Contemporary Strategies for Fundamental Development: Utilizing Extended Techniques to Advance Foundational Trumpet Methodology

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CONTEMPORARY STRATEGIES FOR FUNDAMENTAL DEVELOPMENT: UTILIZING EXTENDED TECHNIQUES TO ADVANCE FOUNDATIONAL TRUMPET METHODOLOGY

By

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CONTEMPORARY STRATEGIES FOR FUNDAMENTAL DEVELOPMENT:
UTILIZING EXTENDED TECHNIQUES TO ADVANCE FOUNDATIONAL
TRUMPET METHODOLOGY

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With virtuosic soloists continuing to push the boundaries of skill in trumpet performance, so too have composers set new bars that redefine the instrument’s previously conceived limitations. In recent years there has been both a significant increase in the number of solo compositions for the trumpet and a rise in the use of the trumpet as a soloist in the orchestra. Contemporary works are being performed, not just by groups dedicated to new music, but also by major orchestras and ensembles who (in additional to traditional repertoire) present these works in the contexts of new commissions and the performance of recent additions to the accepted repertoire. Along with the new demands being made of the trumpet due to changes in its role in the orchestra, there have been a multitude of new techniques discovered and explored in contemporary literature. This dissertation outlines an original method comprised of studies on these new techniques, built on strategies seen in extant technical performance guides, as well as fundamental method books established by renowned trumpet pedagogues throughout history. This method will synthesize standard trumpet fundamental approach with new techniques in order to introduce them into a student’s regular practice. This will allow trumpet pedagogues to incorporate new standards for trumpet technique into their training of future musicians.
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CHAPTER 1

Introduction

Who knows what music they might need to play? If they have only studied sonatas and they are asked to play a show, or if they have to play in a church orchestra and transpose, their studies were not very useful. I try to give them a really well-rounded approach to what a trumpet can do and the techniques involved. They need to be able to move freely in any direction. One of our responsibilities as teachers is to make sure that can happen.¹

-Vincent DiMartino

This study provides college-level instructors with adaptive teaching strategies and exercises that incorporate extended techniques. The objective is to provide a foundation for new skills, while still maintaining a focus on musical development in traditional trumpet technique. Accordingly, the exercises are organized by the fundamental skills required for executing a particular extended technique. The format of each exercise is based on mainstream methods, which will both provide a sense of familiarity and also supply the student with strategies for independent adaptation in the future.

What is an Extended Technique?

The definition of an extended technique can be a contentious one. In Amy Cherry’s 2009 dissertation, she defines them as “ways of playing a traditional instrument that produce new and often unexpected sounds.”² The reason this is sometimes disputed


is because of the word “new”. At one point techniques like pedal tones, flutter tonguing, and growling were considered extended techniques, yet today they have been incorporated into mainstream trumpet pedagogy due both to their extensive use in music for brass instruments and the additional benefits afforded the student’s fundamental technique through their practice. The classification of an extended technique, then, should be based on its prevalence in the repertoire. If a technique written for a single soloist creates a new sound and is produced by means beyond a traditional trumpet technique, it should be labeled as extended. However, once a technique spreads into a significant number of other works and across multiple genres of music, it should then be considered a standard requirement for the professional musician.

The reason this distinction is important is its correlation to the increasing likelihood that these latter techniques will be required of a classically trained musician. In the second half of the twentieth century, multiple virtuosic soloists, such as Hakan Hardenberger, Maurice Andre, Markus Stockhausen, John Wallace, and Marco Blauuw, rose to international fame and performed a multitude of new works written specifically for them by renowned composers. Peter Maxwell Davies wrote several works that showcased the skills of John Wallace, Karlheinz Stockhausen wrote extensive solo passages in his seven-day opera Licht for his son Markus, and H.K. Gruber pushed the boundaries of multiphonics in his concertos Aerial and Busking, written for Hakan Hardenberger. In the past fifty years, new sounds and techniques have been developed in a process akin to an “arms race” between composers, who have constantly striven to push the boundaries of sonic possibilities in their works. As solo literature has evolved, so has

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the standard role of the trumpet in chamber ensembles. The instrument has since become
a permanent and integral member of contemporary new music collectives such as the
Schoenberg Ensemble, Ensemble Intercontemporain, and Ensemble Modern.4

Any orchestral musician would want to be prepared to approach a new work,
especially in light of the short time frame a professional is commonly given and length of
time necessary to perfect these techniques. Since extended techniques always have the
potential to become standard techniques, it is important to prepare students for the chance
that one of these may be required of them in their future performance careers. Looking at
the recent histories of orchestras like the New York Philharmonic, Los Angeles
Philharmonic, and Chicago Symphony Orchestra, the number of premieres presented by
these groups reveals the frequency with which contemporary works are performed by
professional classical musicians. In the past three years, the Los Angeles Philharmonic
has presented world premieres and U.S. premieres of works by Stephen Hartke,5 Kaija
Saariaho,6 Anders Hillborg,7 Peter Eotvos,8 and Unsuk Chin.9 Since 2000, the Chicago
Symphony Orchestra has premiered thirty-seven works by living composers, including

4 Kurt George Gorman, “The Literature for Trumpet in Mixed Chamber Music of the Twentieth
Century” (DMA diss., University of Missouri-Kansas City, 2001), 16.
/music/doremi-concerto-for-violin-and-orchestra-world-premiere-la-phil-commission-peter (accessed
November 5, 2015).
Mathias Pintscher, Mark Anthony Turnage, Elliott Carter, Pierre Boulez, John Corigliano, Toru Takemitsu, and Harrison Birtwistle. The New York Philharmonic has performed thirty-nine world premieres and thirty-four United States premieres in the past five years. Furthermore, premieres haven’t been restricted to the larger and better-known orchestras of the United States. In a listing by the League of American Orchestras, it was revealed that fifty-eight United States orchestras performed world premieres in the 2012-2013 season alone. Of the composers listed, Eotvos, Pintscher, Turnage, Carter, Takemitsu, and Birtwistle have all written pieces specifically for the trumpet in either a solo or chamber music setting. As trumpet historian Eliza Koehler points out, the techniques required of trumpet soloists can and often quite rapidly do make their way into the solo lines of the orchestral trumpet underscoring the need for orchestral musicians studying them.

