Correcting Linear Intonation on the Trombone

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CORRECTING LINEAR INTONATION ON THE TROMBONE

by

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ABSTRACT

Trombone intonation literature addresses intonation challenges arising from multiple, simultaneous sounds. This "fixed" intonation has a corresponding body of materials devoted to helping trombonists improve aural and technical skills. However, the literature and pedagogy on sequential sound intonation is less well developed. This project contextualizes this linear intonation and offers an original set of exercises that not only demonstrate the principles but offer trombonists the opportunity to gain practical skills to improve their linear intonation. By drawing on seminal literature in the trombone repertoire, the 43 exercises provide a bridge between theory and practice.
INTRODUCTION

The mechanics of the trombone engender an intonation problem that is unique among wind instruments. Slide technique problems can manifest themselves as intonation flaws, and are illustrated in the following examples:

Figure I.1. Example 1.

When trombonists are required to play these pitches very quickly on the same partial, they commonly play the half step “wide” and the whole step “narrow.” That is, they traverse too great a distance in moving from first to second position and too little in moving from second to fourth. By pacing slide movement too evenly from first to fourth position, the player places the e too low on the slide, resulting in a note played flat. The parallel example, e, e♭, d, commonly results in a sharp e♭ for the same reason: the distance on the slide is traversed too evenly between first and fourth position. These slide technique problems result in intonation problems.

If the tendency toward even pacing reflects one group of trombone intonation problems, a second may be found when the player changes the direction of slide motion. Figure I.2 demonstrates a passage that requires such a direction change:

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1 The following method of octave identification will be used in this Treatise:
In Example 2, the slide changes direction as the \( f^\# \) is played. When a trombonist is required to play these notes in rapid succession, the player will commonly fail to reach fifth position before changing direction, resulting in a sharp \( f^\# \). Thus, the listener hears a wide whole step followed by a narrow one.

Examples 1 and 2 demonstrate the intersections of slide technique and intonation that result in flawed \textit{linear} intonation – the intonation within a melodic line. Linear intonation is different from the more well-studied fixed intonation. Fixed intonation is the intonation of simultaneously sounded pitches – intonation at a fixed point in time. Current intonation studies can help the trombonist with the following issues:

1. Training the ear to detect and eliminate intonation problems between two or more notes that are played at the same time.
2. Understanding the overtone series on the trombone and the intonation tendencies of each partial, so that correct adjustments can be made on the slide.
3. Understanding the correct adjustment of each member of a given chord using just intonation. For example, the third of a major triad should be placed approximately 14 cents flat when compared to equal temperament in order for the chord to ring true\(^2\).

While flaws in fixed intonation are a result of failing to accommodate for challenges posed by other players, the instrument itself, or the human ear, flawed linear intonation is caused by improper slide technique and results in consecutive interval imprecision.

In addition to intonation studies, there are many sources that help to increase awareness of alternate positions and that deal with slide technique concerns. These, like the present body of intonation information, fall short of addressing the slide technique issues as they relate to linear intonation outlined in the examples above. In short, the current body of intonation studies, trombone method books, and etudes leaves a void when it comes to explanation and correction of linear intonation. This work seeks to fill that void by defining it in the context of the trombone literature and outlining pedagogical strategies for helping translate this knowledge into improved performance on the trombone.

\(^2\) Equal temperament was developed to facilitate transposition to any key without having glaring intonation problems. This means of “compromising” the mathematical ratios that dictate each interval gives us twelve equal intervals in an octave. The result is the ability to play in any key, but the inability to play intervals or chords perfectly in tune. However, in orchestra, wind ensemble, and many chamber music settings, musicians are required to tune chords in a manner that yields no audible intonation inaccuracy, thus deviating from the compromised intervals in equal temperament. This system of just tuning requires us to alter pitches from their normal equal temperament positions as much as 31 cents in one direction.
trombone. This Treatise requires basic knowledge of the trombone including standard slide positions, alternate positions, and the ability to read tenor clef. It is intended to benefit advanced high school trombonists through all levels of college trombonists, as well as the people who teach them.
LITERATURE REVIEW

This literature review is designed to contextualize the topic of linear intonation on the trombone and lay the groundwork for the performance-related materials that follow. The literature most closely related to the topic will be described, while other materials that can provide further insight will be listed in the bibliography.

Intonation Studies:

Intonation studies are sources designed to help musicians improve their critical listening skills and performance. The following sources offer a useful understanding of intonation, and some include aural examples to train the ear.


Colley introduces acoustics to explain the relationships among all intervals in a mathematically pure scale and explains just intonation versus equal temperament. The theory behind the system is that using just intonation when tuning intervals yields a much more pleasing sound than equal temperament, and should be favored if possible. The purpose of the system is to develop awareness and acute perception of just intonation in intervals as they relate to the tonic. Helpful information about chord member awareness is included, along with balance considerations when tuning chords. The included “TuneUp: Basic Training” CD has recorded examples that compare equal temperament to just intonation, allowing listeners to hear the intonation problems – the “beats” – that are present in the equal temperament examples as compared to just intonation. In addition to excellent explanatory text, the book describes exercises to be used with the CD. These are mainly interval studies within a major or minor framework to be done on long tones. Colley suggests taking as much time as needed to tune each pitch. The *TuneUp* materials are available at http://www.tuneupsystems.com.


In the introduction to his method, Keener acknowledges the significance of works such as Christopher Leuba’s *A Study of Musical Intonation* and Reginald Fink’s chapter on intonation in his *A Trombonist’s Handbook*. He points out that while these sources are excellent reading materials, accuracy in intonation is an aural phenomenon, and readers cannot benefit as much without hearing examples. Unlike Colley, he explains the difference between equal temperament and just intonation in terms of tuning the common overtones of each pitch of a given interval, and uses recorded musical examples to reinforce this. He believes that the first step to correcting intonation problems is to perceive them as “beats” in the common overtone (p.9). He offers recorded examples for


Part One of Leuba’s book explains intonation of intervals and chords based on the concept of resultant tones. Any two pitches played simultaneously produce a frequency that is equal to the difference between the two frequencies being played. On page 3, Leuba offers the following example: a note of 1000 cycles per second played with a note of 1100 cps will produce a note of 100 cps. He explains that superior intonation occurs when the resultant tone produced by every interval present in a given chord coincides exactly with the frequency of a chord member, or reinforces it at a different octave. He shows that this is often impossible with equal temperament, and gives many mathematical examples to prove his point. He also gives a number of examples using intonation based on the diatonic major scale built from the ratios of the harmonic series, showing the reinforcing nature of the resultant tones.

Keener, Colley, and Leuba all provide good sources, grounded in scientific research in aural physics. Trombonists will certainly benefit from a better understanding of vertical intonation, and careful work with these sources will likely be an important step in the improvement of fixed intonation. While these sources approach intonation from the perspective of simultaneous pitches and eliminating the “beats” heard when the interval is not just, they do not account for the impact that slide technique problems have on intonation, especially in faster passages.

**Trombone Studies:**

There are countless books and methods relating to the trombone, but few have valuable information on the topic of intonation, especially that of linear intonation. The sources that address the topic most directly are as follows:


Reginald Fink’s description of “timing” as it relates to slide technique is perhaps the best description of linear intonation problems of any source available. He describes a situation very similar to the one presented in Figure I.1 of this treatise. He points out that the slide must change speed in order for the positions to be played in tune in rapid passages. He also describes the tendency to even out the distance between the outer positions, resulting in intonation deficiencies. The three paragraphs on timing that he includes in his slide technique chapter describe the exact problem that this treatise will expand upon and help correct.

In a chapter on slide technique, Burtis discusses specific slide technique issues that impact linear intonation, including right hand grip and palm facing up or down. He also distinguishes the technique of stopping the slide on every note versus a smooth, continuous motion, pointing out that there is a gray area that includes elements of both techniques. The chapter also includes exercises designed to improve slide accuracy and speed. Like Fink, Burtis presents a series of notes similar to Exercise 1 of this treatise. He also acknowledges the linear intonation challenges that this exercise presents, and offers techniques to master them. He addresses acceleration and deceleration of the slide in order to achieve correct intonation.

Between Burtis and Fink, fewer than ten pages address the topic of linear intonation correction. This is enough to show that the problem exists, but certainly not enough to help trombone players correct it.

**Trombone Literature:**

Orchestral excerpts, solo repertoire, etudes, and methods were examined in order to find specific linear intonation challenges. The following sources are included because they exhibit linear intonation challenges, and also because they are popular materials for trombonists.


The “Hungarian March” from *The Damnation of Faust* by Hector Berlioz is one of the most common excerpts on orchestral audition lists. It requires great agility in slide technique, clear and rapid articulation, and accurate rhythm. As Dr. David Gier points out, the accuracy of the slide in achieving correct linear intonation is crucial to the accurate performance of the excerpt.³


The David *Concertino* is one of the standard concerti in the trombone repertoire. Students and professionals play the piece on solo recitals, concerto performances, competitions, and it even appears on orchestral audition lists.


Eric Ewazen’s *Sonata for Trombone* is quickly becoming standard recital material for students and professional trombonists. Ewazen has even modified the solo and written an orchestral accompaniment to create a concerto. Being an accomplished pianist,

Ewazen’s music is often difficult for trombonists because passages which are not necessarily difficult when played on the piano can be much more awkward for the trombonist because of the considerations which must be made with the slide.


The *Concerto for Trombone and Piano* by Launy Gröndahl is one of the most popular concerti in the repertoire. Many trombonists consider it more accessible than other concerti, and it therefore becomes a popular choice for students preparing for recitals or choosing repertoire for concerto competitions.


Alexandre Guilmant’s *Morceau Symphonique* provides wide variety in the areas of range, dynamics, and articulation. The piece allows the performer to demonstrate soft, lyrical playing as well as some relatively quick technical work. This is all part of what attracts professionals and teachers to the piece, and makes it one of the most popular college audition pieces.


The Marcello *Sonata in A Minor* is a popular choice for trombone recitals. Compared to that of instruments in the keyboard and string families, the solo trombone repertoire is limited in terms of stylistic periods and number of solos. Therefore, when planning recitals, trombonists often look to transcriptions of baroque music. The Marcello A Minor Sonata is one of the most popular transcriptions that trombonists perform, and is a popular choice for recitals even when compared to original trombone works.


The *Gazza Ladra* excerpt is a unison excerpt for trombone section, and the linear intonation is crucial for its success. Because of the fast tempo of the excerpt, the eighth note passages are very challenging for trombonists. It is very common for college and advanced high school trombonists to practice the excerpt, and it is one of the most common excerpts for orchestral auditions.


A short excerpt from the first trombone part to Tchaikovsky’s *Symphony No. 5* was selected for inclusion because it provides an excellent example of how linear
intonation can be problematic between notes on the same partial. The excerpt is not one of the most popular for orchestral auditions, but, like Tchaikovsky’s fourth and sixth symphonies, it is programmed quite often.


Tyrell’s studies are some of the most popular among college and advanced high school students. Technical studies such as these are an important complement to the lyrical studies that most trombonists use, such as the Bordogni or Concone etudes. The etudes can help the trombonist improve articulation, slide technique, and accuracy.


David Vining’s book is an excellent resource for trombonists. There are eight routines in the book that give the trombonist an opportunity to focus on important fundamentals of trombone playing. Each routine has a different focus, but also contains the elements of long tones, buzzing, dynamic work, flexibility, articulation, and range extension. It combines exercises designed to improve all of these fundamentals into a series of routines that are easy to follow in an organized and efficient way.


