatial relations.

It might be supposed that the pitch-timbre analogs are artifacts of the way the issues have been posed. But it is more interesting, and I believe more true, to argue that underlying principles channel musical cognition and that the analogs rely on certain of these principles. Musical trees (or elaborational hierarchies) need consonance-dissonance continua on which to operate. These continua emerge to a large extent from physical and psychoacoustical levels of description (though they are not identical with these levels). For trees of any interest to arise, the continua must be capable of arrangement in at least two dimensions; thereby creating a cognitive space ... The structure of space permits the structure of musical relationships. In so flexible a medium as timbre it should be possible to construct a variety of spaces that allow a variety of interrelated syntaxes.¹¹

Lerdahl's concept of continua, in this case based on the perception of consonance-dissonance relationships, is fundamental to imagining abstract spaces. In an equal tempered pitch space, the chromatic scale represents such a continuum though one made out of discrete and equal steps. Timbre, on the other hand, presents a challenge, particularly with instrumental music. While discrete steps may be possible to imagine, it is difficult to imagine equal steps that can also be transposed from instrument to instrument. While the ability for modern instruments to fuse and blend makes it possible to imagine a smooth timbre space, a continuum of timbre with quantifiable steps is highly dependent on the collaboration of pitch and rhythm. Lerdahl's concept is an attempt to map characteristics of pitch space onto a concept of timbre space—to bring characteristics of an *inner morphological* space to bear on an *outer morphological* space. Though the concept is derived from controlled experiments, the idea of quantifiable steps in timbre space is perhaps more interesting as a compositional fantasy than as an issue of music perception. Nevertheless, in both contexts there is a distinction between the space and the space within a space, the continuum and its measurement.

¹¹ Fred Lerdahl, "Timbral Hierarchies," *Contemporary Music Review*, 1987, p.157.

Inside/outside spaces in three contemporary pieces

While considering pitch and timbre in three pieces:--Reich's *New York Counterpoint*, Ligeti's *Double Concerto for flute, oboe, and orchestra*, and Stockhausen's *Mantra*--I have noticed that timbre tends to emphasize *inner* or *outer morphological* space. Given the original juxtaposition between pitch and timbre presented at the beginning of the chapter, timbre is perhaps more precisely positioned *between* pitch and location. The simple opposition is made more complex and open to other internal boundaries and oppositions:

Simple:	<u>Outer Morphological</u>	<u>Inner Morphological</u>
	Timbre	Pitch
Complex:	<u>Outer Morphological</u>	<u>Inner Morphological</u>
	Space of location-----Timbre-----	Pitch

At the same time that contemporary composers emphasize the *outer morphological* space of location as a kind of ultimate *form-extrinsic* space, there is another tendency that treats timbre as a space capable of more *inner morphological* type relations, such as Lerdaahl's experiments in timbral hierarchies. These two tendencies shift inner/outer boundaries in

two directions towards different kinds of *extrinsic* spaces. Associating timbre more with the *outer morphological* emphasizes the space of location as an *extrinsic* space.

Associating timbre with the *inner morphological* emphasizes register as an *extrinsic* space.

<u>Extrinsic</u>		<u>Extrinsic</u>
Space of location	Timbre	Register

While the conceptual timbre spaces that Lerdahl imagines are perhaps capable of exhibiting hierarchically differentiated steps, how such spaces relate to pitch, or, if pitch spaces “outweigh” distinctions made in timbre space, remain open questions. What I have noticed in the pieces discussed at the end of this chapter, is that basic qualitative analogies between pitch space and timbre space can be made. These analogies depend on *form-intrinsic/form-extrinsic* oppositions available to pitch and timbre as spaces that can be characterized as “smooth” and “striated” qualities, terms Boulez coined to describe different kinds of meter/tempo relationships.¹²

The ‘music-literal’ continuum of register is capable of exhibiting both smooth and striated qualities, the smooth bearing an *extrinsic* relation to the striated. The space of location, an extrinsic space, is similarly capable of a “smooth” quality. Perhaps the greatest number of potential *form-intrinsic/form-extrinsic* oppositions is open to pitch space and register. Robert Morris has classified pitch spaces along a continuum of

¹² Pierre Boulez, *Orientalions: Collected Writings*, ed. Jean-Jaques Nattiez, tr. Martin Cooper (Cambridge, Mass:Harvard Univ. Press, 1986) p. 86-7.

