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Semiotic modeling: relevance to trumpet performance and musical interpretation using Paul Hindemith's Sonata for Trumpet and Piano

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SEMIOTIC MODELING: RELEVANCE TO TRUMPET PERFORMANCE AND MUSICAL INTERPRETATION USING PAUL HINDEMITH'S *SONATA FOR TRUMPET AND PIANO*

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by
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This paper is dedicated to my wife, Stephanie, whose patience is immeasurable, and to my father.

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PREFACE

In the process of learning Henri Tomasi's *Concerto* for Trumpet and Orchestra, I encountered one problem after another. The range was too high and too low, the tonguing passages too fast and complex, and the endurance required by the piece was overwhelming me. All these problems stemmed from the fact I was playing with too much tension. I played the piece for Dr. Joseph Skillen and he immediately identified the source of the tension problem. Dr. Skillen had me visualize my air stream as a cone with the large end of the cone representing low notes and the small end of the cone representing high notes. The next step was to visualize the cone on a horizontal plane. He told me that the tongue was not a factor in the shape of the cone. I started using the visual on two-octave scales and I got immediate results. I would jot the cones down on a napkin, a receipt, or whatever was around and watch them while I played instead of watching the music. Then I applied the cones to the Tomasi and I suddenly felt that I was "in the game."

This use of signs is called semiotics. This system of signs is not all a brass player needs to know. Good fundamentals must be present for the model to work. But with a good foundation, the air stream model is a very useful tool to successful brass performance.

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ABSTRACT

This paper is about the use of semiotics for the purpose of improving technical efficiency and musical interpretation in brass performance. Semiotics is the study of signs. The field is rooted in linguistics and logic, but has widened its influences to musicology and music theory in the last several decades. This paper constructs a model which simplifies music performance. The model has two components that address physical demands and musical analysis. The first component is a mathematically-based visual representation of the air stream used in brass performance. The second component of the model uses a reductive analysis. This analysis is the "roadmap" for performance for the purpose of improving musical interpretation. The dual model of conceptualizing a work for performance will be applied to the first movement of Paul Hindemith's *Sonata for Trumpet and Piano*.

DESCRIPTION OF THE PROBLEM

Aaron Williamon encapsulates the complexities of musical performance when he states that “musicians routinely encounter an elaborated array of mental and physical demands during practice and performance, having to process and execute complex musical information with novel artistic insight, technical facility, and a keen awareness of audiences’ expectations.”[1] Eckart Altenmuller further describes music performance as “one of the most demanding tasks for the human central nervous system. It involves the precise execution of very fast and, in many instances, extremely complex physical movements under continuous auditory feedback.”[2] For these reasons, it is easy to understand why brass players encounter physical problems while performing. One common mistake of brass players is to focus exclusively on the physical aspects of playing the instrument.

This passage below from Paul Hindemith’s *Sonata for Trumpet and Piano* often presents a challenge for trumpet players because of the range and endurance required.

Figure 1. Hindemith trumpet part mm. 67 to 78

[1]Aaron Williamon, “A Guide to Enhancing Musical Performance,” in *Musical Excellence: Strategies and Techniques to Enhance Performance*, Aaron Williamon, ed., (Oxford: Oxford University Press, 2004) , 3.

[2] Eckart Altenmuller and Wilfried Gruhn, “Brain Mechanisms,” in *The Science and Psychology of Music Performance*, edited by Richard Parncutt and Gary E. McPherson, (Oxford: Oxford University Press, 2002) , 63.

Squeezing facial, neck, and chest muscles used in brass performance too hard, due to a physical approach to playing, creates extra tension in the muscles. The added pressure often leads to further tension, resulting in inaccuracy of pitch and negative affects the sound. If enough tension appears, the sound may stop completely.

A non-musical performance is another common result of excessive physical tension. Instead of correctly shaping a musical phrase, a player adopts a mindset of simply surviving the passage, which robs the audience of a convincing musical experience.

Players are often coached to "use more air" or "make the aperture smaller". Statements such as these generally lead to more tension because they are rooted in the purely physical aspects of playing.

Semiotic modeling is a possible solution to achieving a free-blowing, musical approach to brass performance. Semiotics is a "discipline focusing on modes of signification."[3] The purpose of the symbols presented is to simplify the process of performing by incorporating the technical aspects of good brass technique into one basic structure, thus, the performer avoids building physical tension. This frees the mind for musical interpretation and expression.

Semiotics is the study of signs. Its origin is rooted in language and linguistics. Ferdinand de Saussure (1857-1913) proposed a dualistic semiotic model signified in language. He said that language is the "signifier" that represents the actual thing or the "signified."[4] For example, the word "table" is a sign that represents the actual object known as a table. Musical notation has the same relationship to the performance of music. A refinement of Saussure's

[3] Robert S. Hatten, *Musical Meaning in Beethoven: Markedness, Correlation, and Interpretation.* (Bloomington: Indiana University Press, 1994), 293.

[4] Christopher Hutton, "The Arbitrary Nature of the Sign," *Semiotica* 75-1/2 (1989) : 63-64.

model is proposed by American logician Charles Sanders Peirce (1839-1914). Peirce's theory states that any communication using signs requires three parts: 1) an object (the signified), 2) the sign that represents the object, and 3) an interpreter. These relationships exist within a given context and are affected by that context. Peirce used this concept for the purpose of finding greater meaning in the relationships between things.[5]

Within the last several decades, scholars such as Kofi Agawu and Robert Hatten have applied semiotic principles in order to find meaning in music from the Classic and Romantic periods. They have created their own semiotic models to represent the way in which composers such as Mozart communicated with the audiences of his time. Eero Tarasti foreshadowed Agawu's and Hatten's models when he stated in 1987 that "musical semiotics is searching for its place not only in the context of general semiotics, but also as a new subfield of musicological research."[6]

In his 1991 book, *Playing with Signs*, Kofi Agawu creates a semiotic model based on the interplay between structure and topics to demonstrate how the music of Mozart and Haydn was interpreted in its day. The internal structure of the music is symbolized through Schenkerian analysis which Agawu calls introversive semiosis. Semiosis is the process in which a sign represents an object. Extroversive semiosis or the "referential link to the outside world" of a piece of music is represented through topics. Topics are "subjects of musical discourse." Agawu references a letter written by Mozart to his father in which he states that his introduction to the "Prague" Symphony contains "Turkish music."[7] This phrase is called a topic. Topics are from the historical timeframe of the music. Agawu then shows how the

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[5] William Pencak, "Charles Sanders Peirce, Historian and Semiotician," *Semiotica* 83-3/4 (1991) : 311.

[6] Eero Tarasti, "Foreward," *Semiotica* 66-1/3 (1987) : 1-3.

[7] Kofi Agawu, *Playing with Signs: A Semiotic Interpretation of Classical Music.* (Princeton: Princeton University Press, 1991) , 26.

“play” between these internal and external symbols illustrates the way Mozart communicated with the audience of his time.[8]

Robert Hatten also uses a semiotic approach to further musical meaning in composers of the late-eighteenth and early-nineteenth centuries, with particular emphasis on Beethoven. Hatten describes his semiotic method as a “unifying rigor that comes from a stylistically and historically grounded model of musical meaning.”[9] Oppositions and topics lie at the center of his approach. Hatten shows that oppositional concepts within a given context, such as major and minor tonalities, can be used by composers to create meaning. While the major mode usually symbolizes the positive and the minor mode the negative, Hatten illustrates in the “Ghost Trio” Opus 70, No.1 how Beethoven uses notes from the minor mode in order to achieve a calming affect on an unsettled opening in D major. These minor notes also function as a platform from which the piece transitions to a calm and serene inversion of the opening motive. Thus, according to Hatten’s semiotic model, the minor notes represent a positive in this context.

While both of the above semiotic models lie in the realm of musicology and theory, the model described in this paper is generated for the purpose of making brass performance more efficient and more musical. The semiotic model in this paper simplifies these complexities into one construct. The first component of this construct is a visualization of the performer’s air stream. The second component of the model is the use of reductive analysis for the purpose of good musical interpretation and good phrasing.

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[8] Ibid, 3-25.

[9] Robert S. Hatten, *Interpreting Musical Gestures, Topics, and Tropes.* (Bloomington: Indiana University Press, 2004), 34.

THE SEMIOTIC MODEL

The complete semiotic model has two parts. The first part is a mathematically-based visualization of the air stream used to play the music on the trumpet and the second part is an analytical reduction of the music. The purpose of the wind aspect of the model is to address and simplify the technique of trumpet playing, while the purpose of the analysis is to create a "roadmap" for musical interpretation. These two components are combined to form the wind model.

Wind Visualization

The wind model represents the air stream as a series of conically-shaped figures. The wind component is a concept created by Dr. Joseph Skillen, Professor of Tuba and Euphonium at Louisiana State University. The result of using this visualization is a free-blowing approach to playing the trumpet, one that allows the lips to vibrate at the frequencies necessary to play the music with minimal tension. This improves flexibility, range, sound, endurance, and even tonguing. Paradoxically, the physical aspects of playing are improved by not focusing on them at all. Instead, technique is reduced to a mental visualization of what the stream of air should look like in order to achieve the correct pitches with the best possible sound.

The cones are constructed on three principles that link the model to the fundamentals essential to free-blowing brass playing and acoustics: 1) air speed, 2) air and pitch are related horizontally on a brass instrument, not vertically as musical notation indicates, and 3) air is continuously supplied throughout each phrase of music. The wind model encapsulates these principles in one simple structure.[10]

[10] Joseph Skillen, interview by the author, 13 June 2002.

The first principle incorporated into the model is based on air speed. On a brass instrument, high notes are generated by fast air and low notes are generated by slow air. For this reason, Arnold Jacobs, master teacher and principle tuba in the Chicago Symphony, taught his students to focus on the velocity of the air in relation to the pitches in the music.[11] The link to acoustics is straightforward. If the air stream has a higher velocity as it moves through the lips then the lips will vibrate at a higher frequency. The vibration of the lips causes the air inside the trumpet to form sound waves. The faster the lips vibrate the higher the frequency of the sound waves inside the trumpet. The ear perceives this higher frequency as higher pitch.[12]

To represent further this air speed principle, consider at visual representation of a cone or a conically shaped tube. Air flowing through a conical tube changes speeds. In the top cone in figure 2, the air speeds up as it flows from the large end of the cone to the small end of the cone. In the bottom cone of figure 2, the air speed is faster at the smaller end of the tube and is slower at the larger end of the tube. The air flows from left to right in this example and all further models.

This all works because of a principle in physics called the conservation of mass. The principle states that the area at the entrance of the cone times the air's velocity at the entrance of the cone is equal to the area at the exit of the cone times the air's velocity at the exit of the cone.

Simplicity is the essence of the air speed concept. A child understands that sticking his or her finger in the end of a hose with running water will make the water go faster and

[11] Arnold Jacobs, 1973 ITEC Masterclass. Can be accesses at http://www.chisham.com/tips/index.html. Accessed 18 March 2006.

[12] Arnold Meyer, "How Brass Instruments Work," in The Cambridge Companion to Brass Instruments, Trevor Herbert and John Wallace, eds. (Cambrige University Press, 1997) , 19-23.

squirt farther. He/she quickly learns that shrinking the area at the end of the hose will increase the speed of the water with no knowledge of anything called “the conservation of mass.” A player does not have time to calculate flow rates while performing but does have capacity to visualize simple conical tubes that get larger and smaller.

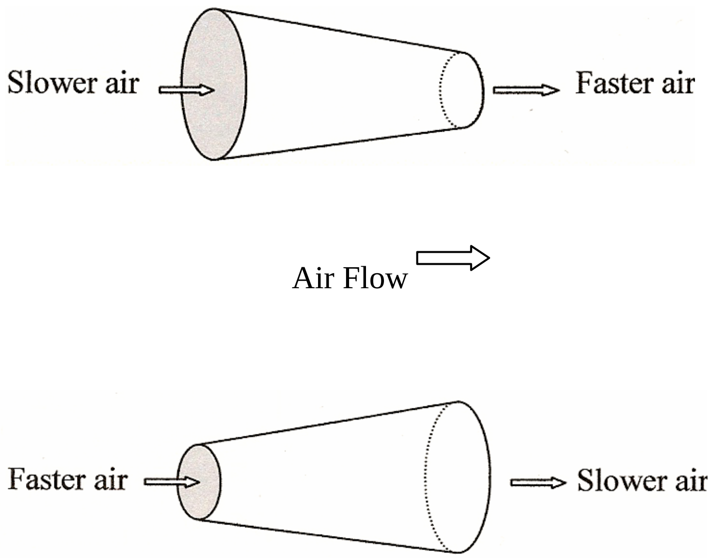


Figure 2. Cones and air speed

The next step applies this concept to a specific interval. The octave is the simplest interval to determine. In order to raise the pitch an octave, the air speed has to double. In terms of acoustics, doubling the air speed will double the frequency of vibrations of the lips and double the frequency of the sound wave inside the trumpet. This is analogous to a violinist touching the string at its midpoint to double the frequency of the string causing it to sound an octave higher. Therefore, in order to raise the pitch an octave on the model, the area at the exit of the tube must be half the size of the area at the entrance of the tube. Using the formula from above, if the initial air speed is half of the exit air speed, then the initial area must be twice the exit area. See figure 3.

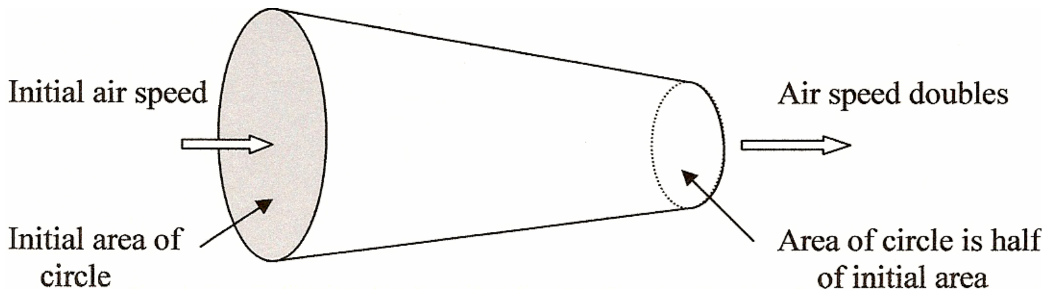


Figure 3. Cone for an ascending octave

This principle has a physical application to brass playing in the aperture. The aperture is the hole between the lips through which the air passes, also defined as the tiny hole between the lips that is inside the cup of the mouthpiece. Philip Farkas states in *The Art of Brass Playing*, "Buzz a middle register note on your mouthpiece rim and with the aid of the mirror, calculate the approximate width of the vibrating opening. Then, at the same volume, buzz an exact octave higher. The opening will become exactly half as wide."[13]

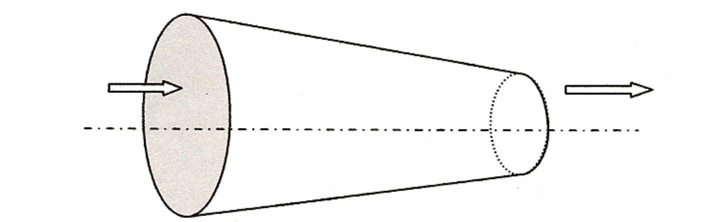
The second principle to apply to the semiotic model is that the air stream does not move up and down to change pitch as is represented by musical notation. The air stream must be represented in the model as being horizontal or linear. This principle is rather abstract because the physicality of playing a brass instrument is hidden inside the mouthpiece and the

[13] Philip Farkas, *The Art of Brass Playing* (New York: Wind Music, 1962) , 40. Farkas was not exactly correct because it is the area of the aperture, not the width of the aperture which must be cut in half. But his example firmly illustrates the conservation of mass principle to brass playing.