*Lohengrin* is required quite often for auditions, and many times is one of the first excerpts that trombonists learn because of its relative ease to play. The linear intonation among the first four notes of the excerpt, however, often proves to be quite challenging. This excerpt is found in unison between the three trombones and tuba, further demonstrating the importance of correct linear intonation.

The current body of intonation studies and trombone studies is very useful for students working on many aspects of trombone performance. However, there is a void in the area of linear intonation correction. The chapters below will identify linear intonation challenges presented by some of the most popular and important selections in the trombone literature. The explanation of the specific linear intonation challenges presented in each musical example will be accompanied by exercises designed to correct each challenge.
INTRODUCTION TO THE EXERCISES

The exercises that appear in the coming chapters follow two important principles that should guide players in nearly every aspect of their practicing. The first principle is the idea that correct repetition yields accurate performance. Many musicians consider practicing as a challenge to play a passage correctly. Once that challenge has been met, they can move on to the next passage. This could not be further from the truth. The nature of playing musical instruments requires the building of “muscle memory” or “kinesthetic memory” – what Arnold Jacobs refers to as building neural pathways in the brain. This is especially true for quick passages, where there is not time to ponder one’s next move. Playing passages slowly and correctly then gradually increasing the tempo is the key to correct repetition. Establishing and repeating the positive rather than trying to eliminate the negative will be much more fruitful for the player. Only after the musician is able to play the passage several times perfectly at a given tempo should he move up to the next faster setting on the metronome. This should be the player’s model for the exercises below.

The other important principle that the exercises follow is the idea of diagnosing the exact problem and building an exercise that addresses the specific nature of the problem. This applies to all facets of practicing on the trombone, but is especially pertinent in the case of correcting linear intonation. It is important to diagnose the problem as specifically as possible. This does not just mean finding the measure or beat that is presenting the challenge, but learning exactly where and why the problem presents itself. The exercises that appear in the following chapters pinpoint the exact location and nature of the linear intonation challenge in each excerpt. After identification of the challenge, it is extracted and placed into exercises that are designed to help work on the problem itself. This idea of extracting problems and building effective exercises around them is one of the keys to efficient practicing. Variation in elements such as meter, key and rhythm allows the player to work on the problem from a number of different angles. The exercises will help the trombonist understand and improve linear intonation, and help the player to create new exercises to work on this and other aspects of trombone playing.

The following four chapters present exercises built on these two principles. Each chapter focuses on a single technique that forms the basis for the creation of exercises that help correct the trombonist’s linear intonation in challenging passages from the trombone literature. The techniques of correct repetition, exaggeration, rhythmic displacement, and transposition are explained and applied in the chapters that follow. Each exercise includes a tempo indication with two numbers. The first number is a suggested starting tempo for practicing, and the second number is a tempo equal to or slightly faster than a typical (or marked) performance tempo. Following the principle of correct repetition, each exercise should be repeated several times before increasing the

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4 As quoted in Fredrickson, Brian. *Song and Wind*, 143-145.
tempo. The player should decide whether a measure of rest between each repetition is appropriate. This may help to avoid mental and physical fatigue that can be counterproductive. Numbers above notes indicate slide positions.
CHAPTER 1: CORRECT REPETITION

As explained in the Introduction to the Exercises, the key to correcting numerous technique problems is to establish the positive and repeat it. This chapter will help the player to identify linear intonation challenges and reinforce the positive by using correct repetition.

Exercise 6E from the “Articulation” chapter of David Vining’s book is designed to apply double tonguing skills while the slide is in motion. Vining provides excellent suggestions on practicing multiple tonguing in the preparatory text for this chapter, but, like the authors of almost all trombone books, he does not address the issue of linear intonation. The following excerpt from Vining’s articulation exercise presents a significant linear intonation challenge by placing sixteenth notes on the same partial between first and seventh position.

![Figure 1.1. Vining 29.](image)

In Exercise 1 below, the player should repeat each measure as many times as needed to be secure before moving to the next measure. The purpose of the exercise is to allow the player to hear and feel the correct repetition of intervals, building a more exact rendition of Vining’s original exercise.

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Exercise 2 applies the same strategy to the even beats of Vining’s original exercise. The player should start each measure in seventh position.

Exercise 3 is designed to help the player keep the semitones accurate and to ensure that the notes that precede and follow each direction change are in exactly the same position. The player should set the metronome to the eighth note pulse.
Exercise 4 allows the player to practice the two whole-step intervals that lie between the direction changes in the original excerpt. The player should listen carefully to the intonation and make sure it is consistent whether ascending or descending.

Figure 1.5. Exercise 4. \( \text{\textbf{\textit{\textdollar}}} = 120-200+ \)

Exercise 5 simulates the original excerpt by requiring the player to move the slide to all of the positions in the original excerpt, but only to play the notes from Exercise 4. The notes that have the “x” for note heads should be placed in the correct position and the player should hear the pitch that is indicated, but not play it. The player should listen carefully and make sure that adding the positions does not change the intonation.

Figure 1.6. Exercise 5. \( \text{\textbf{\textit{\textdollar}}} = 120-200+ \)

The next excerpt requires the player to perform relatively quick scalar passages that present linear intonation challenges. The exact pattern of notes from Figure 1.1 is present between measures seven and nine of the excerpt.
The player should concentrate on the integrity of whole and half steps, especially when they are placed in one direction on the slide. The quick tempo of the excerpt often contributes to sloppiness with respect to linear intonation. Instances of particular concern are shown in Figures 1.8 and 1.10 below.

It is common for players to play the half steps wide and the whole steps narrow as the slide moves quickly in one direction. Exercise 6 in Figure 1.9 is based on Figure 1.8.

At first glance, Exercise 6 seems very simple, and on almost all other instruments it would be. However, navigating this exercise on the trombone requires a change in either the pace or direction of the slide between every note of the exercise. The player should concentrate on keeping the half steps appropriately narrow and the whole step...
between d and e appropriately wide. The player should listen carefully to the intervals as the speed of the exercise increases. If possible, alternating between playing the exercise on the piano and on the trombone would be beneficial for the ear.

![Figure 1.10. Berlioz meas. 103-104. \( \text{\( j \)} = 96 \)](image)

The downbeat e in the second measure of Figure 1.10 above should be an anchor point for the player. An accurate second position will help to keep the e to f semitone in tune. Stopping exactly in second position on the downbeat will help the player make the transition into the rapid deceleration of the slide when the f is added in the fourth measure of the exercise. The placement of the e should not change. Exercise 7 allows the player to practice stopping on this e, and then adding the f.

![Figure 1.11. Exercise 7. \( \text{\( \text{\( j \)} \) = 120-192} \)](image)

The c to B results in a quick seventh to sixth position motion that is often uncomfortable for trombonists. If the player uses a trombone with an F attachment, he will likely use it most of the time for these two pitches. In the case of Exercise 7 and the original excerpt, the B and c lead directly up the scale to f in one continuous slide motion. Using positions 7-6-4-2-1 rather than using the F attachment eliminates the direction change in this relatively quick passage but introduces some linear intonation challenges.

If a change in the right hand grip is necessary to reach the seventh position B, the player should be careful not to let the change back to the normal grip affect the slide positions on the rapid ascent to first position. The two whole steps in the middle will usually be accurate if the trombonist plays exact half steps on each end of this five-note sequence.
Further examples of scalar linear intonation challenges are found in the excerpts below from Guilmant’s *Morceau Symphonique*. After the beautiful Andante section and cadenza, Guilmant writes a spirited section marked “Allegro moderato.” Here, the first entrance of the trombone is the following Eb major scale marked at a tempo of 104 for the quarter note.

![Figure 1.12 Guilmant meas. 43, q = 104+](image)

One note that can be problematic is the a^b (circled), which can easily be played sharp if the player is not concentrating on the linear intonation. Regarding the placement of the d near the end of the scale, a good rule to follow is to play the half steps on the same partial when playing scalar passages. This will often minimize slide motion and will help to keep the semitones from being too wide. Exercise 8 is designed to allow the player to hear and feel the half step between the g and a^b.

![Figure 1.13. Exercise 8, q = 60-104+](image)

In Exercise 9, the player should concentrate on keeping the half step appropriately narrow and the whole step appropriately wide.
Intonation problems can also occur between the first three notes of the scale if the slide changes direction prematurely. The player should be careful not to place the f too low on the change of direction. The following B♭ major scale appears several measures after Figure 1.12:

The two important linear intonation obstacles are circled above. The player must refrain from expanding the half steps between d and e♭ and between a and b♭, thus keeping the e♭ from being too high and the a from being too low.

When playing Exercise 10, the player should stop exactly on the e♭, and make sure the half step between d and e♭ sounds correct each time. If the c would normally be played with the F attachment, it should be done during this exercise also.

Exercise 11 will allow the player to focus on the exact placement of the a. The player should avoid allowing the slide to travel at the same speed between the g and b♭.
Exercise 12 adds two more notes of the phrase to make sure the slide direction changes do not affect the integrity of the intervals between the g and b\textsubscript{b}.

While practicing Exercise 13, the player should concentrate on keeping the half steps appropriately narrow. The player should feel how the e\textsuperscript{b} and the a do not fall in the same place on the slide, and keep them in positions adjacent to their respective semitone neighbors.

Appearing several phrases later, the D major scale (Figure 1.20) begins with the same linear intonation challenge as the E\textsuperscript{b} major scale. It is easy to expand the semitone between the third and fourth scale degrees.
The fourth scale degree (circled) is the parallel intonation challenge presented by the E♭ major scale in Figure 1.12, and is addressed in exercises similar to Exercises 8 and 9. The c♯ circled above is addressed in Exercise 16.

Exercise 16 allows the player to concentrate on keeping the whole steps appropriately wide. The player should work for accurate and consistent second and fourth positions, ensuring that the slide does not change direction prematurely.
The player should remember the feeling of appropriately wide whole steps while moving to exercise 17. Adding the d’ should not change the position of the c”. The c” should be placed appropriately close to the d’.

The following excerpt from Tyrell’s *40 Progressive Studies for Trombone* is an excellent example of the need to be aware of and, if necessary, improve linear intonation. As with the excerpt in Figure 1.1, all of the notes in the first two measures are in the same partial. F attachments and alternate positions cannot make this excerpt easier.

The most common linear intonation problem in this excerpt occurs when trombonists play the sextuplet figures with an even pace to the slide. This compresses the whole steps and leaves the semitone too wide.
The correct placement of the e in the first measure is often the key to the success of a player’s linear intonation in this excerpt. It is very easy to place this pivotal note too low on the slide, traversing the distance between first and fourth position too evenly. The following exercises are designed to help the player hear and feel the correct placement of the e and its adjacent intervals. In Exercise 18, the player should feel the acceleration down from the e that is required to play the d in tune and in time. Measure 2 of Exercise 18 requires the player to stop the slide on the e, which exaggerates the deceleration required when the f is added again in the original excerpt.

Benedetto Marcello’s *Sonata in A Minor* presents linear intonation challenges in both scalar passages and direction changes. The whole step from c to d can be particularly problematic for the trombonist. It appears in the second measure of the excerpt (Figure 1.27) as a direction change and in the third measure in scalar form. The whole-step interval from first to third position is problematic because the intervals that precede it require relatively small adjustments on the slide between notes. The player should be careful to place the c appropriately low.