smooth and striated spaces. He calls register a *c-space*, a continuous contour space.¹³ Morris' *u-space* and *p-space* are striated spaces of unequal and equal spaces, respectively. The examples Morris gives for such striations are that the notes on the piano, for example, which exhibit *p-space* whereas the notes on the harp exhibit *u-space*. Both are capable of forming *m-spaces* (unequal) and *pc-spaces* (equal) that are cyclical. The example he gives for an *m-space* is a C-major scale in which the distances between the notes are unequal but are nevertheless considered adjacent. The cyclical aspect allows for octave doublings and continuation throughout register but at the same time, it does not interfere with these adjacencies. A major scale can also be what Morris calls a *pc-space* when one considers a limited cycle of equal steps of a fifth (ala Perle), something not true of every *m-space*, "synthetic" scale one might imagine.

Morris' different categories of pitch spaces are less at issue than the potential available to pitch structures for what I am calling *extrinsic/intrinsic* oppositions. Striated spaces made of equal steps are open to being *contextualized as extrinsic*; that is to say, they become smooth spaces relative to some form-intrinsic realization a level removed. So the "relatively smooth" can bear an *extrinsic* relationship to the "relatively striated" as, for instance, the chromatic scale bears an *extrinsic* relation to a twelve-tone row, or the diatonic bears an *extrinsic* relation to the locrian mode.

¹³ Robert D. Morris, *Composition with Pitch-Classes: A Theory of Compositional Design* (New Haven: Yale Univ. Press, 1987).

New York Counterpoint

Music made of repetitive structures often evokes a strikingly spatial, object-like quality. I have performed Steve Reich's *Electric Counterpoint* and have felt the experience to be something like surfing or skating on a continuous surface, especially with the soloist and tape version. This quality is largely due to the positioning of timbre so that its *outer morphological* qualities are accentuated. The objective stance required for listening to, or playing, process music makes one aware of physical space differently than in a traditional piece, in which one might be more concerned with the changes in *inner* spaces. This is not to say that there cannot be imaginary (e.g. *inner subjective*) spaces at work in listening to Minimalist pieces. On the contrary, such pieces seem particularly well suited to accompany imagery in a manner similar to that discussed in the second chapter regarding *The Firebird* and *Vertigo*. Philip Glass's work with theater, dance, and film has wed this objective unfolding of highly reduced musical material to an analogous concentrated experience of visual space. Even in Glass's works where visuals are not considered vital to the experience, *outer morphological* space plays a role in shaping *intrinsic* elements experienced by specific listeners under specific listening conditions. Glass, on the album cover of *Music in 12 parts*, comments that difference tones and other psycho-acoustical effects are significant to the experience of these concert works. Sherman's *dispensable* attribute in perceiving pitch (i.e. space) is precisely what is *indispensable* in an experience of *Music in 12 parts*. Reich's pieces also demonstrate how timbre's *outer morphological* role and timbre's relationship to the space of location are both quite important.

New York Counterpoint is scored for an ensemble of clarinets or, as it is more typically performed, for solo clarinet with a pre-recorded ensemble. It is one of a series of pieces, scored in a similar fashion, which includes *Vermont Counterpoint* for flute and *Electric Counterpoint* for guitar. Timbre as an *outer morphological* space seems a kind of containing space that relies on the space of location as an *extrinsic* backdrop. The space of location provides the repeated pitches and timbres a surface on which to register differences among the figures. Both versions of *New York Counterpoint* require a perception of spatial location in order for the patterned texture to be realized. In the ensemble version, we spatially experience the repeated figures in different parts as distributed among different players in different locations. In the soloist with tape version, the listener distinguishes the live soloist from the recorded parts as well as the placement of parts across a stereo field. This striated space of location is set in relief by a timbre-space more smooth in quality. Multiple variations of a single sound create a kind of relatively smooth, narrow spectrum of difference. A mixed chamber ensemble, like that in *Music for 18 Musicians*, might be thought of as a striated timbre space, exhibiting a more “modal” (unequal) scale of difference. With *New York Counterpoint*, we can almost imagine a space of equal steps between these slightly varied clarinets. Pieces scored for an atypical ensemble of the same instrument have the effect of heightening our sense of what I am calling *outer morphological* space. We know from what we *see* that an unusual sound force is in our space. Traditional instrumental ensembles must almost immediately draw us “inward” and promise to tell us a specific story, because we have more experience with their collective timbre in space. Nevertheless in both instances, the *outer*

morphological space of timbre mediates between the *outer morphological* space of location and the *inner morphological* spaces.