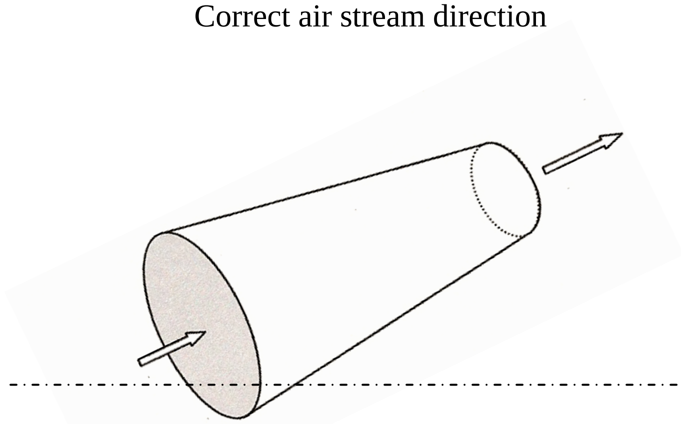
player’s mouth. William A. Adam, Professor of Trumpet at Indiana University, references this concept in a lecture.

> Sometimes a student will see that, for example, he must play from G to C. He sees that the note goes up so he feels he has to do something with the embouchure. But if he will accelerate the air through the instrument, or through the sound that he's playing through the horn, to the point where the next note falls free, he will feel like that note is on the same level. He can let the air acceleration take care of the vibration of the lips.[14]

For this reason, the wind model is visually placed on a horizontal axis. See figure 4.



Correct air stream direction



Incorrect air stream direction

Figure 4. Cones on a horizontal axis

[14] William A. Adam, Professor of Trumpet at Indiana University, lecture from 1975. Can be accessed at http://emedia.leeward.hawaii.edu/minasian/adam.trpt.html

The wind model does not shift from its center on the horizontal axis just as a trumpet player should not try to move the air upward as the pitches go up or downward as pitches descend in a musical passage.

The third and final principle states that in the course of playing a phrase on a brass instrument, the supply of air from the player should be continuous. This is true even between notes that are tongued. The concept is similar to moving a hand through running water from a faucet. The hand segments the water but the supply of water from the faucet is continuous. Roger Sherman illustrates a proper air stream in figure 5 by drawing a representation of the air flow underneath the following musical passage. The air flow remains continuous even between the notes that are not slurred.

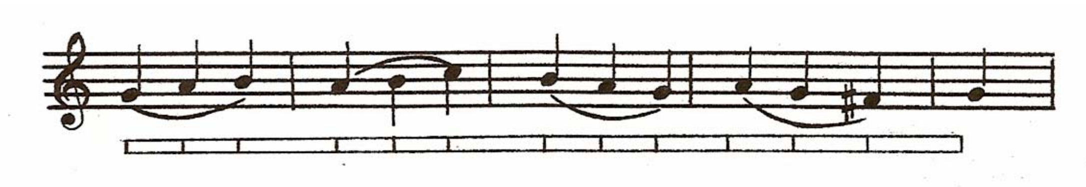


Figure 5. Sherman example with the correct air stream

Figure 6 shows the same passage with an incorrect air stream, in which the air flow is broken between the notes that are not slurred.[15]

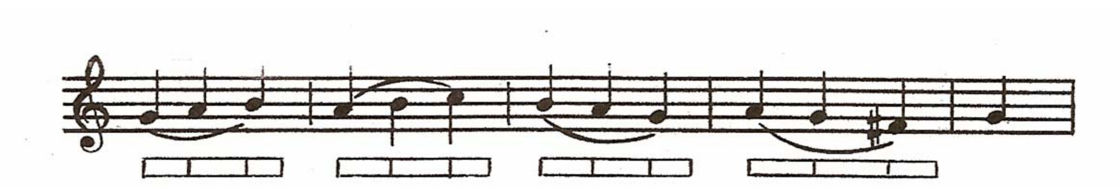


Figure 6. Sherman example with the incorrect air stream

Applying this concept to the wind model means that not only are the cones continuous but each musical phrase will be represented visually by a series of cones connected end to end.

[15] Roger Sherman, *The Trumpeter's Handbook* (Athens, Ohio: Accura Music, 1979) , 23-29.

The complete wind model is based on these three principles. Figure 7 shows a complete wind model using the Sherman's musical passage from figures 5 and 6. The first line of this example is the notated music. The next line is a two-dimensional view of the wind model from the side. The model visually shows the three principles discussed above. First, the cones getting smaller as the pitches go up and larger as the pitches go down. Second, the series of cones stays on a horizontal axis. Third, the cones are continuous to represent continuous air. The bottom line is a three-dimensional view at an angle. This is the model which is best used by the performer. It is important for the performer to visualize the air stream in three dimensions because the actual air stream is in three dimensions.

Thus, in one simple picture the player accounts for air speed, a well-directed air stream, and an air stream that is continuous. These are the traits of free-blowing brass playing.

The next step adjusts the size of the model to specific pitches. In order to graph the wind model with any piece of music, there must be a correlation between pitch on the trumpet and the area of each circle at the end of each cone. The written range of the first movement of Hindemith's Sonata lies between C4 under the staff and C6 above the staff.[16] Every chromatic pitch, between and including these two pitches, needs a sized circle with a specific area. The size of the first circle is arbitrary, but once the first circle is established the rest of the circles must adhere to the ratios according to acoustics. If C4 has a given area, then C5 must be half of that, and C6 must be half the area of C3. I have arbitrarily chosen the circle for C4 to have an area of 201.1 units. (This is 64 times pi.) The area of the circle for C5 is 100.5 units (32 times pi.) C6 is 50.26 units. (16 times pi.) It is not necessary to indicate

[16] I am using ASA notation to discuss pitch at a specific register. In this notation, C below the treble clef is C4, C in the treble clef is C5, C above the treble clef is C6, and so on.

specific units of measurement. While the exact size of the model is arbitrary the proportions of the model must be accurate. I have chosen numbers that are graphed easily.

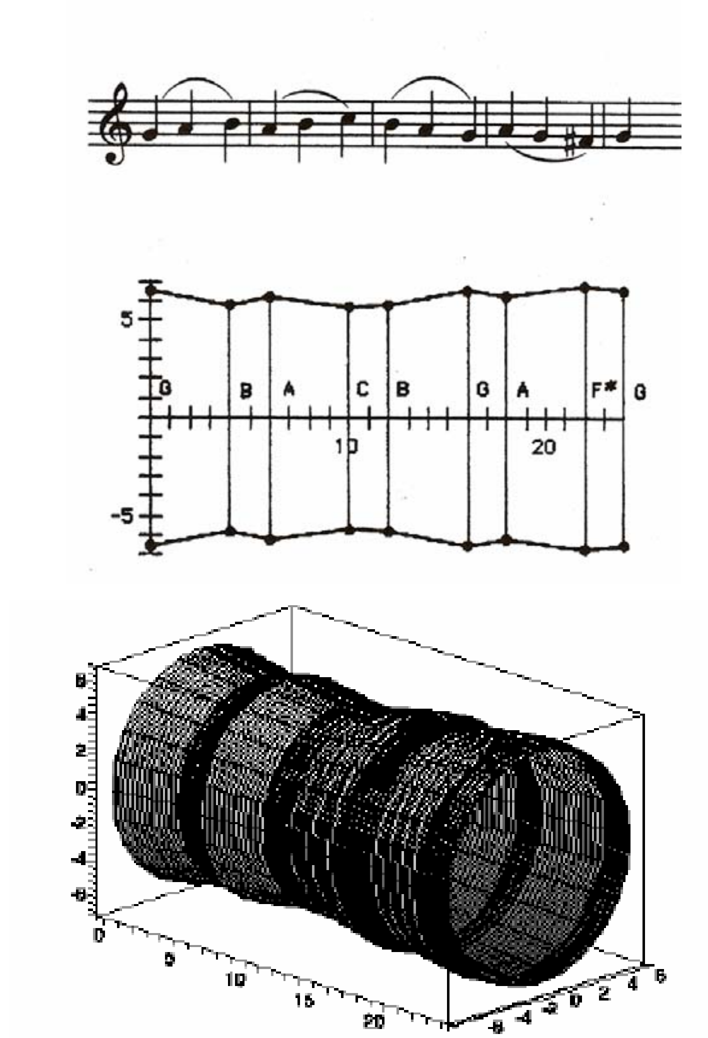


Figure 7. Wind model for Sherman example

Circles for the chromatic pitches line up within this range and are sized according to their acoustical frequency ratios. “Since the frequency of the higher of two pitches an octave apart must be two times the frequency of the lower pitch, the frequency of the higher of two pitches separated by a semitone must be the twelfth root of two or about 1.05946 times the frequency of the lower one.”[17] This just means that each circle is about 94% as big as the circle that

[17] Don Michael Randel. The New Harvard Dictionary of Music. 1986. “Temperment”, 837.

corresponds to the pitch a half step below. Figure 8 is a chart showing the size, area and radius, of the circles for each pitch. Radius is derived using the formula: Area equals pi times the radius squared.

Pitch	Area (units^2)	Radius (units)
C4	201.1	8
C# 4	189.9	7.8
D4	179.1	7.6
D# 4	169.1	7.3
E4	159.6	7.1
F4	150.6	6.9
F# 4	142.2	6.7
G4	134.4	6.5
G# 4	126.7	6.4
A 4	119.6	6.2
A# 4	112.8	6.0
B4	106.5	5.8
C5	100.5	5.7
C# 5	94.9	5.5
D5	89.6	5.3
D# 5	84.5	5.2
E5	79.8	5.0
F5	75.3	4.9
F#5	71.1	4.8
G5	67.1	4.6
G# 5	63.3	4.5
A5	59.8	4.4
A#5	56.4	4.3
B5	53.3	4.1
C6	50.26	4.0

Figure 8. Pitch, area, and radius chart

With this chart, a wind model can be graphically produced for the Hindemith and all other music in this study. For example, if a musical passage moves from C4 to B5, the interval of a major 14th, then the conical tube figure 9 shows a wind model for the passage.

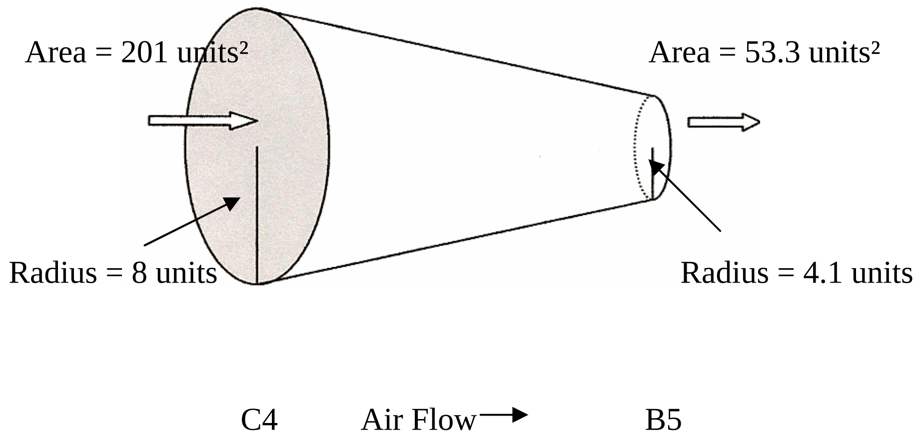


Figure 9. C4 to B5 cone

If the C4 circle has an area of about 201 units squared, the air leaves the cone with an area of about 53 units squared. Thus, the air speeds up approximately 380% from its velocity upon entering the tube to when it leaves the tube.

A two-octave C arpeggio requires a set of two connected cones. This is because the velocity of the air will speed up as the pitches ascend to C6 and slow down as the pitches descend back to C4. See figure 10.

The cones are symmetrical because the scale is symmetrical around the C6. The area of the circles start with C4 at about 201 units squared, moves to an area of about 50 units squared at C6 in the center of the wind model, and then returns to 201 units squared at the return to C4.

Ignoring the numbers leaves a model of a two octave C major scale that is easily grasped. The performer visualizes the model while playing the scale in order to promote a free-blowing approach to trumpet playing. Rhythm is represented in beats on the horizontal axis. Rather than representing every note of a phrase, the model includes only the notes that

affect the important changes in contour. Therefore, it is important to determine where the important musical phrases begin and end.

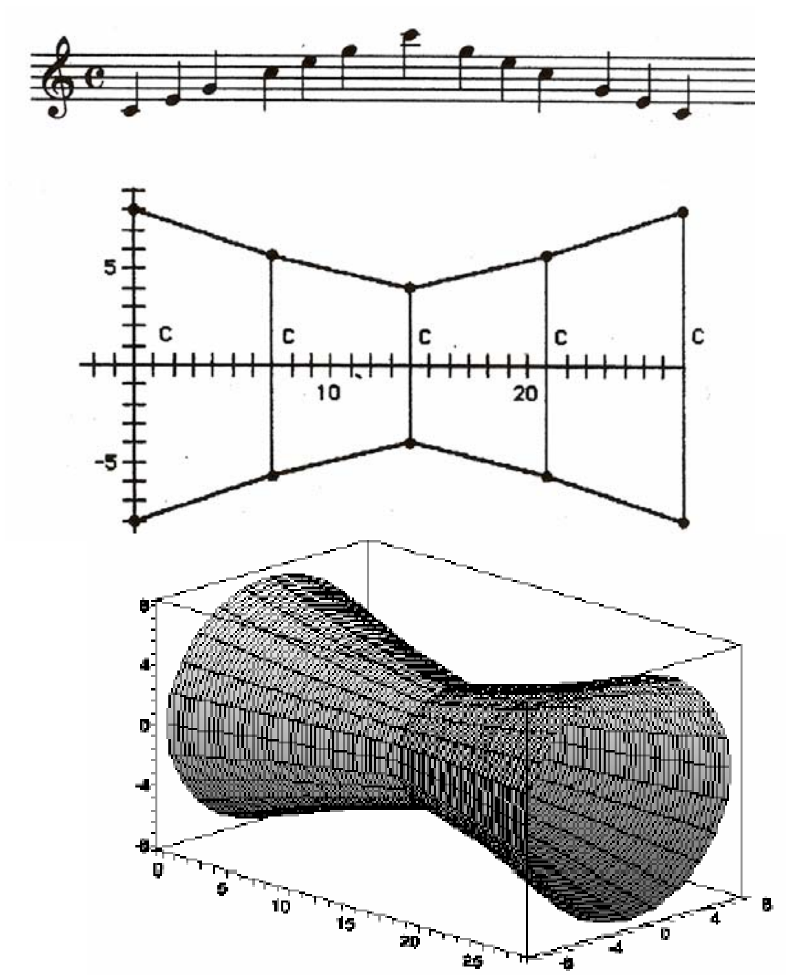


Figure 10. Wind model of two octave C arpeggio

Musical Analysis

The second aspect of the semiotic model is the use of reductive analysis to create a melodic "roadmap" for performance. This aspect of the model forms an elegant visual representation of the music which is used for musical interpretation. Wallace Berry is a proponent of using theoretical analysis for performance. In his book, *Musical Structure and*

Performance, Berry seeks "rational principles by which the critical moment of realization (performance) may be informed." Berry contests that:

> The musical experience is richest when functional elements of shape, continuity, vitality, and direction have been sharply discerned in analysis, and constructed as a basis for the intellectual awareness which must underlie truly illuminating interpretation. In that sense, a good performance is a portrayal, a critical discourse on the conceived meaning of a work, and a fruit of inquiry and evaluative reflection. Such an interpretation makes for that transcendent moment in which creative, theoretical, and practical efforts are fulfilled.[18]

The main purpose of the analysis is to simplify the music in order to clarify the phrasing intentions. Complex melodic contours are compacted through the use of analytical methods to reveal simpler underlying step-wise or arpeggiated motion. This makes the musical trajectory of the melody readily apparent. Figure 11, which is written at concert pitch, is a technically difficult passage from a vocalise by Guiseppe Concone. The reduction beneath the actual music shows that the passage can be reduced to just two notes—a step-wise A to G. The B flat on the second beat and the G sharp in that same beat are neighbor note embellishments of the A. The F and the C are chord tones with their incomplete neighbors of E and D, respectively. But the A is clearly the most important chord tone as it occurs first and receives the most embellishment. In the second measure, the F sharp and A are neighbor notes to the G.