Extended Techniques as a Pedagogical Tool

Teaching extended techniques has benefits for the student beyond giving them the ability to rise to the needs of the evolving repertoire of modern concert music. Although

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14 Koehler, *Fanfares and Finesse…*, 147.
systematic experimental trials would be required to concretely prove the foundational benefits of the proposed course of study, the benefits of using particular extended techniques as a fundamental teaching tool has long been established. By the second half of the twentieth century, many trumpet teachers discovered that the strategies for producing pedal tones led to a corresponding development in general endurance.\textsuperscript{15} Trumpeters often find it difficult to approach the pedal register with a normal embouchure setting, a problem that was found to be mitigated by the practice of pedal tones as a technical exercise.\textsuperscript{16} This led to multiple methodologies employing the use of pedal tones in order to provide a stable single embouchure and to assist in a player’s general endurance while performing in all registers.\textsuperscript{17}

A clinical study of high school students testing the benefits of vocalizations in instrumental playing found that simultaneously playing and singing different intervals resulted in a significant improvement in general interval performance accuracy of the students.\textsuperscript{18} Because of these results and those like them, it can be inferred that the practice and implementation of vocalizations while playing assists in the improvement of intonation and interval accuracy of trumpet players.

As part of her 2009 dissertation, Amy Cherry conducted a survey which contained questions regarding the pedagogy of extended techniques. Although the initial sample

\textsuperscript{15} Malachy Rodriguez, “Trumpet Pedal Tones: Their History and Pedagogical Uses” (DMA diss., Arizona State University, 2014), 25.


\textsuperscript{17} Ibid., 15.

\textsuperscript{18} William Schlacks, “The Effects of Vocalization through an Interval Training Program upon the Pitch Accuracy of High School Band Students” (PhD diss., University of Miami, 1981), 90.
group consisted of 1,134 teachers, she was only able to locate and receive a response from 166 college-level instructors. Of the survey respondents, only 35% of teachers had performed multiphonics, 54% had performed vocalizations, 48% had performed microtones, 59% had performed slide removals, and 51% had performance experience with reading from multiple staves.

While only about half of respondents reported to have experience with these techniques, 73.2% of those surveyed stated that they believed extended techniques were “a necessary element of a trumpet student’s studies.” A majority of the respondents believed students should have experience in multiphonics (70%), vocalizations (69%), microtones (56%), slide removals (72%), percussive effects (70%), and multiple stave reading (51%), before completing their undergraduate degree. Although it represents a relatively small sample of undergraduate professors, Cherry’s survey demonstrates a growing trend of interest in the pedagogy of extended techniques.

**Common Goals of Collegiate Trumpet Instructors**

The curriculum for undergraduate trumpet study, unlike that of other academic disciplines, cannot be delineated into a strict schedule of material. When students enter their college years, they begin with a personally-specific set of technical and musical strengths and weaknesses.

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19 Cherry, 163-4.

20 Ibid., 166.

21 Ibid., 171.

22 Ibid., 174.
Research and anecdotal evidence relating to the specific teaching styles of renowned pedagogues illustrate a common denominator present in the teaching processes of successful trumpet studios. A study by Derek Ganong on Laurie Frink’s trumpet teaching demonstrates how her weekly routine was determined by both the individual student and the “specific variations” in their skills. A student’s response to her exercises provided her with feedback to make an informed decision on which materials to assign next.\(^\text{23}\) Despite there being a similarity in the content of her exercises, no two weekly routines were identical from one student to the next.\(^\text{24}\) Similarly, Bradley Sargent’s study on Vincent Chicowicz described the pedagogue’s assignments as “highly flexible” for the undergraduate students while the lessons had a core structure to address specific fundamental issues that were identified across the studio.\(^\text{25}\) One of the goals of the lessons given by Vince DiMartino and Armando Ghitalla was to “discover weaknesses” and to teach students to become self-reliant in addressing their own issues.\(^\text{26}\)

Ghitalla stated that “it is the job of the teacher to find all of the things the student can’t do,” and then provide instruction (presumably oriented towards these perceived deficiencies).\(^\text{27}\) The goal of the successful instructor, the evidence seems to suggest, is not just to help the students improve in a general sense, but also to assist them in

\(^{23}\) Derek Ganong, “Laurie Frink’s Method of Trumpet Instruction” (DMA diss., University of Miami, 2015), 81.

\(^{24}\) Ibid., 82.


\(^{26}\) Ibid., 29-30.

\(^{27}\) Ibid., 23.
developing strategies for independent improvement in the areas in which they are the weakest.

The exercises composed as a part of this doctoral essay are structured to accommodate a flexible approach to teaching trumpet. The fundamental techniques chosen are based on the primary technical goals of college-level students and their teachers. Based on a survey done of undergraduate trumpet players, articulation, production, range, and flexibility of tone/timbre were the aspects of their technique that they felt they most needed to improve.\(^\text{28}\) Thus, the exercises of this study are designed to focus on improving at least one of these four categories, and have been organized in a tiered sequence based on the difficulty that the techniques pose. The most basic of fundamentals are prioritized in the first levels of each, but require more advanced trumpet technique as the exercises progress.