The smooth quality of timbre-space in *New York Counterpoint* is mirrored in the *inner morphological* space of pitch. Figure 5 is a reduction of the opening measures of the first movement. It shows every chord resulting from the texture of voices fading in and out throughout the course of the constant eighth note pulse for the first 44 measures. The ebb and flow of voices in the texture underscores a pulling towards and away from points of greater modal identity. A widening and narrowing of register accompanies an expansion or contraction of the diatonic pitch space. While we hear a greater sense of goal directedness in Reich's later works (such the *Triple Quartet* for three string quartets) than in earlier pieces, *New York Counterpoint* marks a step in that direction. There is a tendency to hear the more spare diatonic pitch worlds in Reich's earlier works as somehow less goal-directed. However, the kinds of trajectories that I have been describing: ebb and flow, widening and narrowing, pulling towards and away from points of greater modal identity, etc. suggest to me a kind of teleology to the music's direction.

Ligeti's Double Concerto for Flute and Oboe

Timbre-space in *Double Concerto* begins as a unique ensemble in our listening space as it does with the Reich, but since the unusual ensemble constantly emphasizes a *fusion* of sounds, the timbre-space tends towards a greater emphasis of *inner morphological* space. In this piece, pitch and timbre collaborate to form gestures that move from relative stability to instability by establishing oppositions based on basic binary distinctions (e.g. consonant-dissonant, harmonic-inharmonic, equal temperament-microtonal, etc.) along continua like those theorized by Lerdahl in his “Timbral Hierarchies.” Because of this collaboration, timbre-space in *Double Concerto* gravitates more towards the *inner morphological* space of pitch with register as an active *form-extrinsic* space. The orchestration resembles the baroque “unique world” model mentioned earlier, but the importance of timbre’s tendency towards fusion focuses our attention more *inwardly* than in *New York Counterpoint*. Having no violins in *Double Concerto*, there is greater presence of winds and brass. In the first movement, when the strings do play in the high register, they tend to play harmonics or quiet tones meant to blend well with the winds. Much of the uniqueness of the first movement’s overall sound comes from the fact that while there is this baroque-like presence of distinct wind timbres and suggestiveness of solo-tutti contrasts, the overall tendency is for the orchestration to emphasize a *fusion* of sound over an articulation of *difference*. There is, then, a tension between fusion and difference exhibited both by the separation of soloist from orchestra and soloist from soloist. Fragments of the soloist’s melodic material are echoed or prefigured in the

orchestral parts, as if the orchestra was an extension of the soloist's individual timbre. The tension between a highly blended, modern/impressionistic orchestra sound and a "unique world" of a baroque concerto is maintained by having no *overt* sense of opposition between soloist and orchestra, (i.e. no cadenzas or sections in which the soloists play music highly contrasting with that of the orchestra). Both solo parts have "reflections" or "echoes" in the orchestra.

Despite the highly blended texture, one is nevertheless aware that the piece is a *concerto*. Pitch is a factor in this; Ligeti's tendency to introduce new pitches into the imitative texture through the solo parts allows for some degree of separation of soloist from orchestra. This introduction of new pitches complicates the texture and challenges voice-leading boundaries in registral space. The emphasis on a fixed registral placement of pitches (as opposed to pitch classes) brings to the surface the "music-literal" space-like quality of registral space.¹⁴ This space creates a *form-extrinsic* element directly mirrored in a continuum of consonant/dissonant type oppositions in both timbre and pitch-space (equal-tempered notes vs. quarter-tone inflections). These oppositions play out at various levels of structure. At the largest level of structure, one is struck by the contrast in character of gestural types between the first and second movements. On one hand, the first is dominated by long, continuous tones sustained in all of the instruments except the harp and celeste. On the other, the second begins with tremolos and continues on with a quick succession of fleeting, unstable figures.

¹⁴ Jonathan Bernard has noticed the importance in Ligeti's densely layered canons of registral boundaries that guide the voice leading. Furthermore, Bernard has remarked that the canonic layers while markedly linear in nature are important as vertical phenomena as well. For Bernard, these factors contribute towards hearing this music in light of spatializing metaphors. Jonathan Bernard, "Voice Leading as a Spatial Function in the Music of Ligeti," *Music Analysis*, 1994, 13:2-3, p.227-253.