Figure 11. Concone excerpt #1 with reduction

[18] Wallace Berry, *Musical Structure and Performance,* (New Haven: Yale University Press, 1989) , 6.

The next analysis in figure 12 from the same vocalise shows reduction to an arpeggio. This figure is also written at concert pitch.

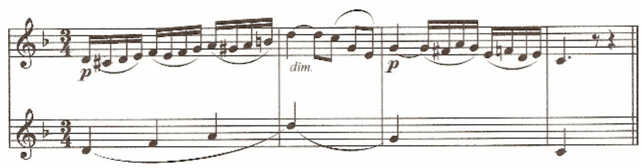


Figure 12. Concone excerpt #2 with reduction

The opening measure outlines a D minor arpeggio with each pitch ornamented with passing tones. Harmonically, the D minor arpeggio is a ii chord in the context of this passage, which is in C major. The D5 in the second measure becomes an appoggiatura over a C chord that resolves to the arpeggiated C major chord that ends on G in the third measure. The G has two neighbor notes, F sharp and A, before resolving to C through F natural. These last two measures are, harmonically, a V7 resolving to tonic.

Music involving greater amounts of chromaticism is also reducible. I previously taught a young student who was struggling with this passage from Vaclav Nelhybel's Suite for Trumpet and Piano. I showed him that the intervallic skips and chromaticism largely reduces to a series of descending step-wise gestures. See figure 13. Once he understood these gestures, passage improved immediately.

The complete semiotic model for a given phrase is a combination of the wind visualization and the reductive analysis. This model visually blends the technical with the

musical, thus addressing the physiological complexities described earlier by Altenmuller and Williamon.

Figure 13. Nehlybel excerpt with reduction

Figure 14, which is written at concert pitch, is the complete wind model using the previous Concone excerpt from figure 12.

This excerpt brings a key element to the wind model—pattern recognition. The wind model looks very similar to a one octave scale with a slight variation on the descent back to the low D. Therefore, once a performer has internalized the general shape of the air stream, that shape may be applied later in the same piece or to other music. The pattern recognition technique then becomes a tool for efficient practice and performance.

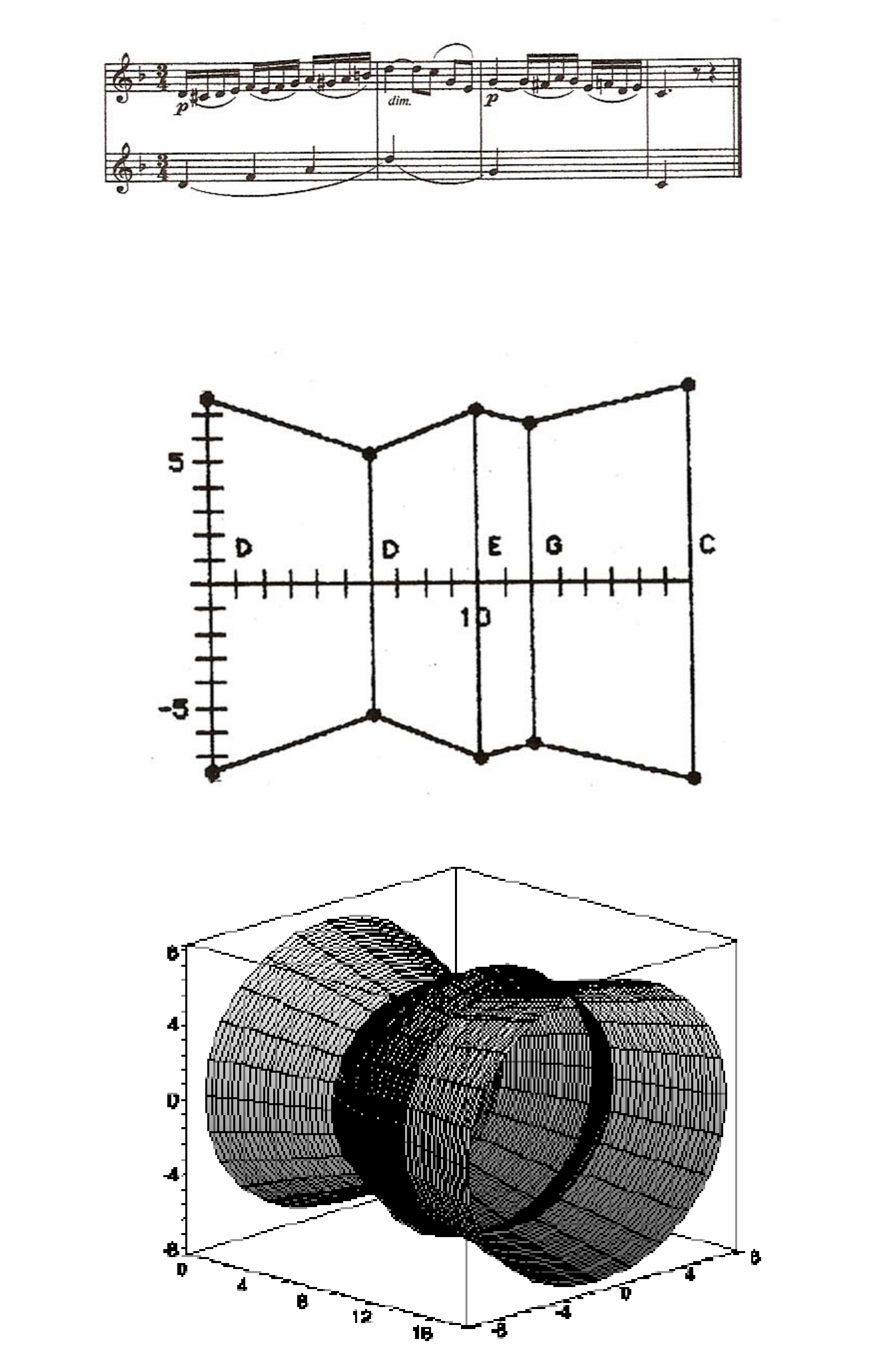


Figure 14. Complete wind model on Concone excerpt #2

PAUL HINDEMITH: STYLE AND COMPOSITIONAL TECHNIQUE

Before I apply the complete wind model to Paul Hindemith's *Sonata for Trumpet and Piano*, I will discuss reasons for choosing the piece and some basic tenets of Hindemith's compositional style that will be helpful in the analysis.

Reasons for Choosing the *Sonata for Trumpet and Piano*

I have chosen the first movement of the *Sonata* for several reasons. First, Hindemith is recognized as a leading composer of music in the twentieth century. Second, the *Sonata for Trumpet and Piano* is considered to be one of the greatest and most significant pieces in the solo trumpet repertoire. Finally, the piece is frequently performed by both students and professionals, and will inevitably be encountered by the student trumpeter in the course of his or her career.

Hindemith's Compositional Style

Hindemith believed strongly in the connection between music performance and music theory. He felt that in the process of learning of piece of music, theoretical understanding and technical mastery must go together. Hindemith blamed schools for separating music analysis and music performance in their curricula. He stated, "To date, all music students concentrate overwhelmingly on instrumental performance studies and are so trained to be more or less capable virtuosi, not (complete) musicians."[19] This quote clearly shows that Hindemith felt that understanding of the structural and analytical elements of a piece is essential for performance.

[19] Peter Cahn, "*Ein unbekanntes musikpadagogisches Dokument von 1927: Hindemith's Konzeption einer Musikhochshule*," translation by David Neumeyer. *Hindemith Jahrbuch* 6 (1977), 162-3.

Hindemith's compositional style lends itself well to analysis. He saw composing as a process of unfolding a piece from its deepest levels, through the unique structural events of the middle ground levels, to the diminutions of the foreground levels. Hindemith's own words further show this point, "Each element is determined by the vision of the complete work, and in each the labor of composition proceeds from the large to the small, from the general to the particular, from the outline to the realization, from the continuous to the discrete."[20]

Therefore, analysis of the trumpet melody in the *Sonata* first requires an understanding of the piece's overall structure and harmonization. Melody rests upon this structural and harmonic framework. Hindemith explains this when he states, "Melody then, does not remain confined to the explicit interval steps from each tone to the next, but is laid out in advance over longer periods, and then subdivided."[21] Each melody is analyzed within the harmonic context of the entire piece.

Thus, understanding melody requires understanding harmony first. The harmonic structure in Hindemith's music has a hierarchical ordering from its deepest level to the surface harmonies. Hindemith says "individual harmonies are then considered important only to the extent that they take their assigned places in the unfolding of the superior harmonic principle—that of tonality."[22] Hindemith calls the important harmonies of the deep and middle levels "pillar chords." These chords are established through "cadences, favorable position in the phrase, recurrent appearance, and support by its most closely related

[20] Paul Hindemith, *Introductory Remarks for the New Version of "Das Marienleben."* Translated by Arthur Mendel. (New York: Associated Music, 1948), 4.
[21] Ibid.
[22] Ibid.

harmonies."[23] The pillar chords define the harmonic framework. Melody flows within this framework and "connects" the pillar chords.[24] Thus, analysis of Hindemith's music first requires knowledge of a piece's tonal design and form and second, the establishment of pillar chords, before the step-wise motion and arpeggiations that comprise the melody is determined.[25]

Hindemith is free to use unresolved dissonance and non-tertian harmonies as he pleases between the pillar chords. He is able to do this because of the clarity and organization achieved by the structural framework of his music. Hindemith states, "If the tonality is well thought through and clearly presented by means of several harmonic pillars placed in wisely calculated positions, then the harmonic construction in-between can be somewhat looser, the tonality worked out in weak, even the weakest, form."[26]

Hindemith used the overtone series in a unique way to explain and justify his system of intervallic and harmonic relationships. This system is important in determining the hierarchy of musical events in Hindemith's music. In his system, the unison and the octave have the greatest stability. The next most stable intervals are the perfect fifth and its inversion—the perfect fourth. Thirds and their inversion come next.[27] Therefore, a chord containing only a root and a fifth has more stability than a chord that contains a root, a third, and a fifth. Quartal harmony is more stable than tertian harmony. See figure 15 for the entire ranking of intervals from the most stable to the least stable according to Hindemith's system.

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[23] Paul Hindemith, *A Concentrated Course in Traditional Harmony, vol. 2: Exercises for Advanced Students.* (New York: Associated Music, 1949), 39.

[24] David Neumeyer, *The Music of Paul Hindemith*. (New Haven: Yale University Press, 1986), 39.

[25] Ibid.

[26] Paul Hindemith, *The Craft of Musical Composition, III: Ubungsbuch fur den dreistimmigen Satz.* Edited by Andres Briner, P. Daniel Meier, and Alfred Rubeli. (Mainz: Schott, 1970), 203.

[27] Neumeyer, 31.

Figure 15. Hindemith interval hierarchy

Hindemith uses stable chords as “goalposts” at the beginning and end of each section of music. In between these pillar chords, he has a great deal of freedom but by framing each section with stable chords he maintains his connection with the “superior harmonic principle.”

APPLICATION OF THE MODEL TO THE SONATA

The form of the first movement is a palindrome with seven sections. The movement opens with three different sections (A, B, and C), the middle section is a return of the A section, and the last three sections reverse the order of the first three sections (C, B, and A.) Kostka and Graybill call this movement an arched form.[28] Each section of the form has its own pitch center. The A section, characterized by its stately opening theme in mm. 1 to 4, has a pitch center on B flat. In measure 67, the opening theme marks the return of A at the interval of a major third higher. This section then closes the movement with the reprise occurring in measure 125. The pitch center of the final section returns to B flat. The B sections are marked by rising step-wise motion in the trumpet over the piano's march-like ostinato pattern based on quartal harmony. The first B section begins in m. 30 and is centered on C sharp. The second B section has centricity in E flat and precedes the final A section beginning in measure 114. The two C sections are defined by subdued tertian arpeggiations in both the trumpet and piano. The first C section has centricity on and the second C section is centered on B. These two sections flank the middle A section. The first begins in measure 47 and the second begins in measure 85. The measures between the sections are linking passages. (28-29, 46, 63-66)

Section	**A**	**B**	**C**	**A'**	**C'**	**B'**	**A"**
mm.	1-27	30-45	47-62	67-84	85-106	107-126	127-end
Pitch centers	B^b	$C^\#$	A	D	B	E^b	B^b

Figure 16. Form diagram—first movement of Hindemith

[28] Stefan Kostka and Roger Graybill, *Anthology of Music for Analysis* (Upper Saddle River, New Jersey: Prentice Hall, 2003) , 248-249.

The sections are characterized by specific dynamic levels. All three A sections remain forte or greater. Both B sections begin at pianissimo and end at forte or fortissimo. The varying dynamics of the C sections are marked by crescendos followed by diminuendos. The dynamics accentuate the stability and prominence of the A sections.

The application of the wind model to the Sonata begins with the opening four bar theme. In just these first four bars, Hindemith establishes a motive that is the centerpiece for the movement. From the standpoint of the model, this means the patterns established in these first four bars are applicable many times. The opening gesture, Bb 4, rising to Eb 5, and then to F 5, is based on quartal harmony with B flat as its root. The B flat is the root due to its support in the piano. Because of Hindemith's hierarchy of intervals, this quartal sonority represents a more stable sonority than the C flat arpeggiated triad in the third measure. This arpeggio reduces to its root, C flat, which is an upper neighbor to the return of B flat in measure 4. Even though this opening theme is characterized by skips, it reduces to a simple prolonged B flat with a half step upper neighbor.

Visualizing the cones on this opening theme establishes a pattern that will be used fully or partially seven more times in the movement. Thus, internalizing the shape of the air stream on these first four bars is a large step towards the performer learning this movement effectively and efficiently.

The cone gets smaller as the trumpet moves from Bb 4 up to F5, with a connecting cone getting larger as the contour of the melody moves down to low E flat. The next cone gets smaller as the theme continues to the D flat in the third measure. And the cone gets slightly larger upon the resolution to B flat in measure 4. Figure 17 illustrates the complete wind model for the opening theme.