One method of reinforcing the whole step from d’ to c’ is adding repetition on that particular interval. Exercise 19 is based on the last three measures of Figure 1.27. The player should avoid using alternate positions, as this can defeat the purpose of the exercise; the d’ should always be played in first position.
Due to the relatively fast tempo, the player must be extremely careful with the linear intonation in the following excerpt from Rossini’s *La Gazza Ladra*:

This excerpt presents a linear intonation challenge in the mode alternation between Ionian and Aeolian. When played in rapid succession, the linear intonation tendency of a second position note between first and fourth position notes is to be flat, but a third position note in the same circumstance would tend to be sharp. This excerpt requires the performer to play each of these correctly with identical rhythmic values, comparing measure 3 to measure 11 of Figure 1.29. The following exercise is designed to help the performer practice this modal shifting. It will help the player to feel and hear the difference between the two modes and will help reinforce the correct linear whole- and half-step relationships through repetition. The player is encouraged to alternate between playing the exercise line by line and playing all of the Ionian passages (the first three measures of each line) followed by the Aeolian passages.
The following excerpt from Tchaikovsky’s *Symphony No. 5* presents additional linear intonation challenges that involve both scalar motion and direction changes.

Exercises 21 through 24 allow the player to tune and repeat the semitones before the whole step is added. Exercises 22 and 24 shift the beat of Exercises 21 and 23 respectively by one eighth note, allowing the agogic accent to shift. More applications of rhythmic displacement are explored in Chapter 3. The player should concentrate on playing the g and a in exactly the same position regardless of the preceding slide position and direction.
The ability for players to identify linear intonation challenges and to create exercises that build on repetition of accurate linear intonation is important to their success on the instrument. The ideas presented in this chapter should increase the player’s awareness of linear intonation and spur creativity in designing exercises built on establishing the positive. The following three chapters will explore different solutions for correcting linear intonation problems including transposition, exaggeration, and rhythmic displacement.
CHAPTER 2: EXAGGERATION

It is often helpful for trombonists to practice a passage at “pp” if the dynamic indication is marked at “p.” Likewise, if the player is playing a piece that approaches the player’s highest comfortable note, it is useful to practice exercises that stretch the player’s range higher than needed for the piece. The technique of exaggeration can also be applied to make linear intonation challenges more difficult. The player will find that by practicing the passage with alterations made that exaggerate the linear intonation challenges, the original excerpt is easier to play.

Linear intonation problems in a given passage can often be corrected by the identification and careful placement of one problematic note. As identified in the previous chapter, quite often the problematic note is c’ in the fourth movement of Marcello’s Sonata in A Minor.

![Figure 2.1](image) (Repeat of Figure 1.27) Marcello meas. 11-14. \( \dot{=} \) 66

In this excerpt, the positions are quite close together in the first two measures until the arrival of the c’. The c’ also lies on a change of direction from first position to third and back. Each of these factors could easily lead a person to play the c’ higher than third position and sound sharp. The fact that both factors exist in the same spot makes the excerpt significant from a linear intonation perspective.

An exercise to work on the correct placement of the c’ involves exaggerating both of the aforementioned factors that make the pitch problematic. Lowering the c’ by a semitone exaggerates the distance traveled and the direction change. The player should practice Exercise 25 with the metronome, taking great care not to allow the extended slide distance to affect rhythm. After Exercise 25 is mastered, the player should find the original excerpt much easier to navigate.
Another application of exaggeration as a means of improving linear intonation can be derived from one beat of the excerpt below from Wagner’s Introduction to Act III of *Lohengrin*.

This excerpt presents an opportunity to examine the linear intonation challenges presented by quick direction changes on the slide. It is common for trombonists to fail to reach the exact position before changing direction. Taken individually, the direction changes present a moderate level of difficulty. In this excerpt, however, the two consecutive direction changes compound the difficulty in managing the linear intonation.

Each direction change from the excerpt is examined below. The player should practice Exercises 26 and 27 slowly, gradually increasing the tempo as much as possible without losing the integrity of the linear intonation. When each direction change is comfortable and accurate, the player should return to the original excerpt and begin slowly again, increasing speed after a few correct repetitions. The arrows in the following exercises remind the player to pull or push the note in the direction of the arrow to offset the linear intonation challenge presented by the direction change.
The technique of exaggeration can be very useful in working on these direction changes. To create Exercise 28, the notes with arrows in Exercises 26 and 27 above have been altered by a semitone in the direction that makes the slide travel further between direction changes.

Exercise 28 is nearly impossible to play at the “performance” tempo of the excerpt, but will help the player to feel the extreme acceleration necessary after each direction change. It is important to use the indicated positions for Exercise 28. Only by doing so does the exercise provide the exaggeration of the linear intonation challenges.

A similar example of how exaggeration can help a player correct the linear intonation on direction changes is drawn from Eric Ewazen’s *Sonata for Trombone.*
This excerpt presents a linear intonation challenge in the change of direction between relatively fast sixteenth notes. Quite often, the b (circled) is placed sharp because the player changes direction prematurely in an effort to get back to the a in time. It is possible to play the first a in sixth position (positions 6-4-2 for the sixteenth notes), but for most people this would probably be more difficult than negotiating the linear intonation challenges (positions 2-4-2.)

It is a rare mistake for a player to place the b past fourth position before the change of direction. Therefore, it is useful to exaggerate the direction change by practicing the following exercise:

![Figure 2.8. Exercise 29. \( \frac{1}{4} \text{q} \text{=} 72 \text{-} 108 \).](image)

As always, the player should start very slowly and make sure that the slide positions are exact, gradually increasing speed after several correct repetitions. Many players who play the exercise will find that as the tempo increases, it begins to sound like the original measure 88; the b\(^b\) begins to sound like a b. This illustrates the importance of making sure the slide does not change direction prematurely.

When the player is comfortable with the exercise, the next step is to change the b\(^b\) back to a b and start slowly again. By exaggerating the distance traveled before and after the direction change, the player should find the original excerpt much easier to navigate, and will feel and hear the importance of moving the slide to exactly fourth position.

When practicing the following short excerpt from the David Concertino, the player will find that the keys to playing beat four in tune are having a rapid acceleration of the slide down from the f and an immediate deceleration once the e\(^b\) is played.

![Figure 2.9. David meas. 113. \( \frac{1}{4} \text{q} \text{=} 126 \)](image)
Exercise 30 exaggerates the direction change between f and g by lowering the g to g\textsuperscript{b}. Unlike the previous examples, it also exaggerates the acceleration and deceleration in the last beat by lowering the e\textsuperscript{b} and d by a semitone each. Using sixth position for the last f would be a good option under normal circumstances, but would defeat the purpose of this exercise. The player should concentrate on the feeling of the acceleration and deceleration between the f and f\textsuperscript{b}. Doing so will make the original excerpt much easier to play in tune, as it is much easier than the exaggerated example below.

Figure 2.10. Exercise 30. \( \frac{\text{q}}{\text{=} \text{80-126}} \)

Exploring the concept of exaggeration from a different angle, a short excerpt from Tchaikovski’s Symphony No. 5 will be examined.

Figure 2.11. Tchaikovski meas. 102-103. \( \frac{\text{q}}{\text{=} \text{160}} \)

In order to avoid playing in equidistant positions in this passage, the player should practice actually playing g flat and the a sharp. The player will often find that by trying to play narrow half steps and wide whole steps, he ends up playing the pitches correctly. Actually compressing the semitones and playing wide whole steps in this excerpt will cause the player to be aware of and exaggerate the slide speed changes necessary for correct intonation. Exercise 31 shows the excerpt with arrows pointing to the direction the player should work to push or pull the indicated pitches. \(^6\)

\(^6\) The author acknowledges that the idea of intentionally playing out of tune may be controversial. It is in direct contradiction of “correct repetition,” a key component of these exercises and successful practicing in
Exaggeration of the linear intonation demands of a passage can be a useful method of correcting linear intonation by making the player aware of the physical demands that linear intonation challenges place on the slide. It is very common for trombonists to change slide direction prematurely or play consecutive notes in equidistant positions on the slide, ignoring the whole and half steps. By exaggerating the linear intonation demands, the player is doing the opposite; he is focusing on correcting the changing pace or direction of the slide.

general. The player should realize that this is done for a specific purpose, and should not be repeated so many times that bad habits are established. The awareness of the significant changes in slide speed is the main goal of this exercise. This exaggeration is akin to the pedagogical approach of occasionally practicing with exaggerated demands in order to produce a more comfortable performance. Examples of this would be practicing a section marked “ff” at “fff”, practicing one’s upper range higher than the highest note the person is required to play in a given situation, or practicing a challenging technical passage faster than the indicated tempo.
CHAPTER 3: RHYTHMIC DISPLACEMENT

This chapter explores rhythmic displacement as a means to correct linear intonation problems. Previous chapters have explained the importance of the correct placement of a single note that affects the linear intonation of a passage. Many times this pivotal note is on a weak beat in a measure or part of the subdivision within a beat. Altering the rhythm or meter can often move this note to a stronger beat in the measure, making it easier to place the slide in the exact position for the pivotal note.

Rhythmic displacement can help simplify the intervallic relationships that require linear intonation attention. Two important spots to consider are the slide direction changes at first and sixth position in the sextuplets above. The player should practice the following exercise and concentrate on the interval that precedes and follows the direction change.

Exercise 32 is condensed to create Exercise 33. The player should try to feel a strong dotted quarter note pulse at first, continuing to play the intervals in tune on either
side of the direction change. As the tempo is increased, however, the player should begin to feel the dotted half note pulse (in one.)

![Figure 3.3. Exercise 33.](image)

Exercise 34 returns to the original rhythmic placement of the sextuplet pattern. The player should again shift from feeling the dotted quarter pulse to the dotted half as the tempo increases. The player should also practice exercises 33 and 34 alternately. The linear intonation should remain constant regardless of the rhythmic placement.

![Figure 3.4. Exercise 34.](image)

Exercises 35 and 36 provide further rhythmic displacement within a rhythmic framework identical to the original excerpt. Looking more specifically at the linear intonation challenge with the original exercise, the e becomes a crucial note to place correctly. Two reasons for this are that it is located on both sides of a slide direction change, and that it separates the whole-step intervals (e-d-c-d-e) from the semitones (e-f-e). This means that the pace of the slide movement changes each time the e is played. Because the e is such a pivotal note in the linear intonation of the excerpt, Exercises 35 and 36 place the note on the downbeat. This can help the player to hear and feel the exact position of the note by giving it a slight agogic accent.
Rhythmic displacement of the entire seventeen-measure excerpt can prove very useful for working on the linear intonation in Rossini’s *La Gazza Ladra*.

This excerpt is one of several challenging sections of this piece. As with the changes of slide direction examined in the *Lohengrin* exercises, this excerpt presents several such challenges in the fourth and fifth measures alone. The circled notes in Figure 3.8 below tend to be sharp notes for many trombonists in general. If the player uses the F
attachment for the b, they are placed on slide direction changes that require traveling at least two positions before and after, further stressing the importance of accurate slide positions on direction changes.

![Figure 3.8. Rossini 118-119. \( \text{\textit{\textdollar}} = 69+ \)](image)

Quick scalar passages that appear between f\(^\#\) and a in the key of E major often result in third position being too low on the slide as the slide motion between second position and fifth position becomes too even. The parallel example is second position being flat in F major scalar passages in the same range.\(^7\) The E major scalar passage in measures 3 and 4 is the same as the one in measures 7 and 8, rhythmically offset by one eighth note. It is often much easier for the player to play the latter example in tune because the g\(^\#\) is on the downbeat rather than an upbeat. The natural agogic accent can lead the player to hear the third position note better, and to make sure the slide position is correct. In the following example, this process of shifting the agogic accent pattern significantly changes the way the excerpt feels and sounds to the player. Even though the exact same notes and rhythmic values are used, practicing the excerpt in 6/8 time provides a different approach to the linear intonation. Some of the same notes that provide linear intonation challenges are on strong beats and are much easier for players to hear, feel, and perform accurately.

\(^7\) See Appendix I for further examination of linear intonation challenges in scales.
The technique of rhythmic displacement can also be used to simplify the following excerpt from the Gröndahl Concerto.