The first 42 measures of the first movement form three large phrases. Each of these phrases moves from a relative stability to instability. In the first phrase, the flute soloist leads. This is followed by the second phrase that begins with a striking oboe entrance in measures 17. This second large phrase ends with clarinets in a low register at measure 29, and completed with a sudden descent to low register (the lowest pitch of the movement). The third phrase continues with two shorter statements by the soloists. Each of the three large phrases has a kind of consonant-to-dissonant, stability-to-instability trajectory that allows the phrases to appear distinct from one another and share a similar shape in the otherwise continuous texture. Each soloist begins their phrase by playing equal tempered melodic steps and ends with microtonal inflections. In the third large phrase, the flute and oboe melodies maintain this trajectory although their statements follow one another more quickly (*stretto*). From measure 43 to 63, the soloists play together in a quasi-imitative dialogue (again, somewhat reminiscent of baroque concerto) of long values with no vibrato. In measures 63-74, this stability-instability shape comes to a climax by starting with a unison in the strings that has a special kind of charge due to the fact that the register is high for the violas and celli, and the bowing is free and erratic. This unison splinters off (in typical Ligeti fashion) into the densest cluster of pitches in the entire movement, and ends with the highest, loudest note (in the oboe in measure 74).

The stability-instability gesture in the large phrases of the *Double Concerto* is a kind of shape that appears recursively at different layers of structure, as demonstrated by the first phrase. In the first phrase (the first 17 measures) we see that a move from equal-tempered

to microtonal steps correlates with changes in voice-leading in a variety of ways to create a parallel motion between the spaces of register and pitch. Establishing a new position in register space with an equal tempered step, as when the flute solo introduces an E-natural in measure 3, has a more unambiguous quality than the G-quarter-tone-flat in measure 12. Juxtaposed with the other G's (G-flat in measure 11 and the G-natural in measure 13 as well as lingering G-flats), this G-quarter-tone-flat seems highly ambiguous and unstable. In the voice leading, the positions in the registral space appear to splinter off with effort while at the same time, the ambit of the overall registral space increases. This spatial sense of voice leading is consistent with what Bernard has found in other works. As registral space becomes widened and filled, a kind of widening wedge shape is formed in the registral space. The microtonal inflections occur as this widening appears and new positions in registral space are occupied. This kind of gesture strikingly contrasts with what follows: the oboe solo entrance jumping in space to the B in measure 17. The clear, vibrato-less oboe (along with the percussive harp and celeste attacks) announces a new timbral stability and registral ambit to occupy. This widening wedge gesture recurs in the oboe phrase (measure 17-29) and it is correspondingly complicated by microtonal inflections (measures 24-29) in the oboe solo. And, as mentioned, the gesture is repeated again at measure 69 but this time in the strings and at an accelerated rate, providing the movement with a dynamic and gestural climax as well as its highest point in register.

Figure 6 shows the entrance of each pitch and timbre in the first seventeen measures. The reduction shows how the widening wedge shape, or the gesture I characterize as stable-

unstable-stable, is present at smaller levels of structure from the very beginning. This stable-unstable-stable trajectory occurs in a timbre space as well as in pitch and registral space. As the first six pitches unfold, they effect a widening cluster completed by the flute solo's F-sharp in measure 4. This gesture is complicated by a widening if you will, of timbre space. New timbres present themselves as smooth differences or changes from the timbral paradigm set by the previous music.

For example, the entrance of string harmonics (and alternative fingering for the reoccurring E-flat in the flute solo both in measure 4) creates an unfolding trajectory in timbre space towards a more complex, unstable sound. It is as if timbres in the *Double Concerto* establish paradigms that mirror the way pitches establish positions in registral space. The paradigm becomes established, is then challenged, moved away from and back towards by slight steps just as registral points give way to others. The piece relies on an intrinsic/extrinsic opposition between these shapes and the continua that they are made of. These shapes are *form-intrinsic* trajectories along continua such as the consonance-dissonance continuum in pitch space between equal temperament and microtonal steps. With timbre, it is a matter of differences and similarities between timbres that allows for the perception of a motion towards or away from a timbral paradigm. This is consistent with Lerdahl's concept of timbral hierarchies that relate along a single abstract dimension.

The way timbre unfolds in the first seventeen measures seems intent on making us aware of a gulf between the flute and oboe timbre. There is a kind of journey from the flute timbre to the oboe timbre through a timbre space of difference/similarity that recalls John M. Grey's multidimensional scaling of similarity and difference between synthesized instrumental timbres. Grey found that by asking musicians to rate the similarity/dissimilarity of instrumental timbres he could arrive at a three-dimensional model, a timbre space, where each axis corresponded to a measurable parameter of an instrument's timbre. In the graph reproduced in figure 7, up and down represents spectral energy distribution (with wide, high peaks at the bottom), left/right represents the rates at which partials rise and fall (with partials rising and falling at the same time on the left). Forward and back refers to how noisily the sound is initiated (with the less noisy at the front). The first seventeen measures of the *Double Concerto* make a kind of spiral through Grey's multidimensional timbre space, starting with the flute and journeying through each quadrant before centering in on the oboe sound. Along this path, the timbres fluctuate back and forth, as in measures 9-12 where the timbres make little epicycles in the front right/up-and-down quadrant.