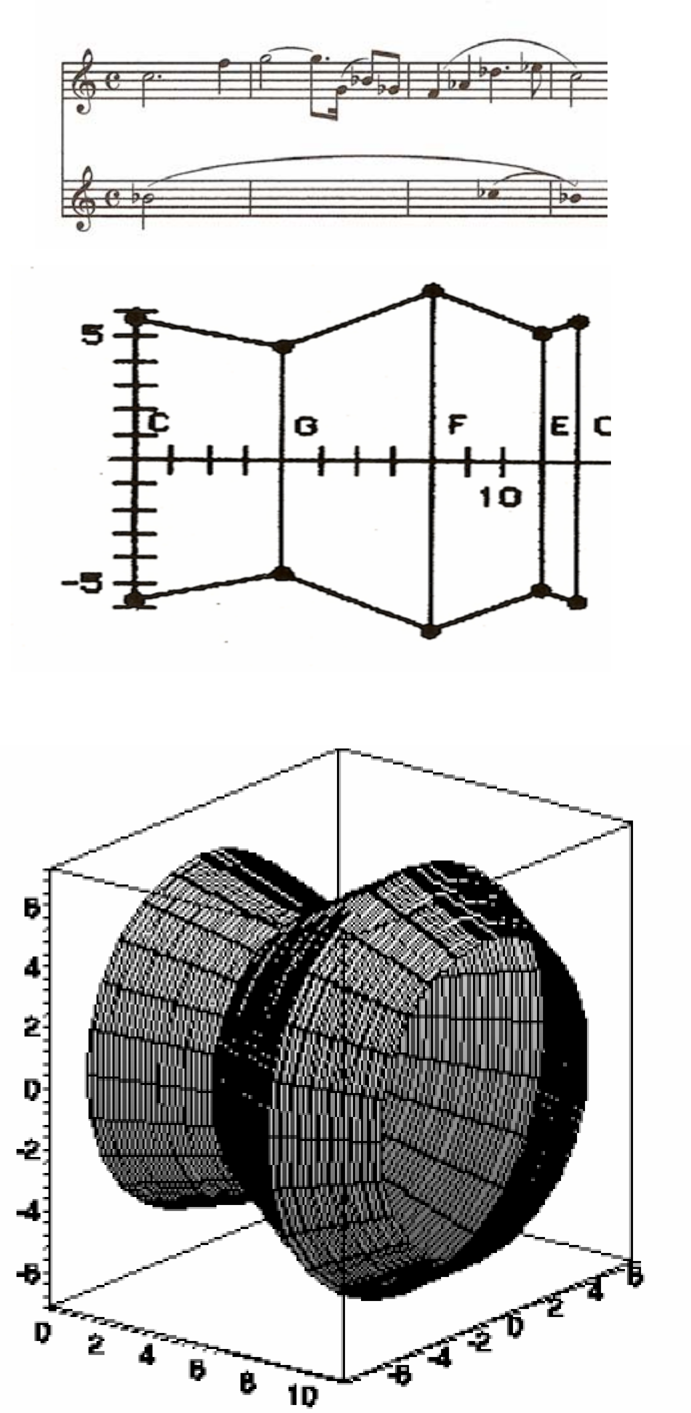

Figure 17. Complete wind model of opening theme of section A

The trumpet plays in 114 bars of this movement and 31 of these bars are comprised of the same theme or a piece of the theme. This accounts for just over 27% of the movement. Hence, learning the repeated pattern well will return important dividends.

This opening theme returns two more times. The second statement occurs in m.12 centered on F4. This line ascends to a Bb 5 before resolving to B5 in m.16. The cone starts larger and gets smaller due to the extended range of the passage, but the general shape is still visible. Notice how similar the model in figure 18 is similar to the model of the opening theme.

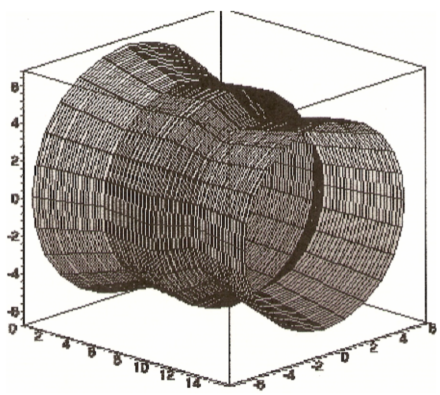

Figure 18. Wind diagram of Hindemith Section A mm. 12 to 16

The slightly different shape indicates that this passage transitions to B rather than returning via the upper neighbor back to the F natural that began the passage.

The final statement of the opening theme starting in m. 24 is a slightly extended restatement of the opening. Thus, the end of this model looks similar to the previous two.

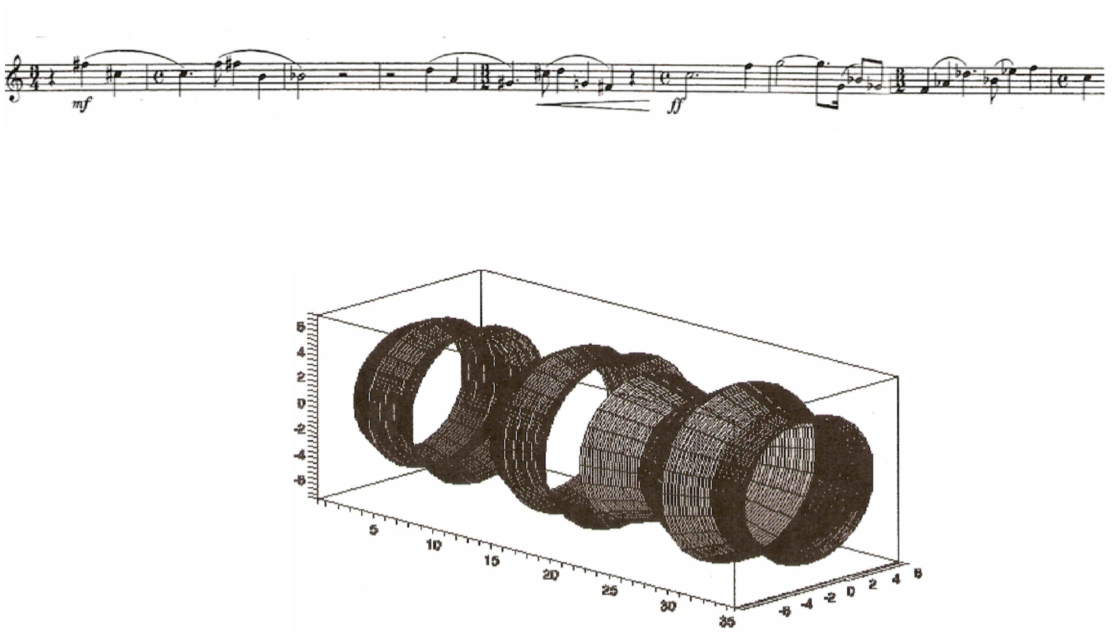

Figure 19. Wind diagram of Hindemith Section A mm. 19 to 27

The statements of the themes are connected by two descending passages in the trumpet. The first descending passage occurs from mm. 4 to 9. The trumpet line reduces to a descending whole tone scale. The A4 in m. 5 moves to G4 in m. 6 and then resolves to F4 in m. 9. The wind model reflects this descending motion with a series of cones gradually get larger. However, the passage is still rather disjunct so the cones also reflect this contour. See figure 20.

The second descending pattern occurs in mm. 19 to 23. This pattern ends on E4 by way of whole step motion from the Bb 4 in m. 20. This descent is motion to an inner voice.

The piano prolongs B natural during the trumpet descent with the B5 in m. 19 and the B5 on the last beat of m. 23. B natural is the chromatic upper neighbor of the final statement of the section back in B flat.

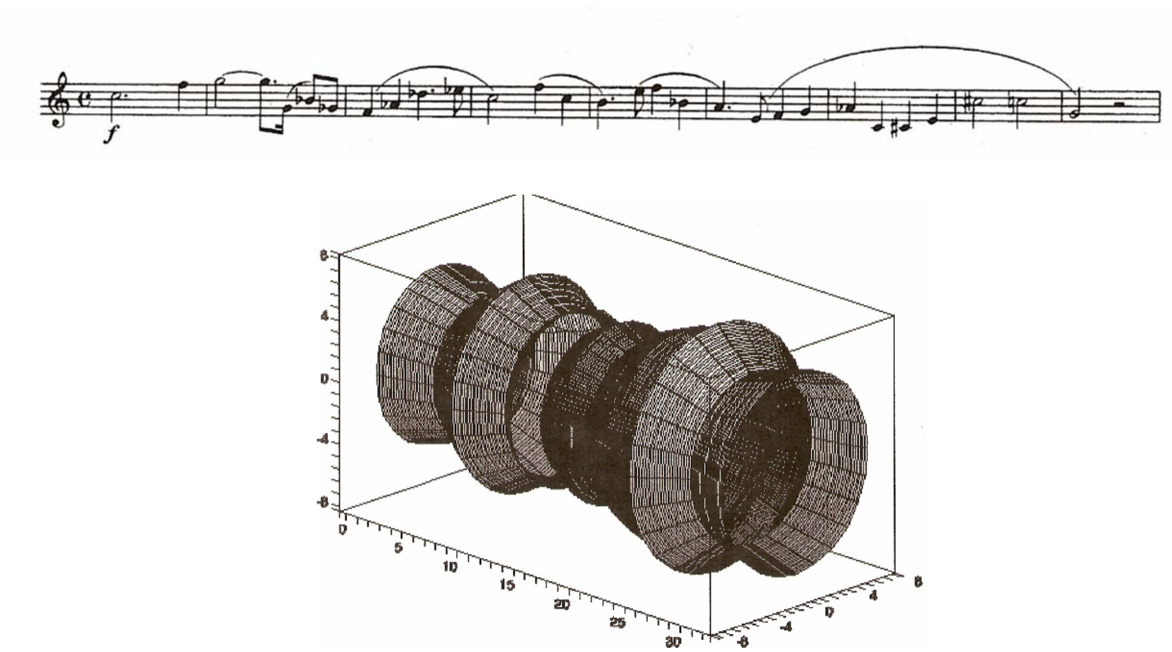

Figure 20. Wind diagram of Hindemith Section A mm. 1 to 9

The rest of the reductive analysis merely shows the upper neighbor patterns, which are the reductions of the main theme, connected by the two descending whole tone passages. The prolonged B natural with its chromatic upper neighbor in mm. 16 to 19 is played by the piano and not the trumpet. Figure 21 shows the entire A section.

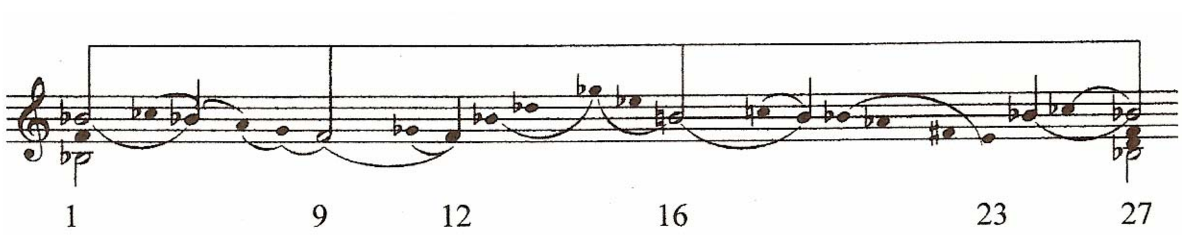

Figure 21. Reductive Analysis of Hindemith A Section

It is interesting to note that the entire section moves in step-wise or arpeggiated motion between the two pillar chords in the piano in m. 1 and m. 27. The first pillar chord is a very stable open fifth on B flat and F. The pillar chord in m. 27 adds the third to the chord which actually makes the chord slightly less stable based upon Hindemith's hierarchy of intervals. The fact that the pillar chord in m. 27 is less stable simply means that the piece is not finished. Ultimately, the final sonority of the piece contains only octave B flats.

The trumpet part of the first B section of the Hindemith is structural around a C sharp minor triad. See figure 22.

Figure 22. Trumpet score with reductive analysis for Hindemith Section B

The trumpet part establishes C sharp as the structural center in mm. 37 and 38 with a gesture that spans a perfect fifth from C sharp to G sharp. The remainder of the B section reduces to an ascending whole tone scale from E4 to E5 before resolving back the pitch center of the passage, C sharp. This ascending whole tone scale contrasts the A section's descending whole tone patterns.

Figure 23. Reductive analysis of Hindemith Section B

The wind model of this B section in figure 24 illustrates the opening gesture of the perfect fifth. This gesture, again, speaks to pattern recognition from the opening perfect fifth gesture in the main theme. If the performer has control of the shape of opening gesture, then this movement by perfect fifth is simply visualizing the same shaped air stream with bigger cones due to the lower pitch.

The middle portion of the graph below depicts the trumpet’s ascending whole tone scale as one smooth shrinking cone. The cone is smooth, as the air stream should be. The air stream should not be jagged.

The end of the B section wind model demonstrates how linear the air stream should be on the three diving fourth gestures in mm. 43 and 44. The air does not go “down” as the musical notation suggests.

Pattern recognition is very useful in the C section of the Hindemith. The shape of the air stream for the section’s main gesture accounts for almost 70% of the section. The gesture descends a fourth and then ascends an octave. The first example of this is found in mm. 47 and 48. When the trumpet returns with this gesture a minor third higher, the same wind shape

is used. The shape, however, is smaller to account for the higher notes or faster air. Again, only the notes that shape the cones are necessary. Representing every note in the wind model is too much information for the performer; only the main contour needs to be represented.

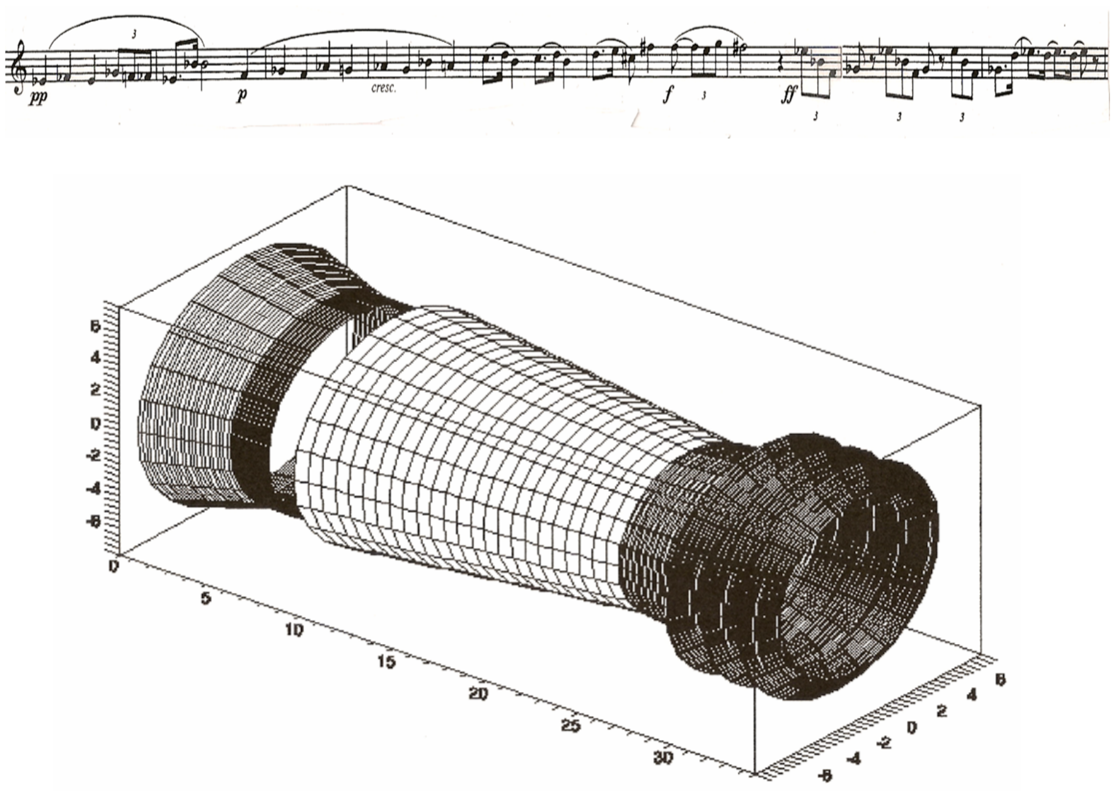

Figure 24. Wind diagram of Hindemith Section B

The melodic content of the C section reduces to series of major triads. These triads outline a diminished triad when considered as a whole. The trumpet outlines an A major triad twice to open the section. The piano makes the next two statements of the main gesture in mm. 54 to 57. The first is in G flat and the next returns to A major. The trumpet takes the gesture back at beat before m. 58. The last two statements of the gesture are in C major. This completes the diminished triad with major chords on G flat, A, and C. See figure 25 below.