The following exercise eliminates the syncopation from the excerpt by changing the rhythm and meter. This allows the player to concentrate on the exact slide positions and minor tonality. The player should pay particular attention to the circled aˢ's.
Due to the quick slide direction changes that occur on both sides of the g in the original excerpt, attention must be paid to the exact placement of the g itself. A common mistake in fast passages is to change direction too soon and not make it out to a true fourth position. If the g is placed higher than fourth position, the intervals that follow it will not be correct.

Exercises 39 and 40 use rhythmic displacement to help the player practice the placement of the g and a\textsuperscript{b}.

![Figure 3.12. Exercise 39. \( \text{\textit{q}} = 80-11 \)](image)

![Figure 3.13. Exercise 40. \( \text{\textit{q}} = 60-80 \)](image)

Rhythmic displacement can be an important solution to linear intonation challenges. After the pivotal note(s) of an excerpt have been identified, alteration of rhythm and meter can make it much easier for the player to place them in the correct position. In the Rossini excerpt above, no rhythmic values are altered, but the agogic accent shift is enough to make the excerpt feel completely different to the player. Other times, rhythmic displacement is used to create exercises that sound quite different from the original problematic passage. Both methods allow the player to hear and feel the linear intonation challenges in a different way, and can help correct flawed linear intonation.
CHAPTER 4: TRANSPOSITION

Transposition can often provide a way of correcting linear intonation problems on the trombone, and can be applied in two distinct ways. Transposing passages can often lessen the linear intonation difficulties as the intervals will lie between different slide positions. Reducing the severity of linear intonation challenges can allow the player to hear and reinforce the correct intonation before transposing it back to its original problematic location. If available, playing the passage on the piano can have a similar reinforcing effect to the ear and linear intonation problems will be more easily detected and corrected because of the increased aural awareness of the problems.

The other use of transposition as a means of working on linear intonation involves a very different approach. Instead of transposing to lessen the degree of difficulty, transposition can be used to build exercises that allow the player to repeat the problematic sections and concentrate on the correct repetition of the slide motion. This technique is explored through the Gröndahl Concerto in exercise 43 below.

![Figure 4.1](image)

Figure 4.1. (Repeat of Figure 1.27) Marcello meas. 11-14. \( \frac{q}{\text{a}} = 66 \)

When this excerpt was addressed in Chapters 1 and 2, the c’ was identified as a pivotal note between the second and third measures of the excerpt. The other place that the c’ presents linear intonation challenges is in measures 3 and 4 of the excerpt. There are no slide direction changes on c’ at this point, but the slide positions are very close together until the d’ to c’ interval, making it easy to compress the whole step. In measure 3 of the excerpt, the slide will need to accelerate quickly down to the c’ to keep it from being sharp, then rapidly decelerate so that the c’ to b semitone is accurate.

Transposing the example up a step alters the location of slide direction changes and limits every movement of the slide to one position or less. By reducing the physical challenges involved with the linear intonation, the player should able to hear the whole and half steps correctly. Exercise 41 is a transposition of measure 3 of the original excerpt. Even though the exercise looks similar to measure 2, it should not be viewed as
an alteration of that measure. The player should alternate between Exercise 41 and measure 3 of the excerpt when practicing.

![Figure 4.2. Exercise 41. \( \frac{3}{8} = 66 \)](image)

Returning to the David Concertino introduced in Chapter 2, the technique of transposition is applied to work on the same problematic beats three and four.

![Figure 4.3. David meas. 113. \( \frac{3}{8} = 126 \)](image)

Two linear intonation challenges are found in the last two beats of this short excerpt. The first is the quick direction change from first to fourth position between the f and g. The other challenge comes in the final beat of the excerpt, where the e changes to e\(^b\). This is a challenge simply because the rest of the measure has a and e in second position. Moving the slide to third position for the e\(^b\) requires a more dramatic acceleration of the slide out of the first position f. This is followed by a rapid deceleration into the fourth position d, whereas the rest of the measure requires the slide to move quickly into and out of fourth position from either first or second position.

In addition to the exaggeration that was explored in Chapter 2, another way to address the intonation challenge in the last two beats is by transposition. As in Exercise 42 below, transposition allows the player to build exercises that make it easier to play a passage.
Exercise 42 transposes the last two beats of the excerpt into tenor clef, moving the passage up a perfect fifth. The linear intonation challenges are significantly diminished, and the player should be able to concentrate on the intervals. The use of the flat fourth position for the d’ makes the exercise even easier to navigate on the slide. Whereas the e\textsubscript{b} was one of the main linear intonation challenges before, it is now a first position b\textsubscript{b}. The linear intonation tendencies of the intervals on either side of this b\textsubscript{b} are also the opposite of those surrounding the e\textsubscript{b} in the original excerpt. This will also make it easier to hear if the linear intonation of the original excerpt was faulty. Alternating between Exercise 42 and beats 3 and 4 from the original excerpt is recommended.

The player must establish accurate slide technique and correct linear intonation right from the opening statement of the Gröndahl \textit{Concerto}. Keeping each a\textsubscript{b} (circled) from being placed too high on the slide is most often the key to correcting the intonation.

The technique of transposition is used to establish correct repetition of the intervals in the excerpt. Exercise 43 shows the first three measures of the trombone entrance followed by two transposed versions.
As the passage is transposed down chromatically, the player should use the marked alternate positions. Slow and careful repetition using the marked alternates will help program the correct slide positions and direction changes into the arm. This repetition will also reinforce the minor tonality in the ear and allow the player to concentrate on the intervals in addition to the slide positions. Note that the transposition used to create this exercise is not designed to simplify the slide technique or make it easier for the player to hear the intervals correctly. The purpose is to allow the player repetition of the intervals and the slide position patterns. This will only be fruitful if the player starts slowly and correctly, and maintains accurate linear intonation as the tempo increases.

The player should explore different ways to practice Exercise 43, always starting slowly and building correct repetition. One way is to repeat each of the three lines slowly a few times before moving to the next. Another way to approach it is to practice lines one through three, starting over again with line one and increasing the tempo. A third way to approach the exercise is to practice the lines in random order.

This chapter has explored the use of transposition as a means of correcting linear intonation. Transposition can allow the player to hear the correct linear intonation, unhindered by awkward slide movement, or it may provide a way of creating exercises that allow the player to repeat the patterns of slide positions to reinforce correct linear intonation.
APPENDIX A: DIATONIC MAJOR SCALE STUDIES

This appendix will illustrate the linear intonation challenges present in each of the twelve major scales. The range of E to f' was chosen because the range above f' involves much shorter distances to travel on the slide, therefore minimizing linear intonation problems. The range below E is not without linear intonation challenge, but the solutions applied to an octave above this range can usually be considered. The player may find that starting on E or F is more difficult compared to starting on the first scale degree of each scale, but this format was chosen because it is most efficient to discuss linear intonation challenges and relate them to other scales in the same range.

The “major scale” terminology is used so that it is possible to relate linear intonation to scale degrees. However, it is important to understand that the linear intonation challenges should be considered based on the key signature, not just the major scale. Since the relative minor scales include primarily the same sequence of pitches and slide motion, they are not listed here. It is not practical to list all forms of the minor scale and all other possible scales. The player should look at other scales as variants of what is learned within each key signature, and should be able to apply the same care and awareness of linear intonation as the scale is changed with accidentals.

A description of the linear intonation challenges of each scale is presented below. The scale is then shown with arrows in the music notation. The arrows indicate the direction that the note will likely need to be pushed or pulled due to the linear intonation challenge.

In the F major scale, second position A, e, and a are pivotal pitches for correct linear intonation. Each should have a semitone above and a whole step below, and should not be placed equidistant from first and fourth positions. Evening the distance between first and fourth position results in these pitches being flat.

![Figure A.1. Diatonic F major scale](image)

In the B♭ major scale, the player should concentrate on keeping each E♭ appropriately low and each A appropriately high. As with F major, the pace of the slide
between first and fourth position must not be constant. In this case, the result would be a flat A and a sharp E♭.

Figure A.2. Diatonic B♭ major scale

During relatively fast passages, the player should play d’ in flat fourth position in the E♭ major scale, and any other time that it lies between two notes in third position. It is important to keep each third position A♭ and E♭ appropriately close to fourth and away from first. This will keep the semitone between scale degrees three and four from becoming too wide.

Figure A.3. Diatonic E♭ major scale

In the A♭ major scale, the player with an F attachment should play B♭ in sharp fourth position (indicated by the “v” below.) Doing so eliminates one direction change and facilitates placing the semitone from c to d♭ on the same partial and in the adjacent positions indicated below. The alternative is to travel from first to fifth position and change direction. The player should be careful of the direction change that happens on the f. A common mistake is to change slide direction before reaching an accurate first position.
In the D\(_{b}\) major scale, the B\(_{b}\) should be played with the F attachment as in the A\(_{b}\) major scale. F should be placed in a position adjacent to G\(_{b}\) in any octave, as should D\(_{b}\) and C. If these positions are used, the linear intonation is much easier, and the B\(_{b}\) becomes the only significant linear intonation challenge. Like f in the D\(_{b}\) major scale, care should be taken to keep the pitch appropriately high on the first position note that lies on the direction change.

The G\(_{b}\) major scale can be played many different ways using the F attachment and alternate positions. As with the D\(_{b}\) major scale, keeping the F and G\(_{b}\) on the same partial in every octave will minimize long position shifts in the scale. Depending on the positions that the player chooses, the G\(_{b}\) major scale can have more direction changes than any other major scale, requiring the player to concentrate on the exact position of the slide before changing direction. The indicated positions show one way of using the valve and alternate positions to minimize distance traveled and linear intonation difficulties, but results in direction changes on every note in the octave between G\(_{b}\) to g\(_{b}\). The b\(_{b}\) should be placed in fifth position in order to keep the b\(_{b}\) and c\(_{b^*}\) on the same partial and in adjacent positions. The c\(_{b^*}\) should be pulled down appropriately close to the b\(_{b}\) and kept away from the d\(_{b^*}\).
Two important notes to tune are adjacent in the B major scale. The d♯ may tend to be flat if the pace of the slide does not change appropriately between second and fifth positions (between e and c♯.) c♯ is also an important note for accurate linear intonation because most players will use the F attachment for B, which places a direction change between two relatively long distances on the slide (positions 2-5-3.) Furthermore, the c♯ is commonly played sharp independent from linear intonation considerations, which further stresses the importance of moving the slide to exactly fifth position before changing directions. Like b♭ in the case of the G♭ major scale, the player should use fifth position for the a♯ in order to put it on the same partial as b in the B major scale.

The E major scale is usually played exactly like the F major scale, except that each note lies one position lower on the slide. This means that the pattern of slide motion is exactly the same as F major, and that the linear intonation challenges lie between the same scale degrees.
The A major scale presents similar linear intonation challenges to B♭ major. The player should be careful in altering the pace of the slide between fifth position and second position in A major just as the pace from fourth to first position is important in the B♭ major scale. d should be kept appropriately close to c♯ and g♯ should be appropriately close to a.

The D and E♭ major scales share linear intonation challenges between E and b♭, but vary above b♭. Like the E♭ major scale, scale degrees 3 and 4 of the D major scale need to be kept appropriately close together, as it is common to play G or g too high on the slide as the player approaches A or a. At the top of the D major scale, however, there is one linear intonation challenge not present in the E♭ major scale. The player should concentrate on the correct position of the c♯ that lies between b and d’. In this case, the linear intonation is of particular importance because the c♯ is the leading tone of the scale, and extra effort should be made to keep it appropriately close to d’. The D major scale shares the c♯, d, e sequence with A Major, and the d should be kept appropriately close to c♯.
Like G♭ major, the G Major scale can have a direction change between each note of the scale between G and g. The player should work for accuracy on the placement of each note before the slide changes direction. The player should watch the placement of c’, as this is the first note that does not occur on a direction change. c’ should be kept appropriately close to b. As with the D major scale, the Gs should be kept appropriately close to the F♯s in both octaves.