Because most students enter the undergraduate trumpet studio with multiple fundamental deficiencies, in most cases they should be allowed a certain amount of time to reach a baseline of proficiency before approaching advanced repertoire. A survey of trumpet pedagogues, done by Matthew Inkster as part of his 1997 dissertation, outlined the strategies that trumpet instructors felt were important to include in their teaching. The consensus was that before any repertoire was introduced, the student should spend a significant amount of their time focusing on fundamentals.\(^\text{29}\) Another important priority that emerged was that the student must reach a consistent level of proficiency in all areas,

\(^{28}\) Jennifer Brown, “Student Perceptions of Skills Learned in Undergraduate Applied Trumpet Lessons” (DMA diss., University of Illinois at Urbana-Champaign, 2015), 52.

so that they develop a well-rounded set of skills.\textsuperscript{30} The goal is to prepare them for performance literature by their junior year.\textsuperscript{31} Several professors also acknowledged that students should not play music that is “over their head or beyond their musical development.”\textsuperscript{32}

To date, most studies in extended techniques have been designed to assist in the preparation of a piece containing these specialized performance needs.\textsuperscript{33} The primary issue with this approach is the fact that the pieces containing these techniques generally require a highly virtuosic level of trumpet playing. Attempting to learn repertoire the student is not fundamentally and musically prepared for can lead to the creation of bad habits through the development of muscle memory rooted in performance mistakes. To avoid these issues while training to use extended techniques, the exercises presented here are isolated from otherwise challenging notational and compositional context and are presented in a methodical way. For instructors who wish to musically contextualize these techniques for either their own knowledge or for that of their students, the appendix of this essay details performance guides and extended technique guides that relate to specific representative works in the repertoire.

**Methods to Adapt**

Because the goal of this method is to integrate extended techniques into progressive mainstream exercises, it is important to model methods that are: (1) proven

\textsuperscript{30} Ibid., 106.
\textsuperscript{31} Ibid., 105-6.
\textsuperscript{32} Ibid., 103.
\textsuperscript{33} Cherry, 15.
successful in developing fundamentals, (2) were considered mainstream methods by trumpet instructors, and (3) had descriptions of specific approaches that could be utilized in this study. Inkster and Cherry’s surveys of instructors helped identify the following three books that focused on basic fundamentals:

- *Daily Drills and Technical Studies for Trumpet* by Max Schlossberg.\(^{34}\)

In Cherry’s study, some instructors stated that they adapted exercises from these method books to develop particular extended techniques.\(^{35}\) Incorporating extended techniques into exercises within these etude collections gives both teachers and students a familiar approach to new material, while also providing strategies for further adaptations on their own.

Additionally, some methods were used that contain exercises that are similar to basic technical studies but have a specific set of rules the player is required to follow. These methodologies seek the most efficient routes to develop basic fundamentals. If particular extended techniques require the development of fundamentals, adapting these methods to include the former can accelerate progress in both veins simultaneously. The methods used were selected in part based on the availability of studies which explicitly outlined a specific approach to performing them. The three chosen were:

- *Methode Complete de Trompette Modern, de Cornet et de Bugle* by Merri Franquin.

\(^{34}\) Inkster, 125-6.

\(^{35}\) Cherry, 191-5.
• *Flexus: Trumpet Clasthenics for the Modern Improviser* by Laurie Frink and John McNeil.

• *Warm-Ups and Studies* by James Stamp.

Three commentaries on these method texts are also consulted in this essay and are drawn upon as they become salient: Geoffrey Shamu’s study on Merri Franquin’s method, Derek Ganong’s study on Caruso-based pedagogue Laurie Frink’s method, and Daniel King’s study of the methods by James Stamp and Carmine Caruso. These analyses of the various methods proposed as models here provide insight that is useful in adapting them in proper accordance with their philosophical approaches and specific aims.

**Categorizing the Techniques**

Each technique is organized into sections based on three aspects: the procedures to produce the effect, the problems found when preparing the technique, and strategies built from research and experimentation. A graded set of exercises has been created using a level-by-level procedure based on the difficulty each technique generally poses for the student. Because these techniques are being removed from the context of any specific composition, no symbols will be intentionally related to the way in which the various techniques are notationally represented in any given work. The fundamental skillsets required to prepare them are discussed in the extant literature on contemporary trumpet work. The surveys and guides to extended techniques by Amy Cherry, William Denton, and Attilio Tribuzi provide common data to group techniques together based on the four primary fundamental groups discussed in the previous section. Performance guides and articles by Jen Baker, Daniel Keberle, and Courtney Jones have all been used to further
corroborate these categorizations. Basic fundamentals of necessity take precedence in the
categorization, however the exercises incorporate more advanced trumpet technique as
the levels of each exercise increase.

Sets of Techniques and Levels

Techniques omitted from this study were excluded for one of three reasons:

1. They did not address or require the development of any fundamental trumpet playing skill.
2. They have been thoroughly absorbed into mainstream trumpet methodology.
3. There was no research providing an approach to performing them that could be corroborated anecdotally or otherwise.

The techniques have been grouped together based on the common fundamental skills developed and are organized in levels based on how advanced those fundamentals have to be. They are organized as such:

• Lip Techniques – Endurance and Flexibility
• Transitional Tonguing – Articulation
• Vocalizations – Immediate Production
• Multiphonics – Sustained Production
• Slide/Valve Techniques – Lip Flexibility

A separate chapter is dedicated to each of these sets of techniques. The grading of each set of exercises is based on deconstructing them into secondary techniques in order provide an instructor with a clear understanding of which fundamental and secondary skills are being developed. Explanations gathered from Norman Hunt’s Guide to Teaching Brass are given to explicate the specifics of each introduced fundamental. With
exception to multiphonics, each section is divided into four levels. They are organized as follows:

- Level One: Develop Required Fundamentals for Basic Production of Each Technique
- Level Two: Build a Basic Proficiency in the Techniques of the Set
- Level Three: Push the Boundaries of Technical Limitations for Each Technique
- Level Four: Demonstrate Fluency and Seamless Transition Between the Techniques

For each level, there is an included description of the fundamentals required, various strategies that have been successfully used to perform the technique, the original exercise that it was adapted from, and a detailed rubric of instruction for the student. The goal of these exercises is to provide any teacher who wishes to develop a practice routine based on successful trumpet curriculum models a resource to expand the palate of their students’ musical vocabularies and further hone fundamental skills. They are encouraged to select freely from and experiment with these exercises and their variants without any strict narrative. It is further suggested that the instructor take care to maintain a balance between those fundamentals which are being developed in tandem with these exercises.