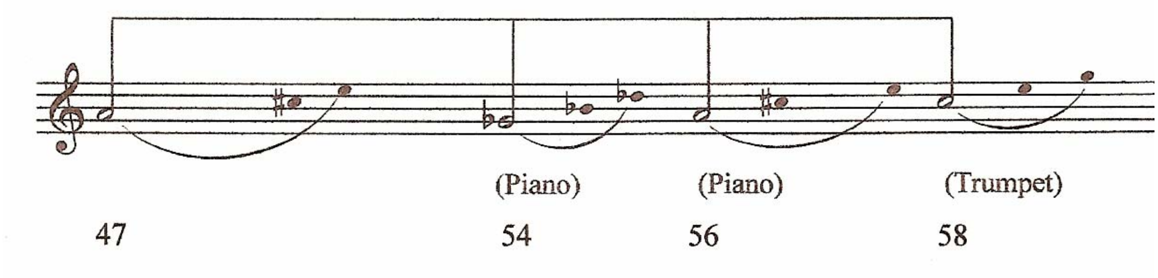

Figure 25. Reductive analysis of Hindemith Section C

There is a cyclical element to this section in mm. 52 and 53 when the trumpet uses a transposed version of the A section's opening 3-note motive as a transition between the A natural and G flat triads. The D flat dotted half note in m. 53 is a common tone between the A major triad and the G flat major triad. The performer, therefore, uses a familiar air stream shape on this transition.

Inversion is another practical application of the air visualization. The A section opens with a very prominent ascending fourth. The C section is full of very distinct descending fourths. The performer merely inverts the cone from one that gets smaller, the ascending fourth, to one that gets larger, the descending fourth. The cones allow the performer to visually calibrate that very important interval.

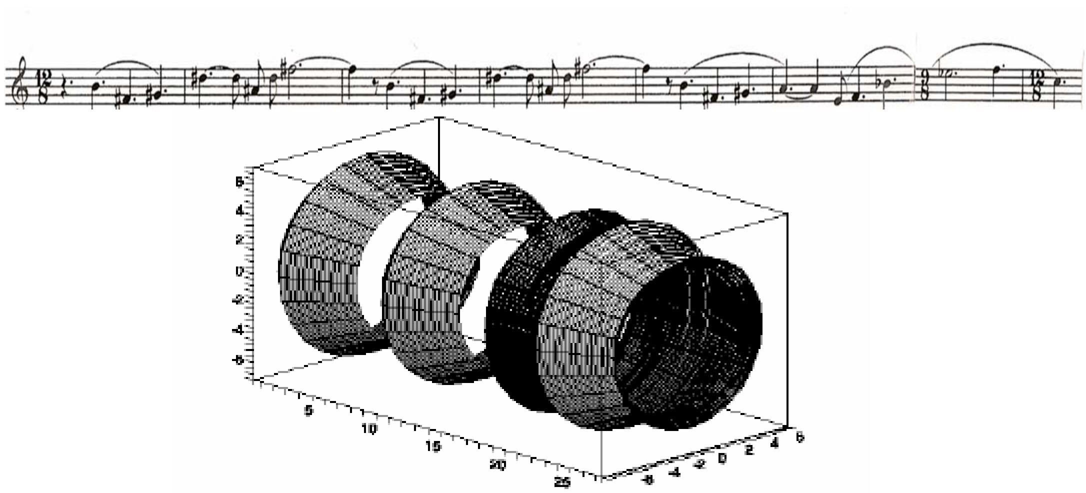

Figure 26. Wind diagram of Hindemith section C mm. 47 to 54

As mentioned previously, the middle A section is a passage requiring a great deal of endurance, range, and flexibility. This passage consumes the thought processes of many trumpet players. The wind model, however, illustrates that the air stream required to sound this passage is very similar to air streams that the performer has already encountered and internalized. See figure 27. The only difference is that the cones are smaller because the notes are higher.

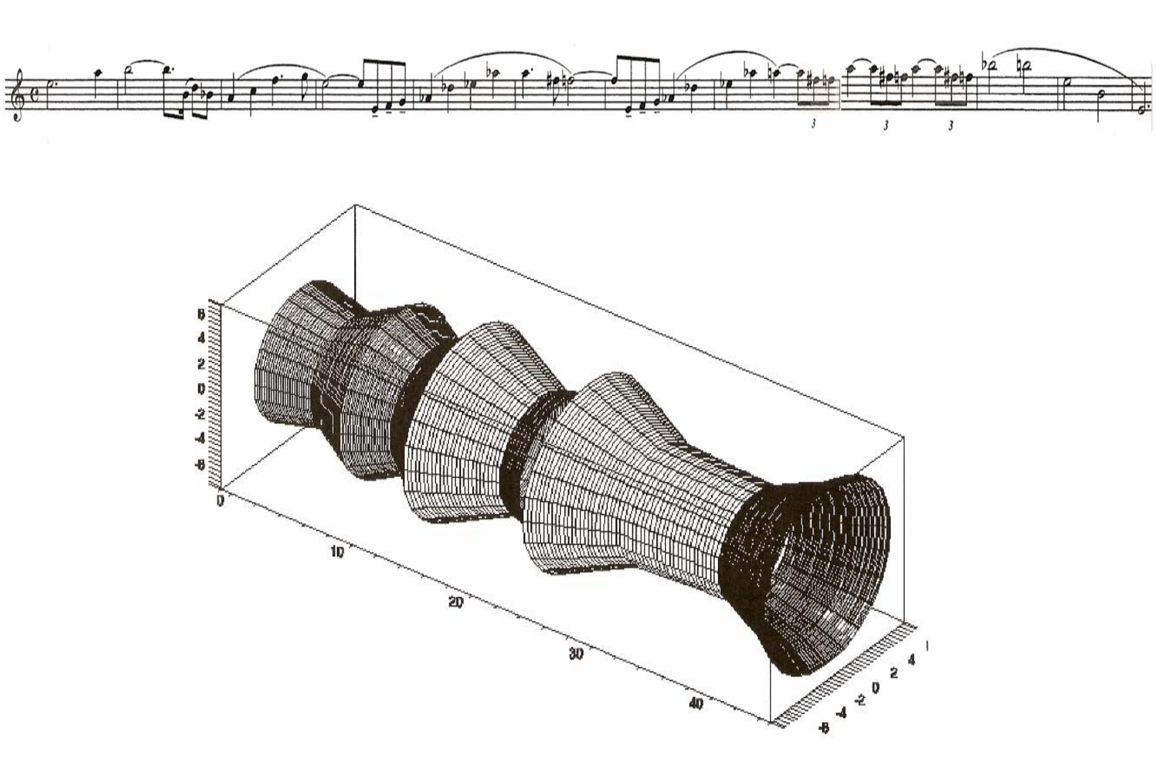

Figure 27. Wind diagram of Hindemith Section A'

The wind model also “flattens out” the low E to high B intervals in the passage. With this model, the air stays linear which makes changing air speeds easier. The tongue functions on this air stream, thus, minimizing tension. It will function properly on a free-blowing air stream.

Analysis reduces this passage to an arpeggiation of a D major chord as shown in figure 28.

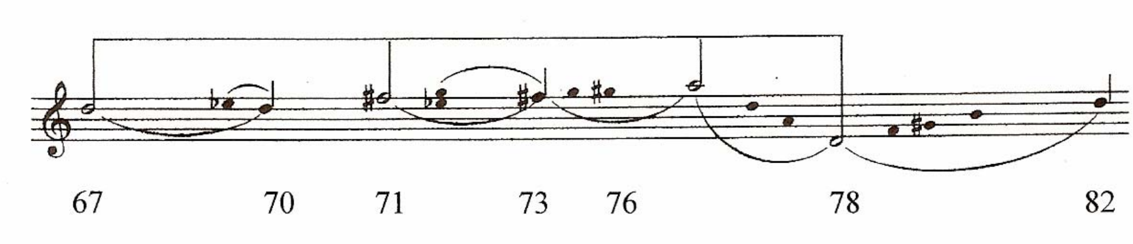

Figure 28. Reductive analysis of Hindemith section A'

The reductive analysis also helps to simplify issues for the performer. The opening gesture is merely a D with an upper neighbor. The B5 is not even the most important note in the gesture. The musical direction of the difficult passage from mm. 71-76 moves up chromatically from F# 5 to A5. Focusing on this musical direction, rather than on the intricate technical details of the passage is a positive for the performer.

In the return of the C section, the wind model allows for a better understanding of the Hindemith's use of transposition and retrograde. The trumpet states the C section gesture in F major and in B major. These transpositions mean that the shape of the air stream is the same, but the F major cones are bigger and the B major cones are smaller. In the transitional passage in mm. 96 to 98, Hindemith cyclically uses the A section's opening 3-note motive. This time the motive occurs three times in retrograde. This pattern begins with the E flat in m. 96 and then transposes down a major third and then down a perfect fourth. (The third statement is incomplete, but the contour is similar.) So the performer simply turns the cone around from the familiar cone that represents the opening three notes of the piece and in a set where each cone gets bigger.

This section also is based on a set of major triads that outline a diminished triad. The three major triads are F, A flat, and B. B has centricity in this section as the B triads are first and last. The piano opens the section with these B major triads and the trumpet takes over with F triads in m. 92. In the transition that follows, the long notes of the retrograde A motives outline a B major triad as the D sharp in m. 96 moves to B natural in m. 97 and then F sharp in m. 98. The piano and trumpet exchange the C section's main gesture to close the section from mm. 99 to 106. The piano states the gesture in A flat and the trumpet responds in B. The piano then returns to A flat and the trumpet finishes the section holding the long G flat. The G flat will have prominence in the closing section of the movement.

The second B section appears as if it is going to repeat the pattern of the opening B section with a pitch center on E flat instead of C sharp. The rising whole tone scale, however, is interrupted to provide a springboard into the movement's final A section. The ascending fifth forms a familiar shape to the air stream in mm. 115 to 118 in the trumpet part. The whole tone scale begins on the Gb 4 in m. 118, but it does not complete the octave as in the first B section. The scale only goes to C5 and then D5 with a strong emphasis on the B4 below. In the air stream, the shrinking cone of the ascending octave scale is also interrupted for the disjunct motion between the D and B naturals. The B natural eventually "wins out" in m. 126 and becomes a chromatic upper neighbor to the return of the A section with centricity on B flat.

The wind patterns of the final A section return the familiar shapes from the opening theme. The opening theme is stated twice, interestingly over G flat harmony in the piano instead of B flat. The G flat harmony recalls the trumpet note from the end of the second C

section and foreshadows the chromatic upper neighbor to the trumpet's penultimate note of F natural.

Following these two statements of the opening theme, Hindemith expands the second portion of the theme to outline an augmented B flat triad that ends on F sharp, the chromatic upper neighbor to F natural. So the shape of the cones in mm. 132 and 133 repeats three times, getting smaller each time the motive moves up a major third. Analysis shows the whole pattern as a series of upper neighbors that each resolves to the notes of the augmented B flat triad. The B triad in m. 132 resolves to B flat, the E flat triad in m. 134 resolves to D natural, and the G triad that begins in m. 135 resolves to F sharp. In m. 138, the F sharp then resolves to F natural to close the augmented sonority and set up its return to B flat. The F natural is held for twelve beats to sustain the tension. The piano brings full closure under the trumpet's final B flat with octave B flats.

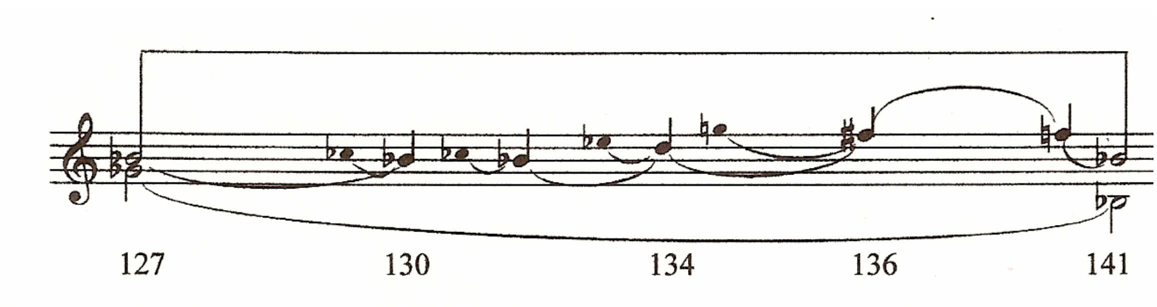

Figure 29. Reductive analysis of Hindemith Section A"

The omission of the fifth from the opening chord of the piece shows that this movement has come to a well established close. Refer to appendix A for a complete wind model of the first movement of the Hindemith *Sonata for Trumpet and Piano*.

CONCLUSION

The essence of the wind model lies in its simplicity. The series of cones represents the fundamentals that allow for a free-blowing approach to brass playing. The model addresses the air stream's speed, direction, and continuity all in one simplistic structure. This lessens tension in the muscles of the performer's aperture, embouchure, neck, and chest. Once tension is minimized, technical elements of performing such as tonguing and flexibility improve.

There must be, however, a balance between the wind model and technical practice. The model does not release the performer from practicing scales, tonguing, flexibility, and finger exercises. The purpose of the model is to allow each of these technical components to coalesce in the most efficient way. Thus, in performance, technical capability and virtuosity is achieved by not thinking about these technical elements at all. A golfer that prepares to strike a ball while thinking about grip, stance, balance, wrist position, shoulder position, swing, swing cadence, line of trajectory, and ball position at the same time will be paralyzed. In the same way, a brass performer cannot think about all the aspects of technique simultaneously. The model allows the performer to consider technique is one simple construct, thus, freeing the mind for musical interpretation and expression.

When Dr. Skillen first introduced the conical wind visualization, I envisioned large ascending intervallic leaps as a cone that went from large to very small to represent the large increase in the speed of the wind. After applying mathematics to the cones, I realized the change from the large end of the cone to the small end of the cone was not as pronounced as I initially thought. In specific terms, a high C on the trumpet is much closer, physically, to a low C than many trumpet players realize. Allen Vizzutti further states that large intervals on

the trumpet are acoustically not difficult.[29] Moving two octaves on a brass instrument does not require drastic physical changes. The wind model allows the performer to fully visualize this concept.

The wind model can be used as a teaching tool for students of all ages. There is no reason why a young student cannot begin conceptualizing the wind's speed, direction, and continuity early in the learning the process. The model is easy to grasp. I find that when I use the model in my teaching, very few words are needed to describe the concept. In my own playing, the wind model is a part of each day's practice.

[29] Allen Vizzutti, *The Allen Vizzutti Trumpet Method: Harmonic Studies* (Van Nuys, California: Alfred Publishing, 1991) , 7.