This space of timbral hierarchies mirrors the *smooth* space of register. The interrelation of parameters is strengthened by the fact that this wedge shape is a parallel shape in the different domains. The wedge shape in register is equated with a greater density, complexity, and instability in the overall sound. Pitch and timbre collaborate to form

gestures that move from relative stability to instability by establishing oppositions based on continua (e.g. consonant-dissonant, harmonic-inharmonic, equal temperament-microtonal, etc.) that provide them a kind of *form-extrinsic* space in which the spaces can unfold in a similar fashion.

Mantra

Stockhausen began composing *Mantra* while in Osaka at a time when the space of location had been a central concern in his work. This treatment of the *outer morphological* space of location is the theme of the previous chapter, but with *Mantra*, Stockhausen turns a corner in his compositional process. *Mantra* ended a phase in his composing in which improvisation and the manipulation of projected sound was Stockhausen's compositional technique of choice. Written for two pianos, percussion, and ring modulation, there are no moving projected sounds or instruments in motion in *Mantra*. The work reexamines a more inward quality of musical space, just as the instruments and their sounds remain fixed in space. The limited palette of percussive instruments reminds one of pieces written early in his career, such as *Schlagtrio*. This unique sound world contributes to the more inward quality of musical space, one centered on pitch and timbre relationships. All of the basic timbres of the piece, with the exception of certain effects of ring modulation, are present in the first few seconds of the piece. The work is constructed as a kind of variation form, although Stockhausen dislikes such a

traditional analytic framework. Segments of the theme (which he calls the “mantra”) provide motives that are expanded and contracted through the augmentation and diminution of their durations. Each fragment of the melody has a specific articulation and/or rhythmic character allowing for its identification when the time values become greatly altered.

The mantra is further transformed by modal mappings of its intervals on to one of a host of synthetic scales derived by transposition and multiplication of the interval values in the original series. Since the piece is monophonically conceived, any polyphony results from combinations of the melody with segments of its inversion. Sometimes a segment of the melody appears simultaneously with its inversion and sometimes it appears with the inversion of another segment of the mantra. Each “variation” emphasizes a limited collection of scales and a particular segment of the mantra, although all of the segments are present in every section.

Both pianists control the frequency and volume of ring modulators that center on one pitch from the original series for each section of the piece. The pitches of the second ring modulator are the inversion of the first. As the players play different pitches, the timbre of the piano changes, at times sounding like a prepared piano, but one that can be altered in the middle of a sound. A particular pitch on the piano in one section may sound quite noisy or dissonant, but in another section, will have a clear piano sound.

The uniqueness of *Mantra* results from a tension between potentially conflicting kinds of musical spaces. On one hand, there is a harmonicity/inharmonicity continuum created by the ring modulation. One hears fluctuations between tone and noise as the timbre of the

piano sound changes due to ring modulation. On the other hand, there are the serial aspects organizing both large-scale sections and some of the more local details. Yet the modal mappings onto synthetic scales cut against hearing the piece in terms of a purely serial kind of pitch world. In addition, there are many places when a motive and its inversion appear simultaneously.

Stockhausen's description of the piece focuses on its construction, on how each note is accounted for in terms of the original theme and/or a synthetic scale of transposition. The frequencies resulting from the ring modulation relate to serial structure only in that the series determines the fundamental modulating frequency. The ring modulation is explicitly functioning as a filter; the composite sounds are not sculpted as they might be in a spectral piece. The composite piano and ring-modulated sound results from independent processes, axes of symmetry in the pitch world unfold independently of what the ring modulator will do to their timbre. The ring modulation is an alternative axis of symmetry, and provides a *contrary* space to the fixed "unique world" of the piano's timbre by way of a *form-extrinsic* consonant/dissonant continuum.