In the C major scale, c’ should be pulled down appropriately close to b and away from d’. As with the F major scale, the player should keep e appropriately close to f and away from d.
APPENDIX B: PEDAGOGICAL AIDS

Just as some of the intonation materials described in the introduction used technology to help musicians improve their intonation, linear intonation difficulties can be diagnosed and improved using pedagogical aids.

The first important tool is using audio recordings of one’s practice sessions. It is not necessary to have thousands of dollars in audio equipment to be able to listen to one’s playing to identify linear intonation problems. In fact, one of the best tools for identifying linear intonation challenges is a reel-to-reel audio recorder. Many of these devices have a “half speed playback” mode, which allows the player to listen to intonation in fast passages. The half speed playback on analog recorders is down one octave from the original performance, which can also be very useful for playing along with half speed recordings at the octave. Computer software can also provide variable speed playback of recorded sounds. Linear intonation problems mainly occur during relatively fast passages, and many trombonists do not notice the intonation problems unless they are severe. Half-speed playback can be very illuminating for players as they listen to their linear intonation.

The use of a large mirror allows the player a different perspective. While playing at a 45-degree angle, the player can watch his slide motion in the mirror. This is much better than looking straight down the slide to see where it is actually placed for each pitch, but not as useful as looking at it directly from the side as a teacher is able to do. It is important for players to develop the ear to hear linear intonation problems, but practicing with a mirror can be a very beneficial tool as well.

It is often very easy for a teacher to look at a student’s slide from the side and see many of the linear intonation problems as they occur. If available, setting up a video camera from the side is something that trombonists can do on their own to identify linear intonation problems. Audiovisual recording is especially useful because the player is able to use visual and aural feedback to correlate slide inaccuracy and linear intonation flaws.

Audiovisual recording is an invaluable tool for trombonists working on linear intonation. Working with a mirror is important and likely more cost effective, but is limited in its efficacy. Practicing the exercises in this text with one of these tools is highly recommended. When a player is able to see and hear his linear intonation problems, he will likely take a more active role in correcting them. Practicing with these tools can be very upsetting at first, as the player realizes the extent to which linear intonation is a problem. By careful practice and application of the exercises in this text, these technological aids can be very empowering for a trombonist.
Correcting Linear Intonation on the Trombone

Bradley Palmer
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Introduction

Trombonists often experience an intonation problem that is unique among wind instruments, due to the mechanics of our instrument. Though the problem is not limited to two situations, it is perhaps best described through the following examples:

Example 1:

```
<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>
```

Positions: 1 2 4

When trombonists are required to play these pitches very quickly on the same partial, they commonly play the half step “wide” and the whole step “narrow.” That is, they traverse too great a distance in moving from first to second position and too little in moving from second to fourth. By pacing slide movement too evenly from first to fourth position, the player places the e too low on the slide, resulting in a note played flat. The parallel example, f, e, d, commonly results in a sharp e for the same reason: the distance on the slide is traversed too evenly between first and fourth position. These slide technique problems result in intonation problems.

If the tendency toward even pacing reflects one group of trombone intonation problems, a second may be found when the player changes the direction of slide motion. Example 2 demonstrates a potentially problematic passage that requires such a direction change:

Example 2:

```
<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>
```

Positions: 2 5 3

In Example 2, the slide changes direction as the f# is played. When a trombonist is required to play these notes in rapid succession, the player will commonly fail to reach fifth position before changing direction, resulting in a sharp f#. Thus, the listener hears a wide whole step followed by a narrow one.

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8 The following method of octave identification is used in this book:
Examples 1 and 2 demonstrate the intersections of slide technique and intonation that result in flawed *linear* intonation – the intonation within a melodic line. Linear intonation is different from the more well-studied fixed intonation. Fixed intonation refers to the intonation tendencies of simultaneously sounded pitches – intonation at a fixed point in time. Current intonation studies can help the trombonist with the following issues:

1. Training the ear to detect and eliminate intonation problems between two or more notes that are played at the same time.
2. Understanding the overtone series on the trombone and the tendencies of each partial, so that correct adjustments can be made on the slide.
3. Understanding the correct adjustment of each member of a given chord using just intonation. For example, the third of a major triad should be placed approximately 14 cents flat when compared to equal temperament in order for the chord to ring true.\(^9\)

While flaws in fixed intonation are a result of failing to accommodate for challenges posed by other players, the instrument itself, or the human ear, flawed linear intonation is caused by improper slide technique and results in consecutive interval imprecision. Authors of books on the trombone have recognized this problem, but have not provided adequate solutions.

In his book, *The Trombonist’s Handbook*, Reginald Fink’s description of “Timing” as it relates to slide technique is perhaps the best description of linear intonation problems of any source available. He describes a situation very similar to the one presented in Example #1 above. He points out that the slide must change speed in order for the positions to be played in tune in rapid passages. He also describes the tendency to even out the distance between the outer positions, resulting in intonation deficiencies.

In *The American Trombone*, Sam Burtis discusses specific slide technique issues that impact linear intonation, including right hand grip and palm facing up or down in a chapter on slide technique. He also distinguishes the technique of stopping the slide on every note versus a smooth, continuous motion, pointing out that there is a grey area in between which includes elements of both techniques. The chapter also includes exercises designed to improve slide accuracy and speed. Like Fink, Burtis presents a series of notes similar to Exercise #1 above. He also acknowledges the linear intonation challenges that this exercise presents, and offers techniques to master them. He addresses acceleration and deceleration of the slide in order to achieve correct intonation.

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\(^9\) Equal temperament was developed to facilitate transposition to any key without having glaring intonation problems. This means of “compromising” the mathematical ratios that dictate each interval gives us twelve equal intervals in an octave. The result is the ability to play in any key, but the inability to play intervals or chords perfectly in tune. In orchestra, wind ensemble, and many chamber music settings, musicians are required to tune chords in a manner that yields no audible intonation inaccuracy, using the correct mathematical ratios rather than the compromised intervals in equal temperament. This system of just tuning requires us to alter pitches from their normal equal temperament positions as much as 31 cents in one direction.
Between Burtis and Fink, less than ten pages address the topic of linear intonation correction. This is enough to show that the problem exists, but certainly not enough to help trombone players correct it. Intonation sources have little if any information on linear intonation and books about the trombone mention it briefly, but this method is intended to fill these voids and explain how to correct linear intonation.

How to use this book:

Linear intonation difficulties can be diagnosed and improved using technological aids. The first important tool is using audio recording of one’s practice sessions. It is not necessary to have thousands of dollars in audio equipment to be able to listen back to one’s playing to identify linear intonation problems. In fact, one of the best tools for identifying linear intonation challenges is a reel-to-reel audio recorder. Many of these devices have a “half speed playback” mode, which allows the player to listen to intonation in fast passages. The half speed playback on analog recorders is down one octave from the original performance, which can also be very useful for playing along with half-speed recordings at the octave. Computer software can also provide variable speed playback of recorded sounds. Linear intonation problems mainly occur during relatively fast passages, and many students do not notice the intonation problems unless they are severe. Half-speed playback can be very illuminating for students as they listen to their linear intonation.

The use of a large mirror is not exactly a technological aid, but it allows the player a different perspective. While playing at a 45-degree angle, the player can watch his slide motion in the mirror. This is much better than looking straight down the slide to see where it is actually placed for each pitch, but not as useful as looking at it directly from the side as a teacher is able to do. It is important for players to develop the ear to hear linear intonation problems, but mirror work can be a very beneficial tool as well.

It is often very easy for a teacher to look at a student’s slide from the side and see many of the linear intonation problems as they occur. If available, setting up a camera from the side is something that students can do on their own to check for linear intonation problems. Video recording is especially useful because the player is able to use visual and aural feedback to correlate slide inaccuracy and linear intonation flaws.

Audio and video recording are invaluable tools for students working on linear intonation. Mirror work is important and likely more cost effective, but is limited in its efficacy. Practicing the exercises in this text with one of these tools is highly recommended. When a student is able to see and hear his linear intonation problems, he will likely take a more active role in correcting it. Practicing with these tools can be very upsetting at first, as the student realizes the extent of the linear intonation problems. By careful practice and application of the exercises in this text, these technological aids can be very empowering for a student.
The exercises that appear in the coming chapters are drawn from two important principles that should guide players in nearly every aspect of their practicing. The first principle is the idea that correct repetition yields accurate performance. Many musicians consider practicing as a challenge to play a passage correctly. Once that challenge has been met, players can move on to another passage. This could not be further from the truth. The nature of playing musical instruments requires the building of “muscle memory” or “kinesthetic memory” – what Arnold Jacobs refers to as building neural pathways in the brain. This is especially true for quick passages, where there is not time to ponder one’s next move, as in a game of chess. It is the difference between playing chess and shooting free throws in basketball. If it were as simple as knowing how to shoot a free throw, anyone could be a basketball star. Taking the exercises very slowly at first and speeding them up very gradually is the key to correct repetition. Establishing and repeating the positive rather than trying to eliminate the negative will be much more fruitful for the player. Only after the player is able to play the passage several times perfectly at a given tempo should he move up to the next faster setting on the metronome.

The other important principle that the exercises follow is the idea of diagnosing the specific problem and building an exercise that addresses the specific nature of the problem. This also applies to all facets of practicing on the trombone, but is especially pertinent in the case of correcting linear intonation. It is important to diagnose the problem as specifically as possible. This does not just mean finding the measure or beat that is presenting the challenge, but learning exactly where and why the problem presents itself. The exercises that appear in the following chapters pinpoint the exact location and nature of the linear intonation challenge in each excerpt. After identification of the challenge, it is extracted and placed into exercises that are designed to work on the problem itself. This idea of extracting problems and building effective exercises around them is one of the keys to efficient practicing. Variation in elements such as meter, key and rhythm allow the player to work on the problem from a number of different angles. Significant excerpts from the trombone literature were selected, and the exercises will certainly help the player sound better on the excerpts. More importantly, however, the exercises will help the player understand and improve linear intonation in general, and help the player to create new exercises to work on this and other aspects of trombone playing.

The following four chapters build exercises built on these two principles, and each chapter addresses linear intonation challenges in a unique way. Each chapter focuses on a single technique that forms the basis for the creation of exercises that help correct the linear intonation problems that many players encounter in specific examples drawn from the trombone literature. The techniques of correct repetition, exaggeration, rhythmic displacement, and transposition are explained and applied in the exercises that follow. Each exercise includes a tempo indication with two numbers separated by a hyphen. The first number is a suggested starting tempo for practicing, and the second number is a tempo equal to or slightly faster than a typical (or marked) performance tempo. Following the principle of correct repetition, each exercise should be repeated several times before increasing the tempo. The player should decide whether a measure of rest
between each repetition is appropriate. This may help to avoid mental and physical fatigue that can be counterproductive.
Chapter 1: Correct Repetition

As explained in the introduction, the key to correcting a wide variety of technique problems is to establish the positive and repeat it. This chapter will help the player to identify linear intonation challenges and reinforce the positive by using correct repetition.

Exercise 6E from the “Articulation” chapter of David Vining’s book\textsuperscript{10} is designed to apply double tonguing skills while the slide is in motion. Vining provides excellent suggestions on practicing multiple tonguing in the preparatory text for this chapter, but, like the authors of almost all trombone books, he does not address the issue of linear intonation. The excerpt below from Vining’s articulation exercise presents a significant linear intonation challenge by placing sixteenth notes on the same partial between first and seventh position.