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APPENDIX A: COMPLETE WIND MODEL

The complete wind model of the first movement of the Sonata for Trumpet and Piano is displayed on pages 42 to 53. The model has four layers. Read top to bottom, the top layer is the trumpet score in the key of B flat. The second layer is the reductive analysis of the trumpet part at concert pitch. The third layer is a two-dimensional wind visualization of the trumpet score; not the analysis. And the bottom line is the three-dimensional wind diagram of the same trumpet music as the two-dimensional diagram. The two-dimensional model is a side view or perpendicular view. The three dimensional model is at an angle so that the cones can be seen. Both the music and the wind models are read left to right as this represents the direction of the air stream.

Figure 30. Complete wind model of Hindemith section A mm. 1 to 12

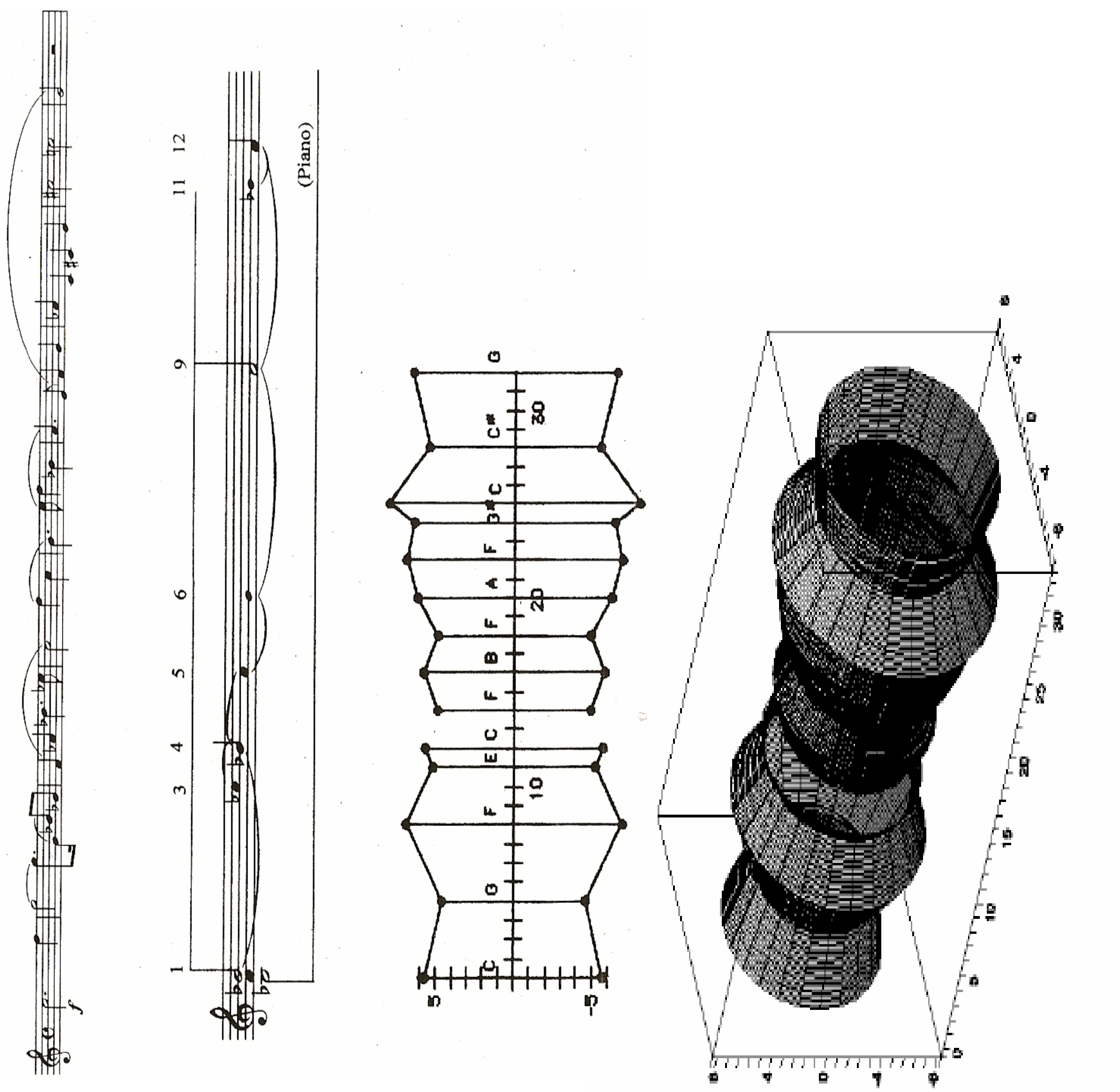


Figure 31. Complete wind model of Hindemith section A mm. 12 to 19

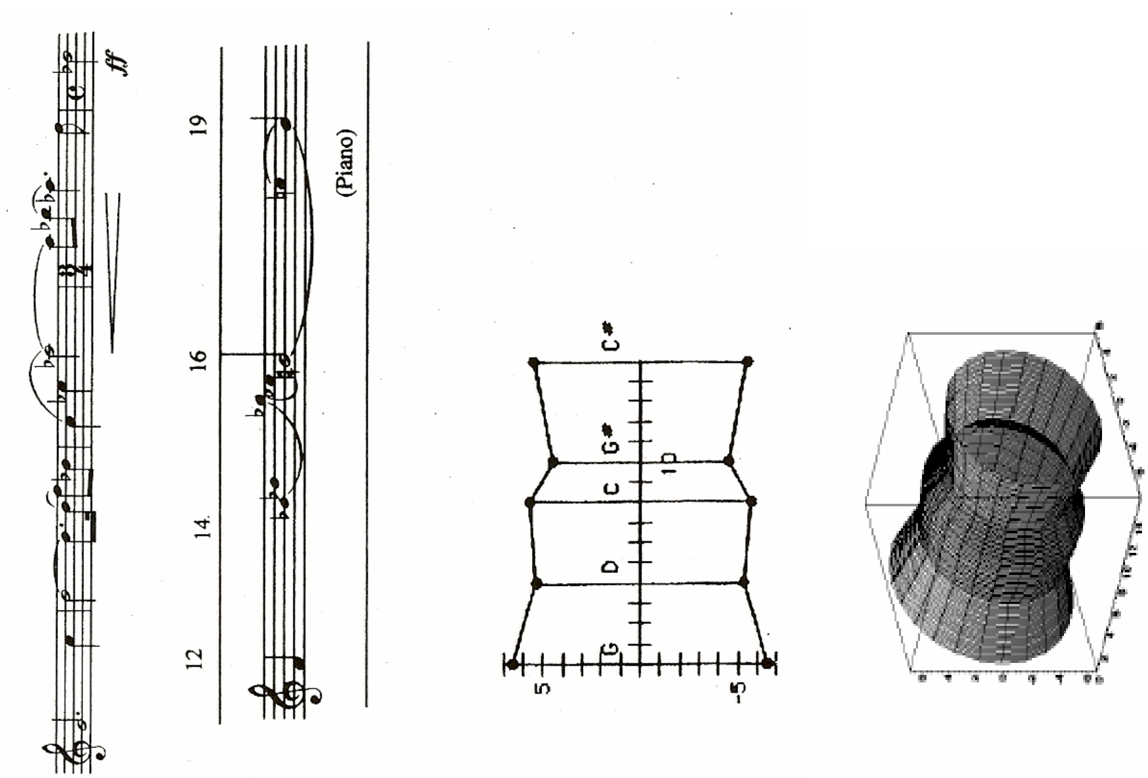


Figure 32. Complete wind model of Hindemith section A mm. 20 to 27

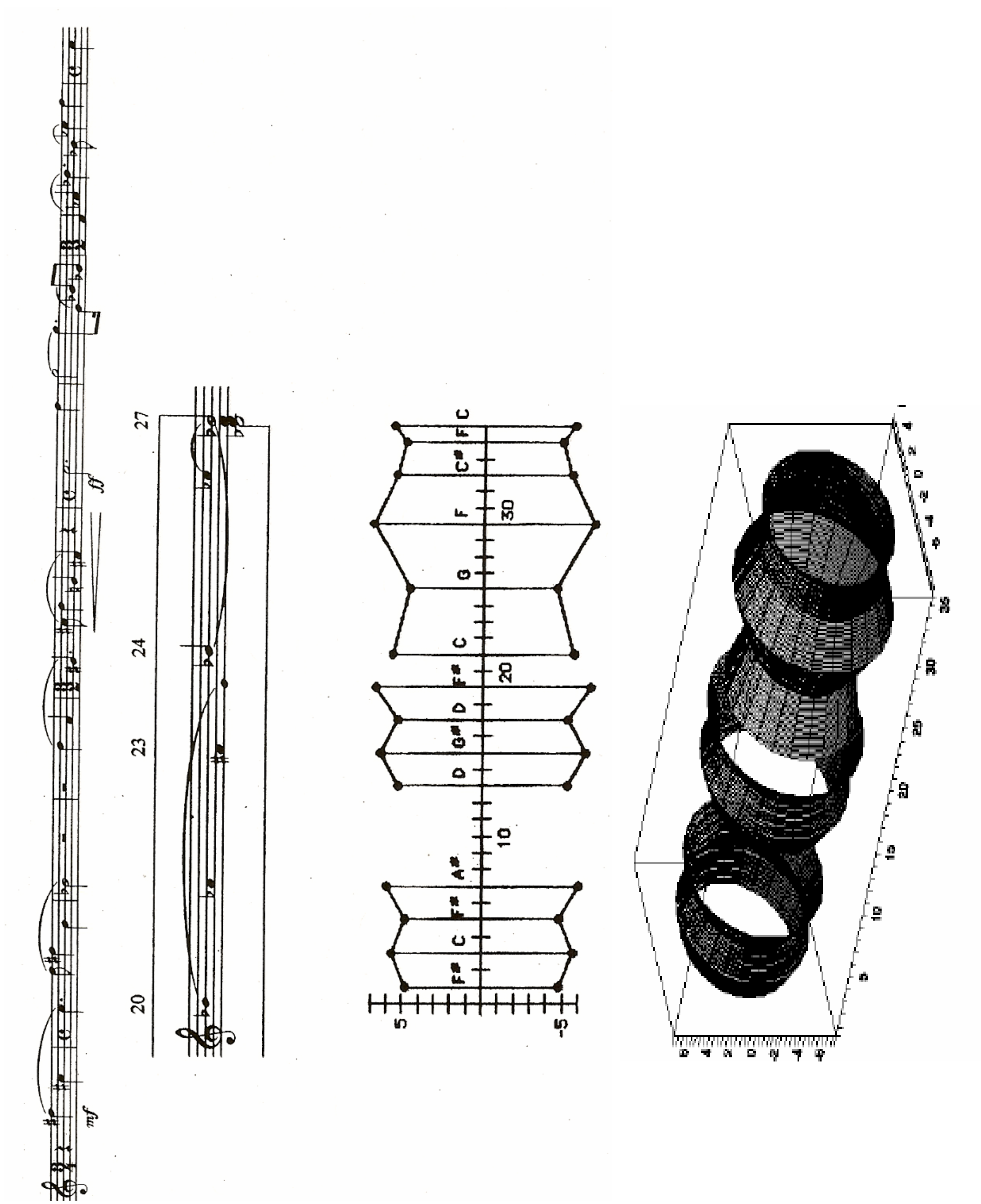


Figure 33. Complete wind model of Hindemith section B mm. 37 to 45