As with language, skillsets, and habits, younger musicians perhaps have the greatest amount of mental plasticity and fast learning skills. Thus, another important goal of these fundamental exercises is to provide young players with resources to develop the same foundation for techniques like multiphonics and vocalizations that they currently have for more traditional techniques, such as double-tonguing and lip trills. This will give them an early grounding in these more advanced techniques, which are increasingly required of professional trumpet players.
CHAPTER 2
Lip Techniques

Many extended techniques required of the trumpet rely on fundamental lip flexibility and aperture control. However, there are a few specific techniques that focus solely on the lip. In Tribuzi’s study, he lists the following lip-based techniques as extended “jazz” techniques: glissandi, vibrato variations, and the shake.36 Cherry and Denton both add microtonal lip bends to this list and provide performance guides and notational contexts pertaining to these techniques.37 There is little extant technical literature on performing split tones on the trumpet because of their recent introduction to the sonic palate of the instrument, but they have been receiving increased attention due to their presence in performances by Ensemble Musikfabrik38 and the improvisations of Peter Evans.39 Accordingly, split tones have been added to the list of lip techniques that have been adapted in these exercises.

Cherry’s study brings up lip vibrato as an extended technique in instances when composers dictate strict parameters for the speed or quality.40 In this chapter these techniques are described and the fundamental skills required to perform them are organized based on the extent to which this fundamental is practiced. An overview of the


40 Cherry, 101.
exercises used are detailed and the strategies in developing the adaptive exercises are outlined. The exercises detail the purpose and approach to each level and explicate the original examples.

**Types of Extended Lip Techniques**

**Split Tones**

Example 2.1 Split tone notation.

![Example 2.1 Split tone notation.](image)

When performing a long tone, the split tone occurs when the embouchure is pinched to the smallest possible aperture. The result is a solid distortion effect that consists of the note two octaves below and the nearest partial above the original pitch. Because of their relationship to the harmonic series, as split tones are performed in higher registers, there are more opportunities for rich harmonics. A link to an aural example of this technique is provided in the footnote below.⁴¹

**Microtonal Lip Bends**

Example 2.2 Microtonal lip bend notation.

![Example 2.2 Microtonal lip bend notation.](image)

Lip bends are the slight alteration of the aperture accompanied by a change in airspeed to either move the pitch up or down without valve or slide movement. The bend

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into a microtone can be characterized as a “miniature glissando”. The pitch is considered microtonal if it falls inside the frequency spectrum of a semitone but it is most often rounded to a quartertone. An aural example has been provided of general lip bend technique in the footnote below.43

**Transitional Vibrato**

Example 2.3 Transitional vibrato notation.

While there are multiple ways to develop standard vibrato, lip vibrato is the best for a large spectrum of oscillation in pitch and color. Transitional vibrato requires the ability to control a range of slow to extremely fast oscillations based on lip fluctuations.

**Transitional Trills and Shakes**

Example 2.4 Transitional trill and shake notation.

Lip trills are characterized by whole-tone repetitions without any valve movement. The shake uses the same type of trill, but adds the movement of the trumpet in a subtle back and forth motion without removing the mouthpiece from the embouchure.44 The resulting effect imbues the lip trill with a “bumpier” rhythm and dynamic. While some of the lip techniques in this study, such as vibrato and the shake,

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42 Denton, 39.


44 Denton, 30.
have been prevalent in music for a long time, rapid technical transitions and their usage in the extreme upper and lower registers are a new requirement in contemporary literature.

**Fundamental Skills Required for Effective Performance of Lip Techniques**

Problems in the performance of lip techniques generally stem from deficiencies in consistency of control and maintenance of the “fixed jaw position” for the embouchure.\(^{45}\) It is particularly difficult to maintain position for the shake because it involves the back and forth motion of the hand at a steady pace.\(^{46}\) Building a reliable fixed embouchure correlates with the “calisthenic” practice of muscles that form and manipulate it.\(^{47}\) Isometric tension and relaxation of the muscles build “both strength and develop flexibility” when kept in balance.\(^{48}\) The more the lip can build its flexibility and strength, the more a vibrato, trill, shake, and bend can all be completely controlled and their transitions navigated. The fundamental skills that have the greatest effect on the performance of lip techniques are:

- Lip Endurance and Efficiency
- Lip Flexibility
- Range
- Mouthpiece Placement and Embouchure Security

\(^{45}\) Cherry, 107.

\(^{46}\) Denton, 30.


\(^{48}\) Ibid, 27.
While the split tone is one of the newer techniques found in contemporary literature, it has gained attention from many composers and is growing more popular with current virtuosic musicians.\(^49\) Though it will require time, surveys, and further corroborative research, anecdotal evidence indicates that practice with this technique has yielded similar developmental results to the other lip techniques in the section.

**Exercises for Lip Techniques**

The exercises to develop extended lip techniques are organized as follows:

- **Level One Exercises:** Long Tones Using Split Tones, Lipped Microtones, and Varying Vibratos
- **Level Two Exercises:** Long Tones Using Lip Trills and Shakes
- **Level Three Exercises:** Scales with Alternations of Lip Techniques
- **Level Four Exercises:** Scales Transitioning Between Lip Techniques

Because the primary fundamental skills required to perform these techniques are lip endurance and efficiency, the first two exercises are adapted from Caruso’s method. *Six Notes*, which is derived from the method, focuses on performing long tones after a breath attack and nasal breath.\(^50\) The concept of “long-setting” is what will develop the stability needed for a secure aperture where the “lips come together.”\(^51\) *Six Notes* are repeated and follow Laurie Frink and John McNeil’s set of variations incorporating lip


\(^51\) Ganong, 60.
bends and changes in dynamics and registers.\textsuperscript{52} The player will want to focus on developing their bent and split tones until notes above the high A and below the low E are equally controllable.

Example 2.5 \textit{Flexus} by Laurie Frink and John McNeil.