Excerpt from Vining’s Exercise 6E, p. 29. \( \text{\textbf{\textit{\textbullet}}} = 100+ \)

\[
\begin{array}{c}
\begin{array}{c}
\text{\textbullet} \\
\text{\textbullet}
\end{array}
\end{array}
\]

In Exercise 1 below, the player should repeat each measure as many times as needed to be secure before moving to the next measure. The purpose of the exercise is to have the player hear and feel the correct repetition of intervals, building a more exact rendition of Vining’s original exercise.

Exercise 1: \( \text{\textbf{\textit{\textbullet}}} = 120-200+ \)

\[
\begin{array}{c}
\begin{array}{c}
\text{\textbullet} \\
\text{\textbullet}
\end{array}
\end{array}
\]

Exercise 2 applies the same strategy to the even beats of Vining’s original exercise. The player should start each measure in seventh position.

\textsuperscript{10} Vining, David. \textit{Daily Routines for Trombone}, p. 29.
Exercise 2: $q = 120-200+$

Exercise 3 is designed to ensure that the half steps are accurate, and that the notes before and after each direction change are in exactly the same position. Set the metronome to the eighth note pulse. Remember that the distance between f and e is smaller than the distance between c and B. Make sure to reach all the way out to seventh position.

Exercise 3: $q = 120-200+$

Exercise 4 allows the player to practice the two whole-step intervals that lie between the direction changes in the original excerpt. The player should listen carefully to the intonation and make sure it is consistent whether ascending or descending.

Exercise 4: $q = 120-200+$

Exercise 5 simulates the original excerpt by asking the player to move the slide to all of the positions in the original excerpt, but only to play the notes from Exercise 4. The notes that have the “x” for note heads should be placed exactly in the correct spot and the player should hear the pitch that is indicated, but not play it. The player should listen carefully and make sure that adding the positions does not change the intonation. The exercise should sound exactly like the previous exercise, but the player will probably find this easier said than done!
Exercise 5: \( \frac{\text{m}}{\text{m}} = 120-200+ \)

The Hungarian March from Berlioz’ *Damnation of Faust* requires the player to perform relatively quick scalar passages that present linear intonation challenges. The exact pattern of notes from The Vining Excerpt above is present between measures seven and nine of the excerpt.

Excerpt from Berlioz’ *Damnation of Faust*, meas. 96-106. \( \frac{\text{m}}{\text{m}} = \text{c.96} \)

It is important to concentrate on the integrity of whole and half steps, especially when they are placed in one direction on the slide. The quick tempo of the excerpt often contributes to sloppiness with respect to linear intonation. Instances of particular concern are shown in the two examples below.

Berlioz Example 1:

It is common for players to play the half steps wide and the whole steps narrow as the slide moves quickly in one direction. Exercise 6 is based on the example above.

Exercise 6: \( \frac{\text{m}}{\text{m}} = 120-192 \)
At first glance, Exercise 6 seems very simple, and on almost all other instruments it would be. Navigating this exercise on the trombone, however, requires a change in either the pace or direction of the slide between every note of the exercise. The player should concentrate on keeping the half steps appropriately narrow and the whole step between d and e appropriately wide. As with many of the other exercises in this text, this one may be transposed down chromatically for more repetition. The player should listen carefully to the intervals as the speed of the exercise increases. If possible, alternating between playing the exercise on the piano and on the trombone would be beneficial for the ear.

Berlioz Example 2:

The downbeat e in the second measure of the example above should be an anchor point for the player. An accurate second position will help to keep the e to f half step in tune. Stopping exactly in second position on the downbeat will help the player make the transition into the rapid deceleration of the slide when the f is added to the passage. The placement of the e should not change. Exercise 7 allows the player to practice stopping on this e, and then adding the f.

Exercise 7: $\frac{1}{4} = 120-192$

The c to B results in a quick seventh to sixth position motion that is often uncomfortable for trombonists. If the player uses a trombone with an F attachment, he will likely use it most of the time for these two pitches. In the case of Exercise 7 and the original excerpt, the B and c lead directly up the scale to f in one continuous slide motion. Using positions 7-6-4-2-1 rather than using the F attachment eliminates the direction change in this relatively quick passage but introduces some linear intonation challenges.

If a change in the right hand grip is necessary to reach the seventh position b, the player should be careful not to let the change back to the normal grip affect the slide positions on the rapid ascent to first position. The two whole steps in the middle will usually be accurate if the trombonist plays exact half steps on each end of this five-note sequence.

Further examples of scalar linear intonation challenges are found in the excerpts below from Guilmant’s *Morceau Symphonique*. After the beautiful Andante section and cadenza, Guilmant writes a spirited section marked “Allegro moderato.” Here, the first entrance of the trombone is the following E♭ major scale marked at a tempo of 104 for the
quarter note.

Measure 43 of Guilmant’s *Morceau Symphonique*: $\frac{\text{q}}{} = 104+$

One note that can be problematic is the a\textsuperscript{b} (circled), which can easily be played sharp if the player is not concentrating on the linear intonation. Avoid placing it half way between fourth and first position. Regarding the placement of the d near the end of the scale, a good rule to follow is to play the half steps on the same partial when playing scalar passages. This will often minimize slide motion and will help to keep the half steps from being too wide. Exercise 8 is designed to allow the player to hear and feel the half step between the g and a\textsuperscript{b}.

Exercise 8: $\frac{\text{q}}{} = 60-104+$

In Exercise 9, the player should concentrate on keeping the half step appropriately narrow and the whole step appropriately wide.

Exercise 9: $\frac{\text{q}}{} = 60-104+$

Intonation problems can also occur between the first three notes of the scale if the slide changes direction prematurely. The player should be careful not to place the f too low on the change of direction. The following B\textsuperscript{b} major scale appears several measures after the E\textsuperscript{b} major scale above.

Measure 55 of Guilmant’s *Morceau Symphonique*: $\frac{\text{q}}{} = 104+$
The two important linear intonation obstacles are circled above. The player must refrain from expanding the half steps between d and e\textsubscript{b} and between a and b\textsubscript{b}, thus keeping the e\textsubscript{b} from being too high and the a from being too low.

When playing Exercise 10, the player should stop exactly on the e\textsubscript{b}, and make sure the half step between d and e\textsubscript{b} sounds correct each time. If the c would normally be played with the F attachment, it should be done during this exercise also.

Exercise 10: \( \frac{\text{tempo}}{\text{beat}} = 60-104 \)

Exercise 11 will allow the player to focus on the exact placement of the a. The player should avoid allowing the slide to travel at the same speed between the g and b\textsubscript{b}.

Exercise 11: \( \frac{\text{tempo}}{\text{beat}} = 60-104 \)

Exercise 12 simply adds two more notes of the phrase to make sure the slide direction changes do not affect the integrity of the intervals between the g and b\textsubscript{b}.

Exercise 12: \( \frac{\text{tempo}}{\text{beat}} = 60-104 \)

While practicing Exercise 13, concentrate on keeping the half steps appropriately narrow. Feel how the e\textsubscript{b} and the a do not fall in the same place on the slide, and keep them in positions adjacent to their respective half step neighbors.

Exercise 13: \( \frac{\text{tempo}}{\text{beat}} = 60-104 \)

Appearing several phrases later, the d major scale begins with the same trap as the e\textsubscript{b} major scale. It is easy to expand the half step between the third and fourth scale degrees.
Measure 91 of Guilmant’s *Morceau Symphonique*: QQ=104+

The fourth scale degree (circled) is the parallel intonation challenge presented by the E♭ major scale above, and is addressed in exercises similar to Exercises 8 and 9. The c♯ circled above is addressed in Exercise 16.

Exercise 14: \( \text{j} = 60-104 \)

Exercise 15: \( \text{j} = 60-104 \)

Exercise 16 allows the player to concentrate on keeping the whole steps appropriately wide by not changing direction prematurely. The player should work for accurate and consistent second and fourth positions, ensuring that the slide does not change direction prematurely.

Exercise 16: \( \text{j} = 40-69 \)

The player should remember the feeling of appropriately wide whole steps while moving to exercise 17. Adding the d’ should not change the position of the c♯. The c♯ should be placed appropriately close to the d’.

Exercise 17: \( \text{j} = 60-104 \)
The following excerpt from Tyrell’s 40 Progressive Studies for Trombone is an excellent example of the need to be aware of and, if necessary, improve linear intonation. As with the Vining Excerpt above, all of the notes in the first two measures are in the same partial. F attachments and alternate positions cannot make this excerpt easier.

Excerpt from Tyrell Exercise #8: \( \text{\textfrac{1}{4}} = 84 \)

The most common linear intonation problem in this excerpt occurs when trombonists play the sextuplet figures with an even pace to the slide. This compresses the whole steps and leaves the half step too wide.

The correct placement of the e in the first measure is often the key to the success of a player’s linear intonation in this excerpt. It is very easy to place this pivotal note lower than it belongs, and the following exercises are designed to help the player hear and feel the correct placement of the e and its adjacent intervals. In Exercise 18 the player should feel the acceleration down from the e required to play the d in tune and in time. Measure 2 of Exercise 18 requires the player to stop the slide on the e, which exaggerates the deceleration required when the f is added again in the original excerpt.

Exercise 18. \( \text{\textfrac{1}{4}} = 112-168 \)

Marcello’s Sonata in A Minor presents linear intonation challenges in both scalar passages and direction changes. The whole step from c’ to d’ can be particularly problematic for the player. It appears in the second measure of the excerpt below as a direction change and in the third measure in scalar form. The whole-step interval from first to third position is problematic because the intervals that precede it require distances of one position or less. The player should be careful to pull the c’ down appropriately far.

Measures 11-14 of Benedetto Marcello’s Sonata in A Minor \( \text{\textfrac{1}{4}} = 66 \)
One way to reinforce the whole step from d’ to c’ is to add repetition on that particular interval. Exercise 19 is based on the last three measures of the excerpt. The player should avoid using alternate positions, as this can defeat the purpose of the exercise; the d’ should always be played in first position.

Exercise 19. \( \text{\textit{\textbf{\textit{q}}}} = 66-100 \)

Due to the relatively fast tempo, the player must be extremely careful with the linear intonation in the following excerpt from Rossini’s \textit{La Gazza Ladra}:

Measures 115-131 of Rossini’s \textit{La Gazza Ladra}: \( \text{\textit{\textbf{\textit{d.}}}} = 69^+ \)

This excerpt presents a linear intonation challenge in the mode alternation between major and minor. When played in rapid succession, the linear intonation tendency of a second position note between first and fourth position notes is to be flat, but a third position note in the same circumstance would tend to be sharp. This excerpt requires the performer to play each of these correctly with identical rhythmic values (comparing measure 3 to measure 11 of the excerpt.) The following exercise is designed to help the player practice this modal shifting. It will help the player to feel and hear the difference between the two modes and will help reinforce the correct linear whole- and half-step relationships through repetition. The player is encouraged to alternate between playing line by line and playing all of the major passages (the first three measures of each line) followed by the minor passages.
Exercise 20: \( \text{\textbullet} = 120-208+ \)

The following excerpt from Tchaikovsky’s *Symphony No. 5* presents additional linear intonation challenges that involve both scalar motion and direction changes.

Measures 102-103 of Tchaikovsky *Symphony No. 5*: \( \text{\textbullet} = 160 \)

Exercises 21 through 24 allow the player to tune and repeat the half steps before the whole step is added. Exercises 22 and 24 shift the beat by one eighth note, allowing the agogic accent to shift. More applications of rhythmic displacement are explored in Chapter 3. The player should concentrate on playing the g and a in exactly the same position regardless of the preceding slide position and direction.