Unlike Ligeti's piece, register is not an analogous *smooth* space with which to make a correlation in the continuum of timbre. Discrete points in register do not bear the same degree of structural importance that they do in Ligeti, in which an arrival at a registral boundary marks a goal or fills a gap. Contour in *Mantra*, which is often characterized by dramatic leaps, echoes Stockhausen's experiments in pointillism. Sometimes a pitch is a pitch class and sometimes it is a unique point in register, since the synthetic scales may

have very large steps between “adjacent” steps. The fundamental tones of the ring modulators refer to the series, but these same pitches may occur simultaneously in the piano as a step in a synthetic scale, in which case they are meant to refer to a segment of the theme. A varied segment of the theme may be accompanied by an inversion of that segment in a synthetic scale, which may or may not double pitches in the series. One becomes aware of two axis of symmetry: the modulating frequency adding side bands above and below the center pitch, as well as an axis of inversion in the pianos’ pitches.

Frankly, there is a kind of messiness to the pitch world that asks a lot of the listener. But this messiness is consistently maintained for the sixty-minute work, and its unique language begins to unfold as something almost comprehensible. One is constantly interpreting a gesture in reference to 1) one of the motivic fragments or 2) the fluctuating resultant timbre due to the modulating frequency or 3) an axis of inversion in the piano’s pitch material or 4) a harmonic fluctuation in the piano chords that at times is contrary and at times parallel to the fluctuations caused by the ring modulation. This harmonic fluctuation of the piano chords follows an independent trajectory to the ring modulation, since a relatively consonant chord can generate a lot of noisy side bands depending on the fundamental frequency of the ring modulator.

Conclusion

Recent pieces, like those discussed in this chapter, reveal the music-space metaphor as one challenged and re-challenged by the thought of musical space as material for composition. The previous chapter addressed a general tendency in contemporary music to emphasize the *outer morphological*. The examined pieces depend on an *outer*

morphological space of location as a kind of ultimate extrinsic space to be articulated by specific *form-intrinsic* elements. Intrinsic/extrinsic oppositions are characteristic of the *inner morphological*, and it is such oppositions that composers mimic, or seek to define, in compositional considerations of *outer morphological* spaces.

In the pieces discussed in this chapter, timbre plays a mediating role between *inner* and *outer* spaces, thus emphasizing one type of extrinsic space over the other. In pieces like the Ligeti's *Double Concerto*, timbre seems to align itself with register and pitch, emphasizing *inner morphological* spaces. In the Reich, timbre strikes a balance between the *outer morphological* space of location and the *inner* ebb and flow of the pitch space. In the Stockhausen, there is a kind of tension between the unified timbre-space of the two pianos and an independent axis of ring modulation, but the emphasis remains on *inner morphological* pitch issues. Whereas the Reich depends on the *outer morphological* space of location as an extrinsic space in which aspects of the form unfold, the others emphasize *inner morphological* spaces as extrinsic continua. As composers continue to recast the music-space metaphor, the challenge remains one of situating suitable extrinsic continua, which can set in relief the intersection between real and imagined spaces.

GLOSSARY

Form-intrinsic. *Form-intrinsic* describes musical elements that belong to a specific piece, or listening-experience. The term is meant to qualify one of the space-types below. A musical figure, for example, might occupy a *form-intrinsic inner morphological* space, the shape of which is set off against an extrinsic backdrop of register.

Form-extrinsic. *Form-extrinsic* describes spaces that contain others. For example, the continuum of register or physical space provides an arena for other shapes or conceptual spaces to be realized.

Imaginary House of Musical Space. The house represents the imaginative activity of listening, and the rooms of the house represent different types of musical spaces, our awareness of which combine to complete a picture of musical space. The rooms in the imaginary house are the *inner subjective* (the bedroom), *inner morphological* (the stairway), *outer morphological* (the entrance hall), and the *outer subjective* (the parlor or living room).

Inner Morphological. The *inner morphological* spaces are “inner” because they are imaginary. They are morphological because they are form defining; pitch and register are the paradigm in this case. The *inner morphological* can also refer to aspects of rhythm and the concept of abstract timbre spaces.

Inner Subjective. The *inner subjective* refers to qualities, feelings, or images that can accompany the act of listening to, or thinking about music that are spatial though not synonymous with the *morphological* spaces of musical form. These include the notion of music as an imaginary landscape or the self as a kind of inner space in concert with the music.

Outer Morphological. The *outer morphological* are form defining effects that happen in real space. They include spatial location, resonance, and even timbre/instrumentation.
Outer Subjective

Outer Subjective. The *outer subjective* refers to those aspects of *musical space/music-and-space* that relate the listener to the space of music. It describes the social conventions of listening determined by space that influence the imaginative activity, channeling the outward physical behaviors of the listener.

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