\textbf{Flexus} by Laurie Frink and John McNeil.

\begin{example}
\textit{Flexus} exercises combine a focus on lip flexibility with lip endurance fundamentals. An example from Markus Stockhausen’s book \textit{Basic Caruso} presents the way the seconds are written.\textsuperscript{53}
\end{example}

\begin{itemize}
\item Because Caruso’s basic exercises are so heavily focused on the security of aperture control and jaw placement, level two exercises will also be based on them to combine a focus on lip flexibility with lip endurance fundamentals. The \textit{Seconds} exercise from Caruso’s method are used for these exercises. An example from Markus Stockhausen’s book \textit{Basic Caruso} presents the way the seconds are written.\textsuperscript{53}
\end{itemize}

\textsuperscript{52} Laurie Frink and John McNeil, \textit{Flexus: Trumpet Calisthenics for the Modern Improviser} (Brooklyn, N.Y.: Omni Tone Press, 2003), 13-16

\textsuperscript{53} Stockhausen, 4.
Example 2.6 Basic Caruso by Markus Stockhausen.

2. Seconds

The next step for students is to increase the speed and response in these techniques as well as to expand their range. To organize a series of exercises in developing this, Stamp’s *Trill Exercises* starting on F has been modeled here.\(^{54}\)

Example 2.7 *Trill Exercises* by James Stamp.

The goal of the final exercises are for transitional fluency and to push the boundaries of speed and range. Herbert Clarke’s *Study #4* is a beneficial one, because of its potential for limitless repetition.\(^{55}\)

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Example 2.8 *Technical Studies for Cornet* by Herbert L. Clarke.

Level One Exercises

Long Tones Using Split Tones, Lipped Quartertones, and Varying Vibrato

All techniques in this particular set require the same fundamental skills. Security in the placement of the mouthpiece in all registers is a common issue, and Carmine Caruso’s basic routine is the best known for its focus on developing this. The two exercises to be practiced are *Six Notes* and Stamp’s *Lip Bends*. The ancillary benefits that can result from these exercises include the development of better flexibility in lip bending, which also requires refined aperture control, a desired trait in any style of trumpet performance.

Fundamental Technique Involved

- Mouthpiece Placement and Embouchure Security
- Lip Endurance
- Aperture Development

Exercise Used

- Carmine Caruso’s *Six Notes*
- James Stamp’s *Lip Bends*
Approach

1. Split Tone Development Exercises

   • While buzzing the lips without the mouthpiece, work to vibrate the smallest possible aperture (mosquito buzz) the middle of the embouchure. Work to strengthen that.

   • When the mosquito buzz is developed, attempt the same maneuver on the trumpet.

   • When a double buzz occurs, work to control both tones until they become more resonant.

   • Once they reform into a solid but dispersed tone, the split tone will be reached.

2. Six Notes

   • Tap your non-dominant foot at sixty beats per minute.

   • Breathe only through the nose two beats before initial attack.

   • Breath attack each set of repeated notes.

   • Do not remove the trumpet from embouchure until completing the exercise.

   • Maintain an overall soft dynamic. 56

   • Perform the exercise only once, do not return to middle G.

   • If the split tone has not been developed yet, skip over it.

   • Ensure that the lip bend is a full semitone to obtain full control over the bend.

3. Six Notes Variations

   • These variations are for when the basic Six Notes can be performed with ease.

   • For the lip bends, practice with a tuner to assure the pitch is 50 cents between the starting semitone.

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56 Six Notes directions are from Markus Stockhausen’s Basic Caruso, 4.
• Apply a slight “pinch” of the aperture to raise the pitch and a slight “widening” of the aperture to lower it.  

• For the vibrato, use the same approach to lip bends, oscillating the opening and closing of the aperture. The size of the notated vibrato indicates speed.

• Practice speeding up and slowing down the oscillation.

• Apply a fermata to the whole note if needed for further practice of the vibrato speed.

• These variations can be interchanged at any time throughout the exercise.

4. Extended Six Notes

• After the first set of Six Notes, the student can execute an optional repeat from low C onwards.

• Do not take the horn off of the face after first set of Six Notes.

• The goal is to expand the lip endurance and embouchure integrity of the player.

• Always remember to stop if there is any excess fatigue or soreness.

Example 2.9 Adapted Six Notes.

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Example 2.10 *Six Notes Variations.*

Example 2.11 Suggested Notes for Second Repetition for *Six Notes.*

**Level Two Exercises**

**Long Tones Using Lip Trills and Shakes**

While these exercises are primarily used as an aide to developing the upper register, they are also meant to develop a sense of interval relationships that are as
“reflexive as possible.” Because “second setting” (taking off the horn and starting where you left off) is a common use in all of the modern variances of Caruso’s interval exercises, these are used as a way to address the variations between lip trills and shakes. The exercises start as normal Seconds, with the same Caruso rules before transitioning into chromatic exercises once reaching the partials for lip trills on F in the treble staff. The first setting will focus on slow movement between each interval on the same valve placement moving up a semitone at a time as high as possible. The second setting will then incorporate the back and forth movement of the shake at double speed of the trill. The player should not continue on until the mouthpiece and aperture feel consistent with the middle setting that the interval exercises start on. The previous exercises should still be done to continue developing the split tone and lip bend in tandem with these exercises.

**Fundamental Technique Involved**

- Mouthpiece Placement and Embouchure Security
- Lip Flexibility
- Range

**Exercises Used**

- Carmine Caruso’s Seconds

**Approach**

1. Seconds

- Follow all of the same rules as in the Six Notes.

- When reaching the note for the shake, use the “right hand” with the “finger hook” to move the horn back and forth in time with the lip trill.59

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58 Ganong, 63.

59 Denton, 30.
• The shake can be skipped until it can be mastered separately if needed.

• Keep a steady tempo throughout the exercise.\textsuperscript{60}

• Try to maintain a soft dynamic.

2. Variations

• Approach the variation once the original tempo can be performed smoothly.

• Practice different vibrato speeds and explore applying a split tone or lip bend to the whole note.

• The overall tempo can be reduced and worked back up.

• Practice seamless interchange between the two trills.

• Once mastered, attempt adapting the exercise to the larger intervals from Caruso’s method book for greater interval flexibility.\textsuperscript{61}

\textsuperscript{60} Ibid.