Exercise 21: \( \text{\textbullet} = 88-160 \)
The ability for players to identify linear intonation challenges and to create exercises that build on repetition of accurate linear intonation is important to their success on the instrument. The ideas presented in this chapter should increase the player’s awareness of linear intonation and spur creativity in designing exercises built on establishing the positive. The following three chapters will explore different solutions for correcting linear intonation problems including transposition, exaggeration, and rhythmic displacement.
Chapter 2: Exaggeration

It is often helpful for trombonists to practice a passage at “pp” if the dynamic indication is marked at “p.” Likewise, if the player is playing a piece that approaches the player’s highest comfortable note, it is useful to practice exercises that stretch the player’s range higher than needed for the piece. The technique of exaggeration can also be applied to make linear intonation challenges more difficult. The player will find that by practicing the passage with alterations made to exaggerate the linear intonation challenges, the original excerpt becomes more comfortable on the slide and easier to play.

Linear intonation problems in a given passage can often be corrected by the identification and careful placement of one problematic note. As identified in the previous chapter, in the case of the fourth movement of Marcello’s *Sonata in A Minor*, quite often that note is c’.

Excerpt from Marcello’s *Sonata in A Minor*, meas. 11-14:

In this excerpt, the positions are quite close together in the first two measures until the arrival of the c’. The c’ also lies on a change of direction from first position to third and back. Each of these factors could easily lead a person to play the c’ higher than third position and sound sharp. The fact that both factors exist in the same spot makes the excerpt significant from a linear intonation perspective.

An exercise to work on the correct placement of the c’ involves exaggerating both of the aforementioned factors that make the pitch problematic. Lowering the c’ by a half step exaggerates the distance traveled and the direction change. The student should practice Exercise 25 with the metronome, taking great care not to allow the extended slide distance to affect rhythm. After Exercise 25 is mastered, the student should find the original excerpt much easier to navigate.

Exercise 25: \( \frac{1}{4} = 66 \)
Another application of exaggeration as a means of improving linear intonation can be derived from one beat of the excerpt below from Wagner’s Introduction to Act III of *Lohengrin*: \( \dot{j} = 88 \)

This excerpt presents an opportunity to examine the linear intonation challenges presented by quick direction changes on the slide. It is common for trombonists to fail to reach the exact position before changing direction. Taken individually, the direction changes present a moderate level of difficulty. In this excerpt, however, the two consecutive direction changes compound the difficulty in managing the linear intonation.

Each direction change from the excerpt is shown below. The student should practice Exercises 26 and 27 slowly, gradually increasing the tempo as much as possible without losing the integrity of the linear intonation. When each direction change is comfortable and accurate, the player should return to the original excerpt and begin slowly again, increasing speed after a few correct repetitions. The arrows in the following exercises remind the player to pull or push the note in the direction of the arrow to offset the linear intonation challenge presented by the direction change.

Exercise 26: \( \dot{j} = 88-138 \)

Exercise 27: \( \dot{j} = 88-138 \)

The technique of exaggeration can be very useful in working on these direction changes. To create Exercise 28, the notes with arrows in Exercises 26 and 27 above have been altered by a half step in the direction that makes the slide travel further between direction changes.

Exercise 28. \( \dot{j} = 54-88 \)
Exercise 28 is nearly impossible to play at the “performance” tempo of the excerpt, but will help the player to feel the extreme acceleration necessary after each direction change. It is important to use the indicated positions for Exercise 28. Only by doing so does the exercise provide the exaggeration of the linear intonation challenges.

A similar example of how exaggeration can help a player correct linear intonation direction changes is drawn from measures 88-90 of Eric Ewazen’s *Sonata for Trombone*:

\[ \frac{\text{\textbar}}{108} \]

This excerpt presents a linear intonation challenge in the change of direction between relatively fast sixteenth notes. Quite often, the b (circled) is placed sharp because the player changes direction prematurely in an effort to get back to the a in time. It is possible to play the first a in sixth position (positions 6-4-2 for the sixteenth notes), but for most people this would probably be more difficult than negotiating the linear intonation challenges (positions 2-4-2.)

It is a rare mistake for a player to place the b past fourth position before the change of direction. It is useful, therefore, to exaggerate the direction change by practicing the following exercise:

Exercise 29: \[ \frac{\text{\textbar}}{72-108} \]

As always, the player should start very slowly and make sure that the slide positions are exact, speeding up little by little after several correct repetitions. Many students who play the exercise will find that as the tempo increases, it begins to sound like the original measure 88; the b’ begins to sound like a b. This illustrates the importance of making sure the slide does not change direction prematurely.

*Note: Make sure that the second a you play is not flat. The slide should be all the way back to second position for the a and for most people will change direction and move slightly lower for the e’ due to a typically sharp partial. Also remember that even if the*
slide movement and articulation are perfect, the sixteenth notes will be impossible without proper air support.

When the player is comfortable with the exercise, the next step is to change the b\textsuperscript{b} back to a b and start slowly again. By exaggerating the distance traveled before and after the direction change, the player should find the original excerpt much easier to navigate, and will feel and hear the importance of moving the slide to exactly fourth position.

When practicing the following short excerpt from the David Concertino, the player will find that the keys to playing beat four in tune are having a rapid acceleration of the slide down from the f and an immediate deceleration once the e\textsuperscript{b} is played.

Measure 113 of Ferdinand David’s Concertino, op. 4: \( \text{q} = 126. \)

Exercise 30 exaggerates the direction change between f and g by lowering the g to g\textsuperscript{b}. Unlike the previous examples, it also exaggerates the acceleration and deceleration in the last beat by lowering the e\textsuperscript{b} and d by a half step each. Using sixth position for the last f would be a good option under normal circumstances, but would defeat the purpose of this exercise. The student should concentrate on the feeling of the acceleration and deceleration between the f and d\textsuperscript{b}. Doing so will make the original excerpt much easier to play in tune, as it is much easier than the exaggerated example below.

Exercise 30: \( \text{q} = 80-126 \)

Exploring the concept of exaggeration from a different angle, measures 102-103 of Tchaikovsky’s Symphony No. 5 will be examined: \( \text{q} = 160 \)

In order to avoid playing in equidistant positions in this passage, the player should practice actually playing each g flat a sharp. The player will often find that by trying to play narrow half steps and wide whole steps, he ends up playing the pitches correctly. Actually compressing the semitones and playing wide whole steps in this excerpt will
cause the player to be aware of and exaggerate the slide speed changes necessary for correct intonation. Exercise 31 shows the excerpt with arrows pointing to the direction the player should work to push or pull the indicated pitches.

Exercise 31: \( \dot{\text{=} \ 80-160} \)

Exaggeration of the linear intonation demands of a passage can be a useful method of correcting linear intonation by making the player aware of the physical demands that linear intonation challenges place on the slide. It is very common for trombonists to change slide direction prematurely or play consecutive notes in equidistant positions on the slide, ignoring the whole and half steps. By exaggerating the linear intonation demands, the player is doing the opposite; he is focusing on correcting the changing pace or direction of the slide.
Chapter 3: Rhythmic Displacement

This chapter explores rhythmic displacement as a way to correct linear intonation problems. Previous chapters have explained the importance of the correct placement of a single note that affects the linear intonation of a passage. Many times this pivotal note is on a weak beat in a measure or part of the subdivision within a beat. Altering the rhythm or meter can often move this note to a stronger beat in the measure, making it easier to place the slide in the exact position for the pivotal note.

Excerpt from Tyrell’s 40 Progressive Studies for Trombone, Exercise #8:
\[ \text{Exercise } 8 \]

Rhythmic displacement can help simplify the intervallic relationships that require linear intonation attention. Two important spots to consider are the slide direction changes at first and sixth position in the sextuplets. The student should practice the following exercise and concentrate on the interval that precedes and follows the direction change.

Exercise 32: \[ \text{Exercise } 32 \]

Exercise 32 is condensed to create Exercise 33. The student should try to feel a strong dotted quarter note pulse at first, continuing to play the intervals in tune on either side of the direction change. As the tempo is increased, however, the player should begin to feel the dotted half note pulse (in one.)

Exercise 33: \[ \text{Exercise } 33 \]

Exercise 34 returns to the original rhythmic placement of the sextuplet pattern. The student should again shift from feeling the dotted quarter pulse to the dotted half as the tempo increases. The student should also practice exercises 33 and 34 alternately. The linear intonation should remain constant regardless of the rhythmic placement.
Exercise 34: $\boxed{\text{q.}} = 100-168$

Exercises 35 and 36 provide further rhythmic displacement within a rhythmic framework identical to the original excerpt. Looking more specifically at the linear intonation challenge with the original exercise, the e becomes a crucial note to place correctly. Two reasons for this are that it is located on both sides of a slide direction change, and that it separates the whole-step intervals (e-d-c-d-e) from the half steps (e-f-e). This means that the pace of the slide movement changes each time the e is played. Because the e is such a pivotal note in the linear intonation of the excerpt, exercises 35 and 36 place the note on the downbeat. This can help the player to hear and feel the exact position of the note by giving it a slight agogic accent.

Exercise 35: $\boxed{\text{q.}} = 50-84$

Exercise 36: $\boxed{\text{q.}} = 50-84$

Rhythmic displacement of the entire seventeen-measure excerpt can prove very useful for working on the linear intonation in Rossini’s *La Gazza Ladra* $\boxed{\text{q.}} = 69+$
This excerpt is one of several challenging sections of this piece. As with the changes of slide direction examined in the *Lohengrin* exercises, this excerpt presents several such challenges in the fourth and fifth measures alone. The circled notes in the example below tend to be sharp notes for many trombonists. If the player uses the F attachment for the b, they occur on slide direction changes that require traveling at least two positions before and after, further stressing the importance of accurate slide positions on direction changes.

Measures 4 and 5 of the *Gazza Ladra* excerpt: \( \frac{1}{4} = 69+ \)

Quick scalar passages in the range of the bass clef staff in the key of E major often result in third position being too low on the slide as the slide motion between second position and fifth position becomes too even. The parallel example is second position being flat in F major scalar passages in the same range.\(^{11}\) The E major scalar passage in measures 3 and 4 is the same as the one in measures 7 and 8, rhythmically offset by one eighth note. It is often much easier for the player to play the latter example in tune because the g\(^#\) is on the downbeat rather than an upbeat. The natural agogic accent can lead the player to hear the third position note better, and to make sure the slide position is correct. In the following example, this process of shifting the agogic accent pattern significantly changes the way the excerpt feels and sounds to the player. Even though the exact same notes and rhythmic values are used, practicing the excerpt in 6/8 time provides a different approach to the linear intonation. Some of the same notes that provide linear intonation challenges are on strong beats and are much easier for players to hear, feel, and perform accurately.

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\(^{11}\) See Chapter 5 for more examination of linear intonation challenges in scales.
Exercise 37: $\text{q.} = 138$

The technique of rhythmic displacement can also be used to simplify the following excerpt from the Gröndahl Concerto.

Measures 2-5 of the Gröndahl Concerto for Trombone: $\text{q.} = 80$

The following exercise eliminates the syncopation from the excerpt by changing the rhythm and meter. This allows the player to concentrate on the exact slide positions and minor tonality.

Exercise 38: $\text{q.} = 80-112$

Due to the quick slide direction changes that occur on both sides of the g in the original excerpt, attention must be paid to the exact placement of the g itself. A common mistake in fast passages is to change direction too soon and not make it out to a true fourth position. If the g is placed higher than fourth position, the intervals that follow it will not be correct.