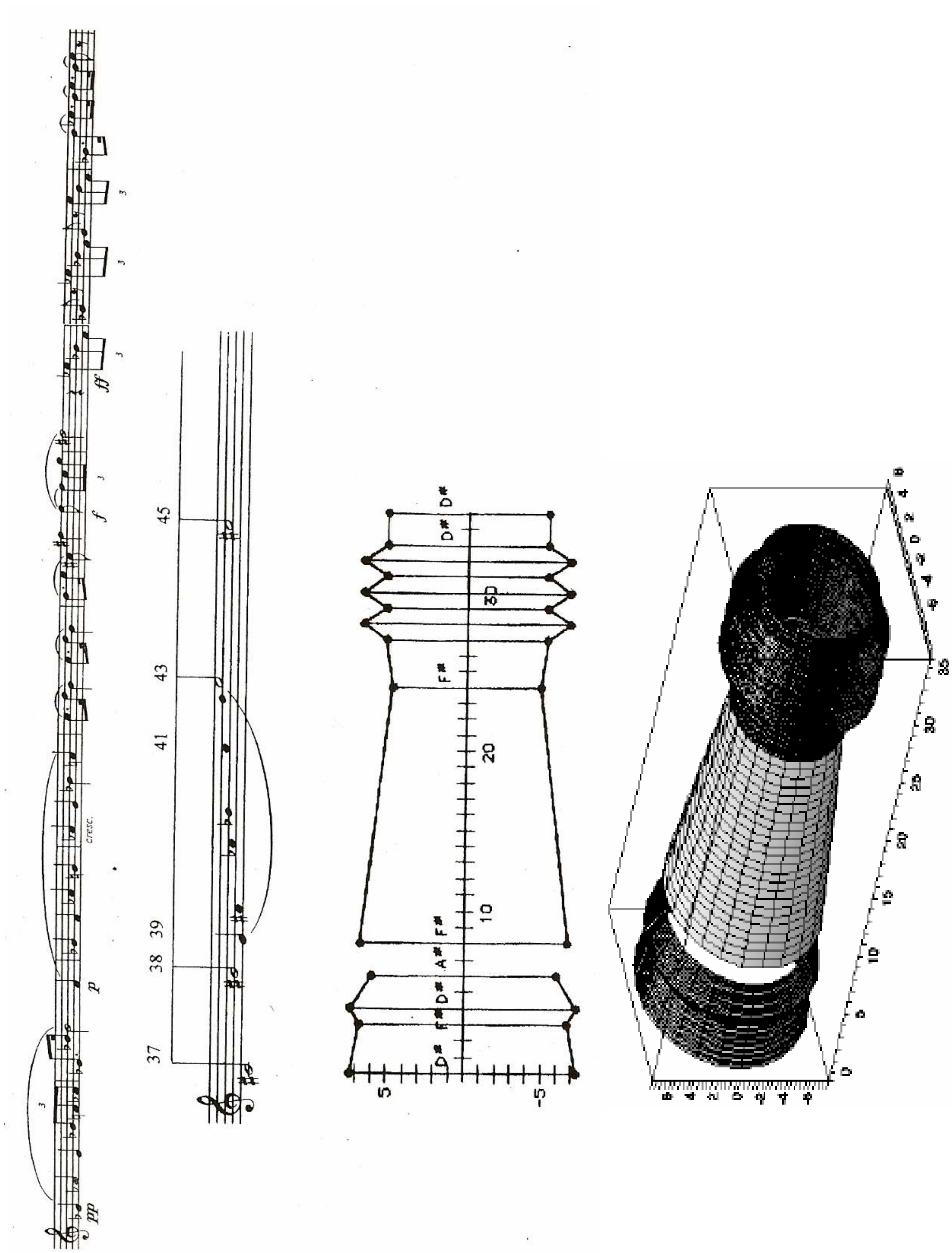


Figure 34. Complete wind model Hindemith section C mm. 47 to 55

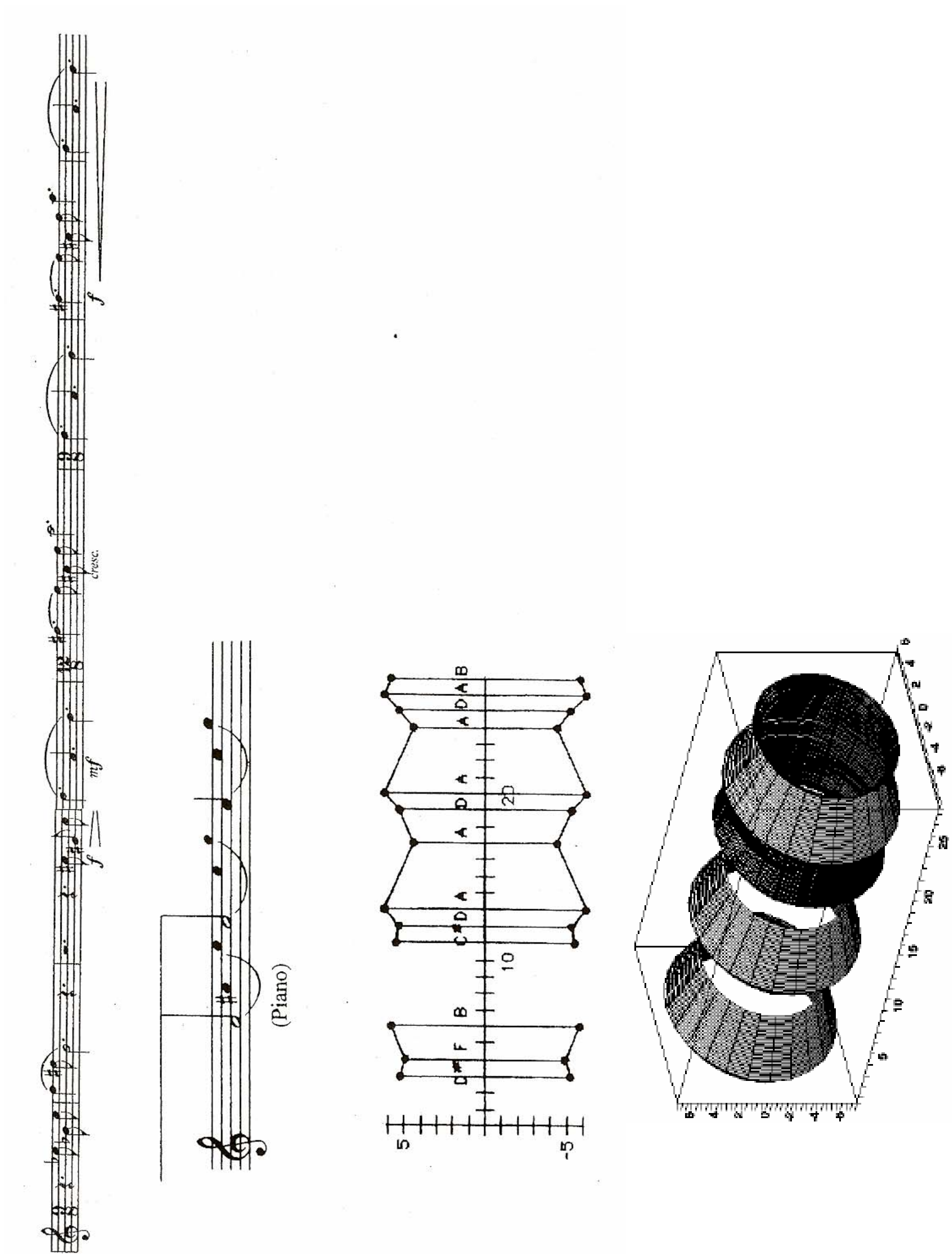


Figure 35. Complete wind model of Hindemith section C mm. 55 to 61

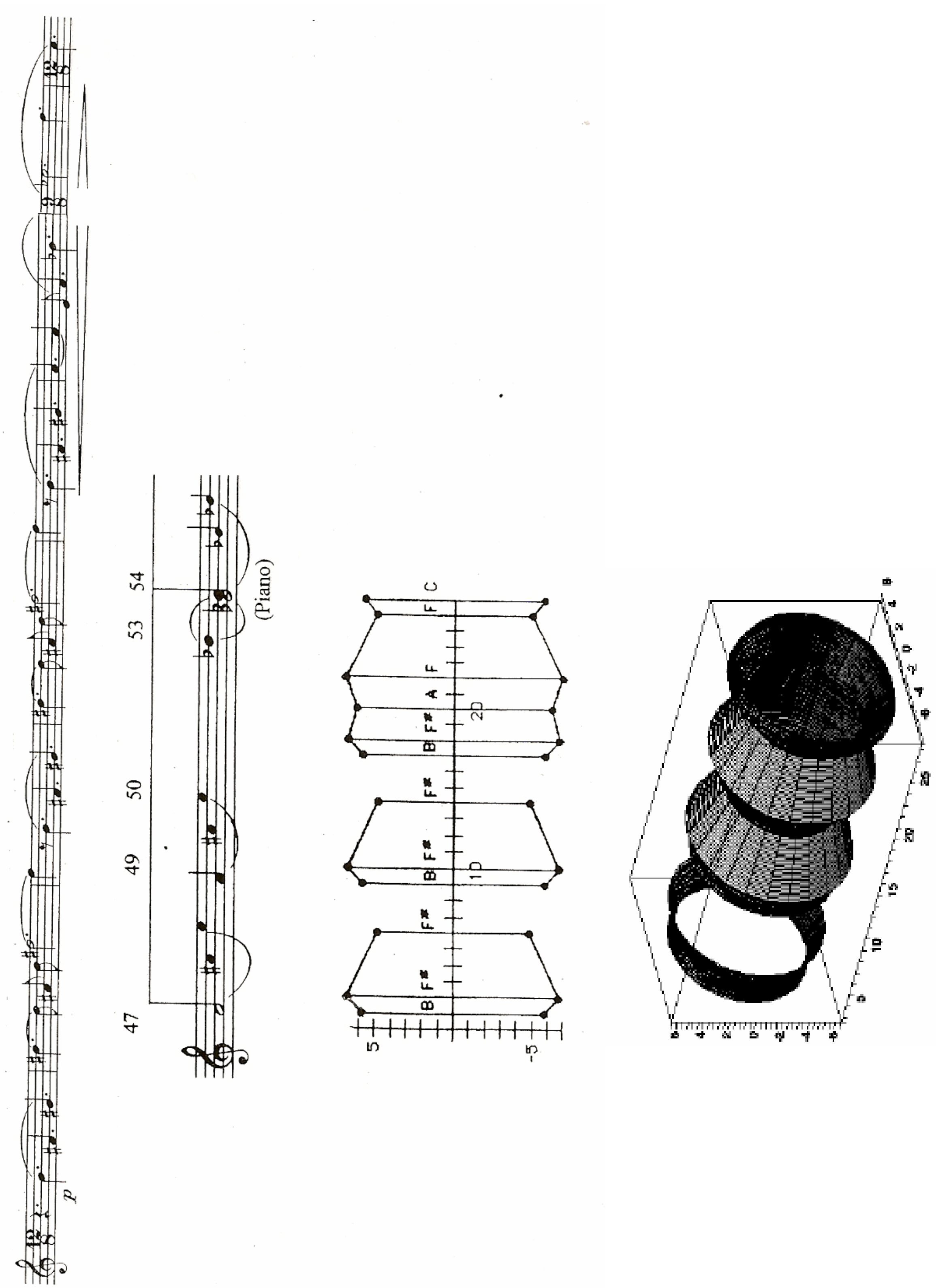


Figure 36. Complete wind model of Hindemith section A' mm. 67 to 78

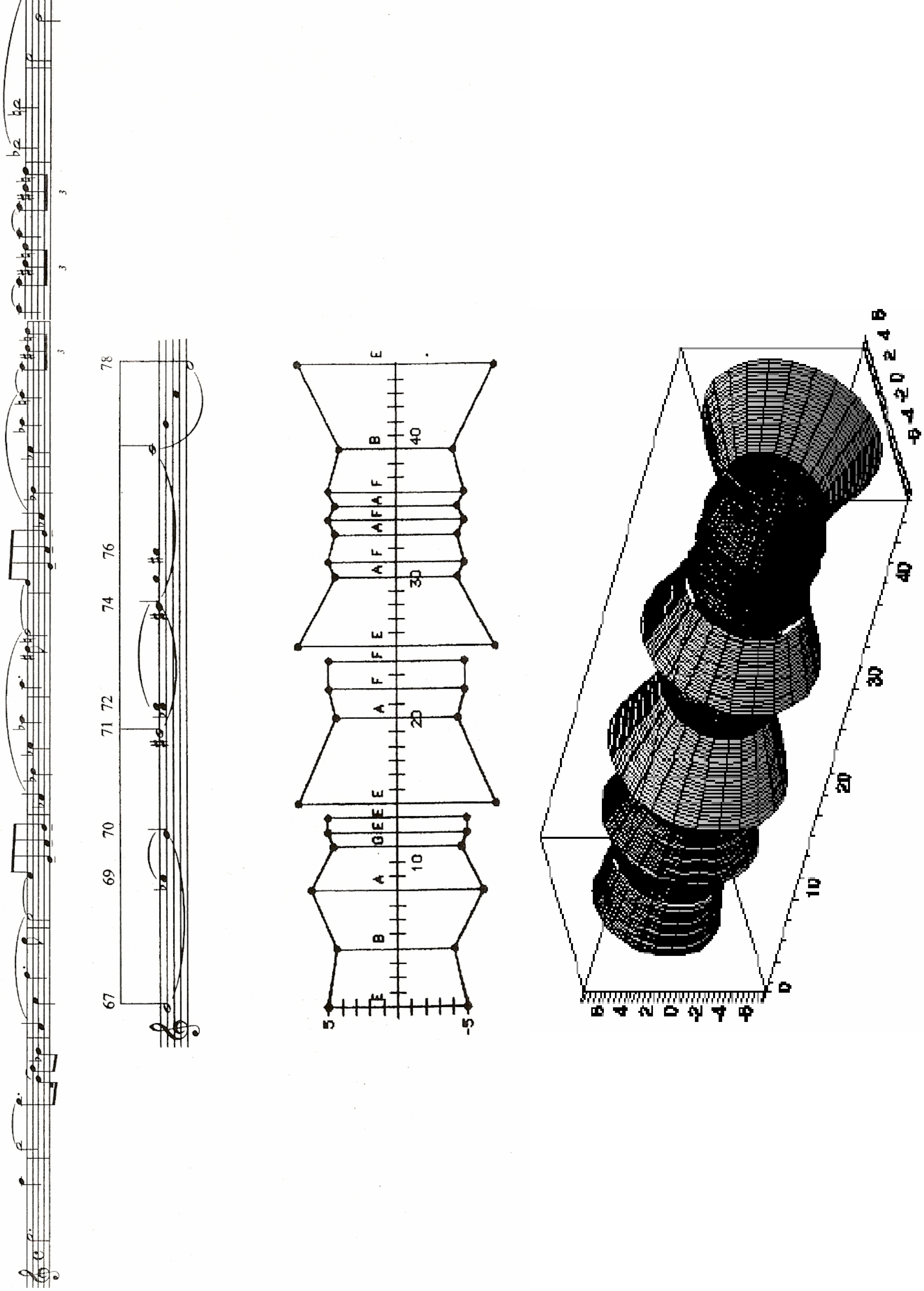


Figure 37. Complete wind model of Hindemith section A' mm. 80 to 82

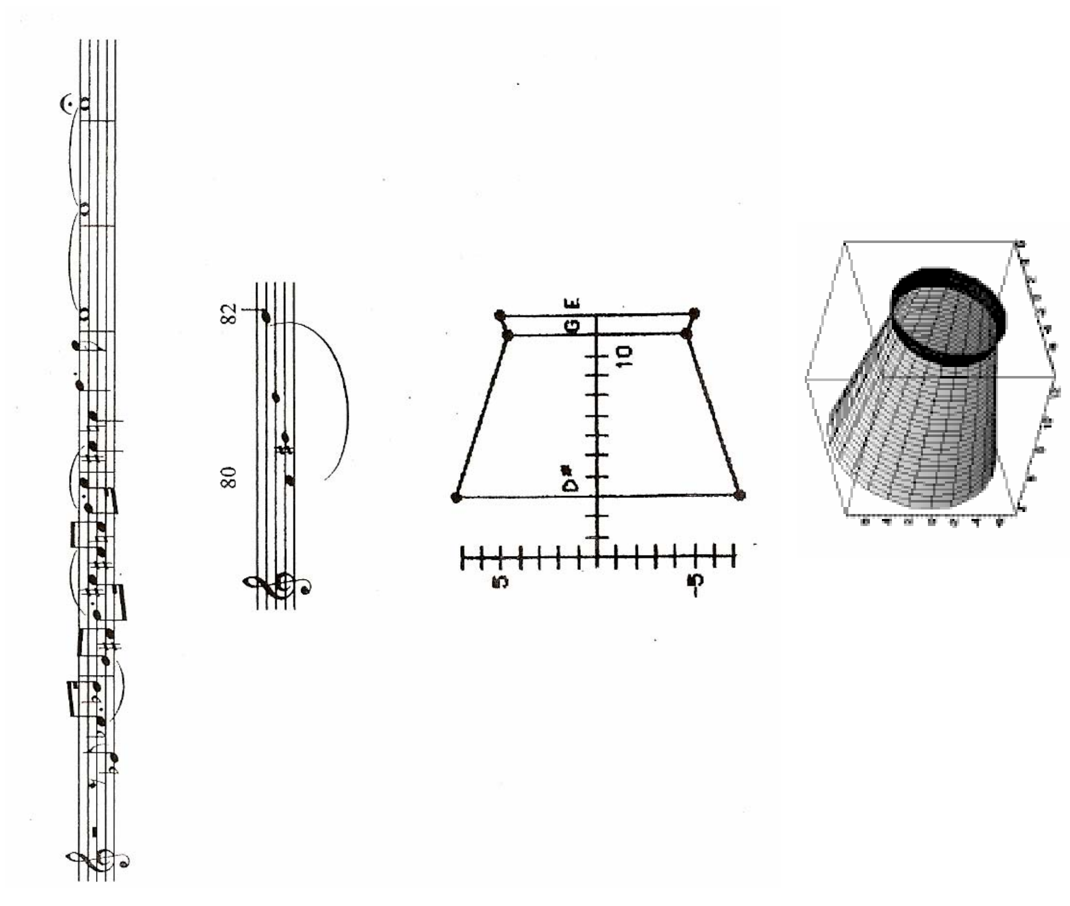


Figure 38. Complete wind model of Hindemith section C' mm. 85 to 100

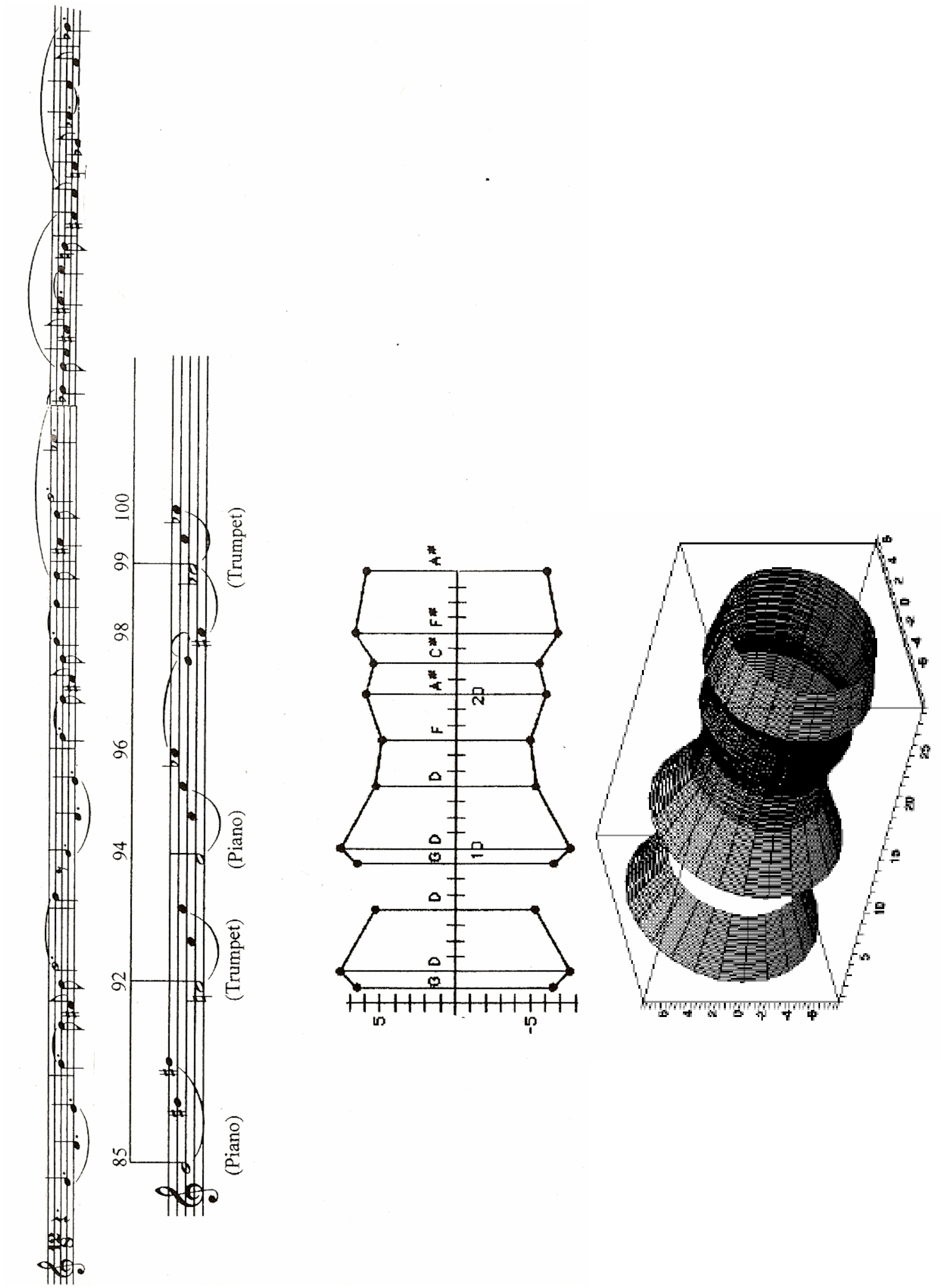


Figure 39. Complete wind model of Hindemith section C' mm. 100 to 106

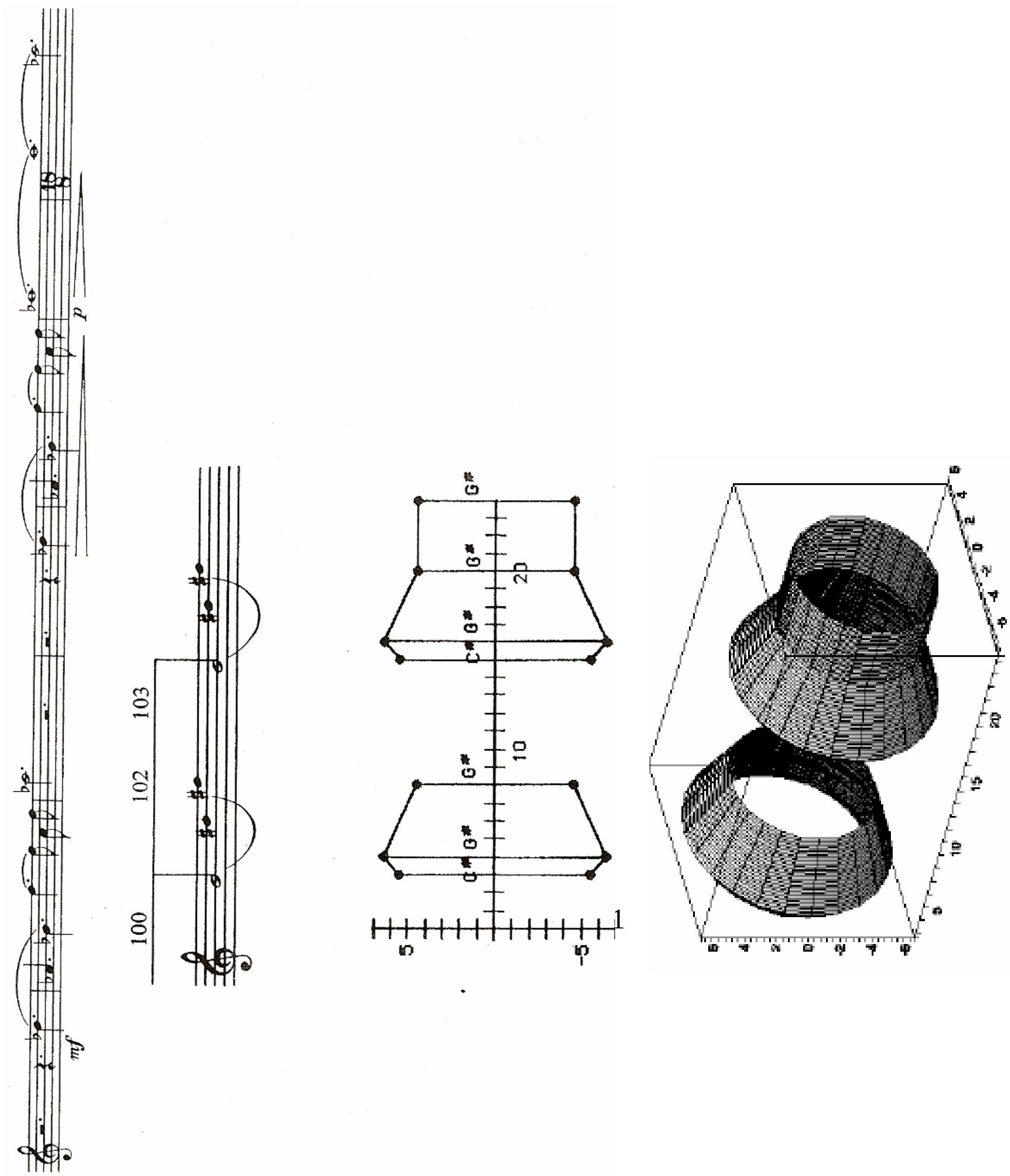


Figure 40. Complete wind model of Hindemith section B' mm. 115 to 127

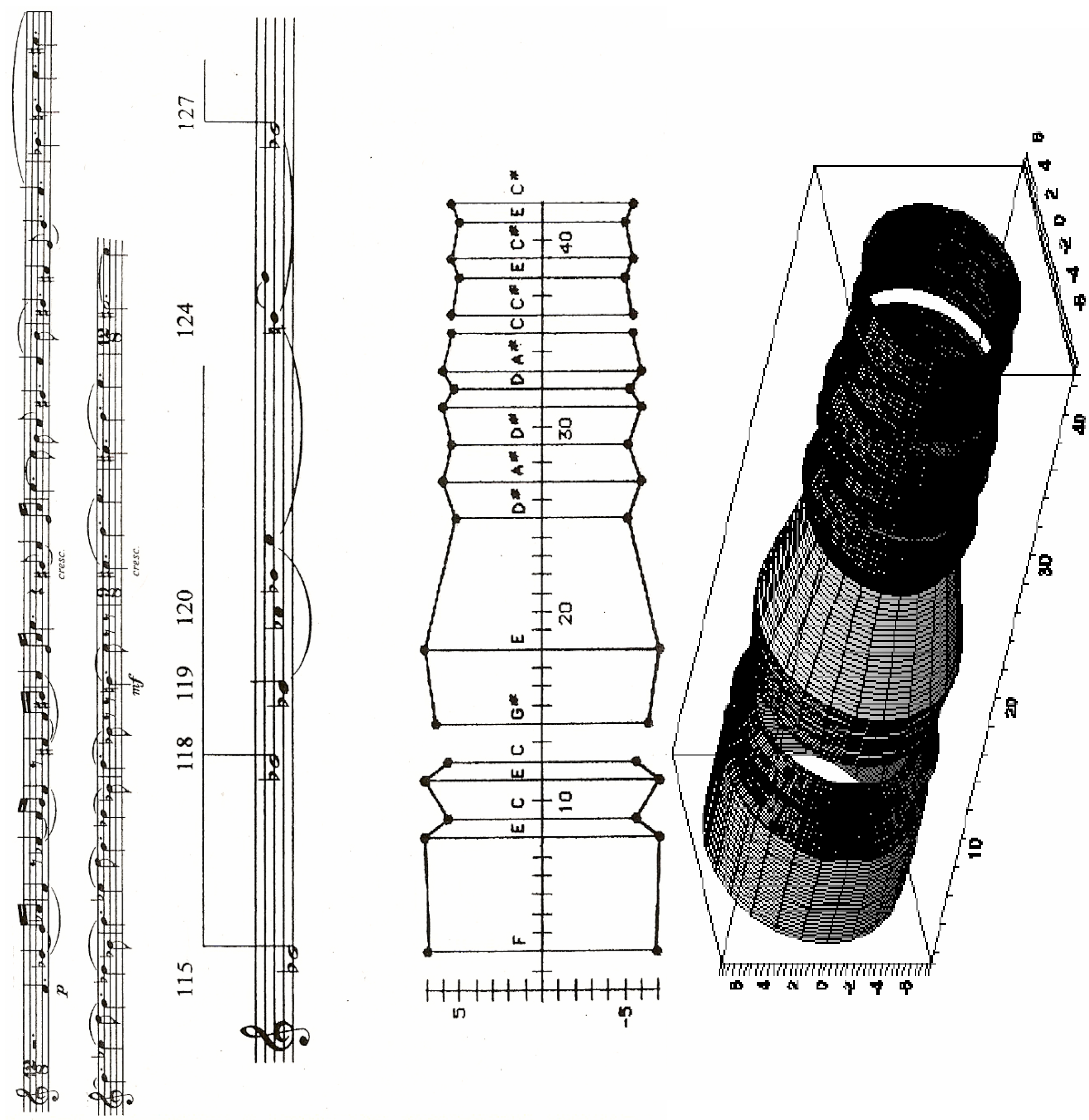
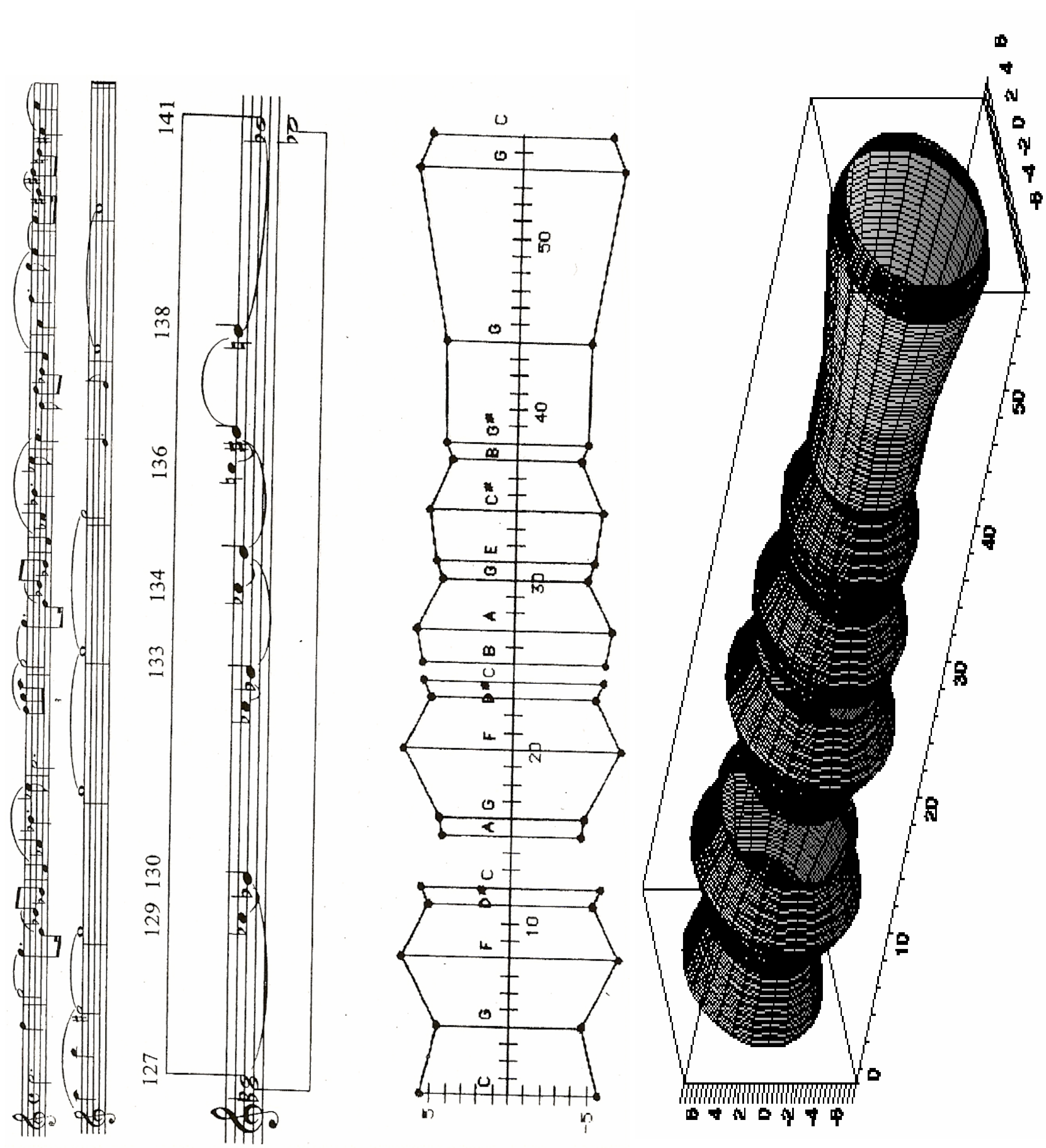


Figure 41. Complete wind model of Hindemith section A" mm. 127 to end



APPENDIX B: COMPLETE TRUMPET SCORE WITH REDUCTIVE ANALYSIS

Pages 60 to 65 show the complete trumpet part of the first movement of Hindemith's *Sonata for Trumpet and Piano* with the notes of the reductive analysis below it. The top line is the actual trumpet part in B flat. The bottom line is the analysis written a concert pitch.


f
10
ff
18
mf
ff

25
31
36
cresc.


cresc.


68
68
76
76
85
85
90
90


96
96
mf
102
102
p
109
109
p
116
116
cresc.


122
cresc.
mf
ff
129
3
138

APPENDIX C: LETTER OF PERMISSION

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28 March 2006

Craig Heinzen
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Baton Rouge, LA 70815

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Mr. Craig Heinzen
28 March 2006
Page 2

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VITA

Craig Heinzen is currently Assistant Professor of Trumpet at Southern University in Baton Rouge and plays second trumpet in the Baton Rouge Symphony. He has also played with the Louisiana Philharmonic Orchestra, the Acadiana Symphony Orchestra, and is an active performer in southern Louisiana. His primary teachers have included James West, Dr. Joseph Skillen, Armando Ghitalla, Vincent Cichowicz, and Dr. Betty Scott. He currently plays in the Louisiana Brass quintet and the Crescent City brass quintet. He holds a Bachelor of Education from the University of Missouri and a Master of Music from the University of Notre Dame.