\textsuperscript{61} Carmine Caruso, \textit{Musical Calisthenics for Brass} (Hollywood: Almo Publications, 1979), P#.
Example 2.12 Adapted Seconds.
Example 2.13 Variations for Seconds.

Level Three Exercises

Scales with Alternations of Lip Techniques

The goals of the trill exercises in Stamp’s method is to develop the facile interchange between the valve trill and lip trill. Each exercise is repeated three times and incorporates the notes leading into the repeat and the held note at the end which will be held as a fermata. Each iteration is focused on combining split tones and lip trills, lip bends and shakes, or vibrato and valve trills. When the player is able to reach the goal tempo with ease, they will be ready to continue on to the final set of exercises.

Fundamental Technique Involved

• Mouthpiece Placement
• Embouchure Security
• Lip Flexibility

Exercises Used

• James Stamp’s Trill Exercises

Approach

1. Interchanging Trills
• Start the exercise at 80 beats per minute and work towards 120 to 140.

• Add contrasting dynamics to each of the three repetitions.

• The *Six Notes* rules of the previous exercises no longer apply.

• The exercise can be completely repeated in each key.

• Swap in microtonal lip bends and split tones to the dotted quarters and whole notes instead of vibrato for variation.

• A notation key for the scale and fingering for the tremolo are provided in example 2.15.

Example 2.14 Adapted Stamp *Trills.*
Example 2.15 Additional Scale Options.

Level Four Exercises

Scales Transitioning Between Lip Techniques

Based on the *Fourth Technical Study* by Clarke, this exercise will begin and end with split tones or vibrato held with a fermata. The repeated patterns will interchange between lip bends and valve trills on the lower octave and lip trills and shakes on the upper octave. As with the previous exercise, it will begin on the F, where the lip and valve trill can be interchangeable. Since the goal is to push boundaries, there is potentially no limit to how far these exercises can be taken in terms of range and tempo.

**Fundamental Technique Involved**

- Mouthpiece Placement and Embouchure Security
- Lip Endurance and Efficiency
- Lip Flexibility
- Range

**Exercise Used**

- Herbert L. Clarke’s *Technical Study #4*
Approach

• Aim to reach a speed that allows for four to eight repetitions in one breath.

• Incorporate the variations once enough repetitions can be done to perform each one.

• While performing variations, start the exercise at as soft a dynamic as possible, crescendo to as loud as possible and decrescendo back within each two bar segment. Attempt to do this within one bar as well.

• Push the boundaries of range in this exercise by increasing each key transposition by a semitone.
Example 2.16 Adapted Clarke *Fourth Study.*
Example 2.17 Clarke *Fourth Study* Variations and Alternate Fingerings.
CHAPTER 3

Transitional Tonguing

It has been established that some extended tonguing techniques such as flutter-tonguing are old enough to be considered standard technique. The necessity of transitioning between the technique of flutter-tonguing, rapid legato, doodle-, growl-, and multiple-tonguing, though, is relatively new and the practice of such dexterity also serves to reinforce the requirements of basic tonguing fundamentals.62 As stated by David Hickman, developed flutter-tonguing can act as a “guide to their most efficient and rapid tongue stroke”.63

In Ronald Brooks’ explanation of doodle-tonguing, the concept is presented as a form of slurring with a light added articulation throughout, caused by the flicking of a tongue. While Clark Terry’s version of doodle-tonguing, which is produced by pronouncing the vowels “a-e-i-o-u” including a “d” articulation, is considered the traditional practice, it was discovered by performers that passages of doodle-tonguing in works such as Luciano Berio’s Sequenza X could not be accomplished with this standard approach.64

The required speed and clarity were found to be better realized through rapid legato double-tonguing, which soon became a distinct technique, lying somewhere

62 Cherry, 56.


64 Christopher Burbank, “Doodle Tongue: Jazz Articulation for the Trumpet Player” (DMA diss., University of Miami, 2014), 96.
between doodle- and multiple-tonguing. Rapid legato allows for a faster execution of line and improved transparency over doodle or slurring, but allows for less of a defined articulation than multiple-tonguing by using an “n” articulation. The growl, which is sometimes used as a substitute for flutter-tonguing, is a more guttural-sounding effect.

**Flutter-tongue**

Example 3.1 Flutter-tongue notation.

```
\texttt{Fl}_2, \ldots, \ldots, \texttt{I}
```

The flutter-tongue is the interruption of a sustained note with a rolled trill in the front of the tongue. As with the vocalized rolled “r” or “tr”, the result is a choppy aggressive effect similar to the sound of a “car or airplane” motor. \(^{65}\) The position of the tongue stays behind the upper teeth, but remains relaxed to allow the chopping effect to stay consistent. \(^{66}\)

**Doodle-tongue**

Example 3.2 Doodle-tongue notation.

```
\texttt{D}l, \ldots, \ldots, \texttt{I}
```

Doodle-tonguing is characterized as a fast, non-defined articulation. Instead of the standard “ta” and “ka” syllables of multiple-tonguing, the player uses a “d” consonant and interchanges the vowels “a-e-i-o-u” between “dle” glottal to keep the tongue moving

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\(^{65}\) Hunt and Bachelder, 45.

\(^{66}\) Denton, 3.
quickly.\textsuperscript{67} The sound of the articulation is like a relaxed multiple-tongue with little
definition in the re-articulations. An aural Example of Clark Terry teaching the technique
has been provided in the footnote below to demonstrate the distinction between it and
rapid legato tongue.\textsuperscript{68}

\textbf{Rapid Legato Tonguing}

Like doodle-tonguing, the goal of rapid legato tonguing is to create a more rapid
but less defined multiple-tonguing. This is achieved by replacing the “ta” and “ka”
syllables with “nuh” and “guh” syllables. The close relationship of these to traditional
multiple-tonguing make it easier to develop and create a slightly higher definition than
the doodle tongue, allowing for incorporation into rapid moving passages that require
both speed and a modicum of clarity.\textsuperscript{69} There have been arguments that it is an alternative
form of doodle-tonguing, however the two techniques are significantly different. The
rapid legato tongue allows for a “contradiction” of the staccato-sounding multiple-
tongue, without the completely undefined doodle effect.\textsuperscript{70} An aural example provided in
the footnote below demonstrates the distinction between a fast legato phrase that still has
multiple-tongue clarity and other tonguing techniques.\textsuperscript{71}

\textsuperscript{67} Burbank, 61.