Exercises 39 and 40 use rhythmic displacement to help the student practice the placement of the g and a♭.
Rhythmic displacement can be an important solution to linear intonation challenges. After the pivotal note(s) of an excerpt have been identified, alteration of rhythm and meter can make it much easier for the player to place them in the correct position. In the Rossini excerpt above, no rhythmic values are altered, but the agogic accent shift is enough to make the excerpt feel completely different to the player. Other times, rhythmic displacement is used to create exercises that sound quite different from the original problematic passage. Both methods allow the player to hear and feel the linear intonation challenges in a different way, and can help correct flawed linear intonation.
Chapter 4: Transposition

Transposition can often provide a way of correcting linear intonation problems on the trombone, and can be applied in two distinct ways. Transposing passages can often lessen the linear intonation difficulties as the intervals will lie between different slide positions. Reducing the severity of linear intonation challenges can allow the player to hear and reinforce the correct intonation before transposing it back to its original problematic location. If available, playing the passage on the piano can have a similar reinforcing effect to the ear and linear intonation problems will be more easily detected and corrected because of the increased aural awareness of the problems.

The other use of transposition as a means of working on linear intonation involves a very different approach. Instead of transposing to lessen the degree of difficulty, transposition can be used to build exercises that allow the player to repeat the problematic sections and concentrate on the correct repetition of the slide motion. This technique is explored through the Gröndahl Concerto in Exercise 43 below.

Measures 11-14 of Marcello’s Sonata in A Minor: \( \dot{=} \) 66

When this excerpt was first addressed in Chapter 2, the c’ was identified as a pivotal note between the second and third measures of the excerpt. The other place that the c’ presents linear intonation challenges is in measures 3 and 4 of the excerpt. There are no slide direction changes on the c’s at this point, but the slide positions are very close together until the d’ to c’ interval. This makes it easy to cheat the direction change by failing to reach third position. In measure 3 of the excerpt, the slide will need to accelerate quickly down to the c’ to keep it from being sharp, then rapidly decelerate so that the c’ to b half step is accurate.

Transposing the example up a step alters the location of slide direction changes and limits every movement of the slide to one position or less. By reducing the physical challenges involved with the linear intonation, the player should able to hear the whole and half steps correctly. Exercise 2 is a transposition of measure 3 of the original excerpt. Even though the exercise looks similar to measure 2, it should not be viewed as an alteration of that measure. The player should alternate between Exercise 41 and measure 3 of the excerpt when practicing.
Exercise 41: $\text{q} = 66$

It was in a situation like measure 3 and 4 of the Marcello example that a teacher joked with a student about linear intonation. The teacher stopped the student and said “Your slide is like lightning! It never strikes the same place twice.” *Make sure the c’s are in the same place each time.*

Returning to the David *Concertino* introduced in Chapter 2, we can apply the technique of transposition to work on the same problematic beats three and four.

Measure 113 of the David *Concertino*: $\text{q} = 126$

Two linear intonation challenges are found in the last two beats of this short excerpt. The first is the quick direction change from first to fourth position between the f and g. The other challenge comes in the final beat of the excerpt, where the e changes to e♭. This is a challenge simply because the rest of the measure has a and e in second position. With the e♭, suddenly the acceleration of the slide out of the first position f is more dramatic. This is followed by a rapid deceleration into the fourth position d, whereas the rest of the measure requires the slide to move quickly into and out of fourth position from either first or second position.

In addition to the exaggeration that was explored in Chapter 2, another way to address the intonation challenge in the last two beats is by transposition. As in Exercise 42 below, transposition allows the player to build exercises that make it easier to play a passage.

Exercise 42: $\text{q} = 126$

Exercise 42 transposes the last two beats of the excerpt into tenor clef, moving the passage up a perfect fifth. The linear intonation challenges are significantly diminished, and the player should be able to concentrate on the intervals. The use of the flat fourth position for the d’ makes the exercise even easier to navigate on the slide. Whereas the e♭ was one of the main linear intonation challenges before, it is now a first position b♭. The
linear intonation tendencies of the intervals on either side of this b♭ are also the opposite of those surrounding the e♭ in the original excerpt. This will also make it easier to hear if the linear intonation of the original excerpt was faulty. Alternating between Exercise 42 and beats 3 and 4 from the original excerpt is recommended.

The player must establish accurate slide technique and correct linear intonation right from the opening statement of the Gröndahl Concerto. Keeping each a♭ (circled) from going sharp is most often the key to correcting the intonation.

Measures 2-5 of the Gröndahl Concerto: \( \frac{3}{8} = 80 \)

The technique of transposition can be very useful in establishing correct repetition of the intervals in the excerpt. Exercise 43 shows the first three measures of the trombone entrance followed by two transposed versions.

Exercise 43: \( \frac{3}{8} = 69-80 \)

As the passage is transposed down chromatically, the player should use the marked alternate positions. Slow and careful repetition using the marked alternates will help program the correct slide positions and direction changes into the arm. This repetition will also reinforce the minor tonality in the ear and allow the player to concentrate on the intervals in addition to the slide positions. Note that the transposition used to create this exercise is not designed to simplify the slide technique or make it easier for the player to hear the intervals correctly. The purpose is to allow the player repetition of the intervals and the slide position patterns. This will only be fruitful if the player starts slowly and correctly, and maintains accurate linear intonation as the tempo increases.
The player should explore different ways to practice Exercise 43, always starting slowly and building correct repetition. One way is to repeat each of the three lines slowly a few times before moving to the next. Another way to approach it is to practice lines one through three, starting over again with line one and increasing the tempo. A third way to approach the exercise is to practice the lines in random order.

This chapter has explored the use of transposition as a means of correcting linear intonation. Transposition can allow the player to hear the correct linear intonation, unhindered by awkward slide movement, or it may provide a way of creating exercises that allow the player to repeat the patterns of slide positions to reinforce correct linear intonation.
Chapter 5: Scales

This chapter will illustrate the linear intonation challenges present in each of the twelve major scales. The range of E to f’ was chosen because the range above f’ involves much shorter distances to travel on the slide, therefore minimizing linear intonation problems. The range below E is not without linear intonation challenge, but the solutions applied an octave above this range can usually be used. The player may find that starting on E or F is more difficult compared to starting on the first scale degree of each scale, but format was chosen because it is most efficient to discuss linear intonation challenges and relate them to other scales in the same range.

The “major scale” terminology is used so that it is possible to relate linear intonation to scale degrees. However, it is important to understand that the linear intonation challenges should be considered based on the key signature, not just the major scale. Since the relative minor scales include the exact same sequence of pitches and slide motion, they are not listed here. It is not practical to list all forms of the minor scale and all other possible scales. The player should look at other scales as variants of what is learned within each key signature, and should be able to apply the same care and awareness of linear intonation as the scale is changed with accidentals.

A description of the linear intonation challenges of each scale is presented below. The scale is then shown with arrows in the music notation. The arrows indicate the direction that the note will likely need to be pushed or pulled due to the linear intonation challenge.

In the F major scale, second position A, e, and a are pivotal pitches for correct linear intonation. Each should have a semitone above and a whole step below, and should not be placed equidistant from first and fourth positions. Evening the distance between first and fourth position results in these pitches being flat.

In the Bb major scale, the player should concentrate on keeping each Eb appropriately low and each A appropriately high. As with F major, the pace of the slide between first and fourth position must not be constant. In this case, the result would be a flat A and a sharp Eb.
During relatively fast passages, the player should play d' in flat fourth position in the E♭ major scale, and any other time that it lies between two notes in third position. It is important to keep each third position A♭ and E♭ appropriately close to fourth and away from first. This will keep the semitone between scale degrees three and four from becoming too wide.

![Diagram of E♭ major scale]

In the A♭ major scale, the player with an F attachment should play B♭ in sharp fourth position (indicated by the “v” below.) Doing so eliminates one direction change and facilitates placing the semitone from c to d♭ on the same partial and in the adjacent positions indicated below. The alternative is to travel from first to fifth position and change direction. The student should be careful of the direction change that happens on the f. A common mistake is to change slide direction before reaching an accurate first position.

![Diagram of A♭ major scale]

In the D♭ major scale, the B♭ should be played with the F attachment as in the A♭ major scale. F should be placed in a position adjacent to G♭ in any octave, as should D♭ and C. If these positions are used, the linear intonation is much easier, and the B♭ becomes the only significant linear intonation challenge. Like f in the D♭ major scale, care should be taken to keep the pitch appropriately high on the first position note that lies on the direction change.

![Diagram of D♭ major scale]

The G♭ major scale can be played many different ways using the F attachment and alternate positions. As with the D♭ major scale, keeping the F and G♭ on the same partial in every octave will minimize long position shifts in the scale. Depending on the positions that the player chooses, the G♭ major scale can have more direction changes than any other major scale, requiring the player to concentrate on the exact position of the slide before changing direction. The indicated positions show one way of using the valve and alternate positions to minimize distance traveled and linear intonation difficulties, but results in direction changes on every note in the octave between G♭ to g♭. The b♭ should be placed in fifth position in order to keep the b♭ and c♭ on the same partial and in
adjacent positions. The c\textsuperscript{b\#} should be pulled down appropriately close to the b\textsuperscript{b} and kept away from the d\textsuperscript{b\#}.

![Diagram of B major scale with sliding intervals]

Two important notes to tune are adjacent in the B major scale. The d\textsuperscript{#} may tend to be flat if the pace of the slide does not change appropriately between second and fifth positions (between e and c\textsuperscript{#}). c\textsuperscript{#} is also an important note for accurate linear intonation because most players will use the F attachment for B, which places a direction change between two relatively long distances on the slide (positions 2-5-3.) Furthermore, the c\textsuperscript{#} is commonly played sharp independent from linear intonation considerations, which further stresses the importance of moving the slide to exactly fifth position before changing directions. Like b\textsuperscript{b} in the case of the G\textsuperscript{b} major scale, the player should use fifth position for the a\textsuperscript{#} in order to put it on the same partial as b in the B major scale.

![Diagram of linear intonation challenges in B major]

The E major scale is usually played exactly like the F major scale, except that each note lies one position lower on the slide. This means that the pattern of slide motion is exactly the same as F major, and that the linear intonation challenges lie between the same scale degrees.

![Diagram of linear intonation challenges in E major]

The A major scale presents similar linear intonation challenges to B\textsuperscript{b} major. The player should be careful in altering the pace of the slide between fifth position and second position in A major just as the pace from fourth to first position is important in the B\textsuperscript{b} major scale. d should be kept appropriately close to c\textsuperscript{#} and g\textsuperscript{#} should be appropriately close to a.

![Diagram of linear intonation challenges in A major]
The D and E♭ major scales share linear intonation challenges between E and b♭, but vary above b♭. Like the E♭ major scale, scale degrees 3 and 4 of the D major scale need to be kept appropriately close together, as it is common to play G or g too high on the slide as the player approaches A or a. At the top of the D major scale, however, there is one linear intonation challenge not present in the E♭ major scale. The player should concentrate on the correct position of the c♯ in the sequence with A Major, and the d should be kept appropriately close. The D major scale shares the c♯, d, e sequence with A Major, and the d should be kept appropriately close to c♯.

Like G♭ major, the G Major scale can have a direction change between each note of the scale between G and g. The player should work for accuracy on the placement of each note before the slide changes direction. The player should watch the placement of c′, as this is the first note that does not occur on a direction change. c′ should be kept appropriately close to b. As with the D major scale, the Gs should be kept appropriately close to the F♯s in both octaves.

In the C major scale, c′ should be pulled down appropriately close to b and away from d′. As with the F major scale, the player should keep e appropriately close to f and away from d.
BIBLIOGRAPHY


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