\textsuperscript{68} Raul Sanchez, “Clark Terry - Student Performance and Master Class - ArtistshouseMusic,”

\textsuperscript{69} Burbank, 96.

\textsuperscript{70} Ibid., 95.

\textsuperscript{71} Pelodelperro. “Luciano Berio - Sequenza X (1/2),” \textit{YouTube} video, 6:00, June 9, 2010,
https://youtu.be/ivVnv5K3JCQ?t=94. Extracted from \textit{All the Sequenzas for Solo Instrument}, Ensemble
Intercontemporain, Gabriele Cassone, trumpet, (Deutsche Grammophone, 1998).
Growl-tongue

Example 3.3 Growl-tongue notation.

\[\text{Growl-tongue notation.}\]

The growl-tongue is like the flutter-tongue, except that it rolls the back of the tongue and throat based on the “guh” syllable. The resulting effect is more delayed and guttural than the flutter-tongue, since its source is deeper in the oral cavity of the performer.\(^{72}\)

Fundamental Skills Required for Advanced Tonguing Techniques

Students must develop control over their tongue placement, airflow with articulation, and overall clarity in order to succeed at transitioning between these tonguing techniques at rapid speeds. The tongue is “never used to stop the note” when performing these techniques, but to “initiate the sound” of the effects.\(^{73}\) Developing skills in transitioning quickly without interrupting the air can lead to improved speed and clarity in general articulation. These skills can also assist in the development of tone production control at softer dynamics and in extreme registers.\(^{74}\) For example, one problem encountered in producing the growl is the effects it has on airflow, due to the “alterations of the oral cavity” which also makes extreme dynamics and registers difficult to control and perform in while maintaining consistent tone production.\(^{75}\) Lastly, it is a

\(^{72}\) Cherry, 52-53.

\(^{73}\) Hunt and Bachelder, 40.

\(^{74}\) Denton, 3.

\(^{75}\) Cherry, 64.
priority in articulation to “coordinate” fingers and slides with the airflow to achieve clean articulation throughout. The fundamental skills that have the greatest impact on the performance of advanced tonguing techniques are:

- Articulation Clarity
- Tongue Dexterity
- Coordination of Tongue and Fingers
- Articulation Flow
- Endurance and Efficiency

**Exercises for Transitional Tonguing**

The exercises to develop advanced transitional tonguing techniques are organized as follows:

- **Level One Exercises:** Developing Individual Tongue Techniques
- **Level Two:** Slow Transitioning Between Tongue Techniques
- **Level Three:** Rapid Transitioning Between Tongue Techniques
- **Level Four:** Rapid Transitioning with Scalar Movement

The articulation exercises by Franquin are used for this exercise, since the goals behind them are focused on the basic mechanics of fundamental articulation: they particularly emphasize maintaining a relaxed “tongue and opening up the oral cavity.” It should also be noted that Franquin’s approach follows a pattern for negotiating rapid tempi that is related to the consonant usage of doodle tonguing and the glottal syllables of

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76 Hunt and Bachelder, 40.

77 Geoffrey Shamu, “Merri Franquin and His Contribution to the Art of Trumpet Playing” (DMA diss., Boston University, 2009).
rapid legato tonguing; he suggests “d” and “g” consonants as alternatives to “t” and “k.”

Combining these concepts with the multiple-tonguing exercises by Franquin allows for a continuity of development through all tongue techniques and encourages the development of fundamental skills that are required for even the most basic of tonguing techniques. The exercises are based on the *Application du coup de langue binaire au rythme ternaire* section of Franquin’s complete method. The specific exercise used is number twenty and its alternate, which requires transition only between syllables, rather than changing pitches and dynamics.

Example 3.4 *Methode Complete de Trompette Moderne* by Merri Franquin.

Using the exercises from Arban’s *Tonguing* section, the goal of the next exercise is to maintain clarity of each note and allow the techniques to “color” the articulation, keeping with the desired open and relaxed oral orientation. The exercises suggested for further practice in this section are the repetitive multiple-tonguing exercises in pages 170-

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179 to allow students options to independently adapt their newly developed tongue technique to a variety of material and explore scalar and intervallic passages.

The Stamp method is used for the final set of exercises. As stated in the Alan Vizzutti preface for the Arban exercises, the final third element required for proper multiple-tonguing is the coordination between tongue, valve, and finger to assist in clarity. Achieving this with every type of technique and successfully transitioning between them rapidly will allow for a solid foundation in the skill. The *Staccato Control* exercises are used to successfully achieve these “rapidly articulated sounds” at “all volumes and speeds”. The exercises are given repeat signs to encourage pushing the boundaries of development in these transitioning technical patterns.

Example 3.5 *Staccato Control* by James Stamp.

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80 Ibid.

Level One Exercises

Individual Tonguing Techniques: Doodle, Growl, Flutter, Rapid Legato

These initial exercises use the long note drills of Max Schlossberg. They start with speech exercises from the studies by Denton and Burbank, then add lip buzzing, mouthpiece buzzing, and finally trumpet production in basic registers without any added dynamics.

Fundamental Technique Involved

- Airflow and Articulation
- Dynamic Control
- Tongue Placement
- Resistance and Tension Control

Exercise Used

- Max Schlossberg’s *Long Note Drills*

Approach

1. Doodle-tonguing

- The concepts from Clark Terry’s version of doodle tonguing come from first practicing the speech patterns of “d” and “l” consonants against “a-e-i-o-u” syllables, thus creating a fast form of speech sounding “d-ay-dle-dee-dle-dle-die-dle-do-dle-doo-dle.”

- These can also be practiced on specific syllables, for example repeating the “doo-dle” syllables.

- Practicing speaking the syllables before attempting them on the mouthpiece.

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83 Burbank, 61.

84 Denton, 7.
• Practice the passage below on the trumpet at a slow tempo and aim to make it as smooth as possible.

Example 3.6 Doodle syllables.

2. Rapid Legato Tonguing

• Begin by speaking the normal multiple-tongue syllables “t” and “k”, for example: “ta-ka-ta-ka” and then trade the consonants with “n” and “g” and using the vowel “uh” to keep the tongue positioned to the roof of the mouth, speaking “nuh-guh-nuh-guh”.\[85\]

• Try to retain a small amount of clarity in the way the tongue articulates.

• Play the passage below, repeating it at a slow tempo, and alternating between defined multiple-tongue syllables and legato syllables.

• Trade off between these articulations and the “ta-ka” articulations of the multiple-tongue technique.

Example 3.7 Rapid legato tongue.

3. Flutter- and growl-tongue

• As seen in Cherry’s surveys, the best way to develop an initial flutter-tongue is through speech exercises using the “T” and “D” consonants to initiate the roll.\[86\]

• This roll will take some time to develop and lengthen and will only be continually reliable once the tongue can fully relax.

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\[85\] This exact approach has not been corroborated by outside research and is this author’s discovery.

\[86\] Cherry, 65.
• The growl-tongue follows the same process as flutter-tonguing, but using the “G” or “guh” sound instead of the “T” or “D”.

• The same result is desired, namely that the back of the tongue will stay relaxed enough to provide immediacy and continuity of the effect.

• Roll both the back and the front of the tongue in spurts.
• Once the tongue can continually trill or growl, apply mouthpiece pressure.

• Repeat the same process until a sustained flutter and growl occur.

4. Schlossberg Exercises.

• Apply the techniques above to the basic long tone exercises by Schlossberg.

• Attempt a similar tremolo effect to the flutter and growl in the doodle and growl.

• Decrescendo to test the limits of flutter and growl production.

• Test ranges of these effects as well.\textsuperscript{87}

• Focus on clear distinction of syllables and effects rather than tempo.

• Focus on different tongue placement for each technique.

\textsuperscript{87} Cherry, 64.
Example 3.8 Long Note Drills by Max Schlossberg.

Level Two Exercises

Slow Transitioning Between Tongue Techniques

These exercises will assist performers who have developed all four techniques and want to achieve success in transitioning between them and multiple-tonguing.

Fundamental Technique Involved

• Tongue Agility and Control
• Articulation Clarity
• Resistance and Tension Control

Exercise Used

• Merri Franquin’s Application du Coup de Langue Binaire au Rythme Ternaire
Approach

1. Slow Alternation Between Tonguing Effects

   - Start at a tempo that allows for clear distinction between techniques.

   - Once clarity is reached add a crescendo and decrescendo.

   - Attempt to push the boundaries of dynamic extremes.

   - Explore in all keys and registers.

   - Exchange the rapid legato with the doodle in the triplets and duplets. Apply “nuh-nuh-guh” syllables to the rapid legato and “doo-dl-Day-ah-dl-day-ah-dl-day” syllables to the doodle tongue.88

   - Aim for multiple-tongue speeds from 120 to 132 beats per minute.

Example 3.9 Alternating tonguing.

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Level Three Exercises

Rapid Transitioning Between Tongue Techniques in Different Dynamics and Registers

The next exercises are especially difficult, because they incorporate the coordination of fingers while alternating tonguing. Once these exercises have reached a multiple-tongued tempo of 120 to 132 beats per minute with ease, the next set of

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88 Burbank, 189.
exercises can be undertaken. Much success has come from adapting Arban exercises to improve flutter-tonguing. 89 Similar results can be achieved by applying these exercises to other transitional tonguing techniques.

**Fundamental Technique Involved**

- Articulation Clarity
- Coordination of Tongue and Fingers

**Exercise Used**

- Jean-Baptiste Arban’s *Tonguing*

**Approach**

Tongue Alternation with Pitch Movement

- Maintain a slow tempo at first to allow for incorporation of fingers.
- Maintain the same standard of distinction between tonguing patterns.
- Alternate the syllables to occasionally trick the tongue.
- Make the goal tempo a standard multiple-tongue speed.
- When the main exercise can be performed with ease, continue adapting the alternating syllables to the Arban’s method.
- Apply syllable alternations to exercises: 11-13, 24-25, 31, and 80-83. 90

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90 Arban, 171-209
Example 3.10 Adapted Arban Tonguing.

Level Four Exercises

Rapid Transitioning with Scalar and Intervallic Movement

The goal of these final exercises is to successfully develop coordinated scalar and intervallic tonguing technique along with rapid transitional tonguing.

Fundamental Technique Involved

• Articulation Clarity

• Rapid Coordination of Tongue and Fingers

• Articulation Flow

• Endurance and Efficiency

Exercise Used

James Stamp’s Staccato Control

Approach

Smooth and fluent transition between the doodle, legato, and multiple-tongue

• Keep low at first to maintain flow and endurance through all registers.

• Repeat the exercise a step upwards continuing chromatically as high as possible.
• Once the exercises are smoothly performed, push the boundaries of tempo and dynamics.

• There are two other *Staccato Control* exercises in the Stamp method. Apply these alternating tongue strategies to them once the first exercises are performed with ease.

• Apply the flutter and growl to the half notes.

Example 3.11 Adapted *Staccato Control*
CHAPTER 4

Vocalizations

As opposed to the vocal sounds involved in producing multiphonics, advanced vocalizations consist of making pitched or non-pitched sounds with the voice, without producing normal tones on the trumpet simultaneously. This category of techniques covers a wide range of possibilities, from basic unpitched sounds with varying specificity of notation, to vocal noise and pitched sounds required of the performer in close alternation with normally produced tones. There are also instances of advanced, sometimes pointillistic phrases that require rapid shifts between singing and playing, incorporating both into connected gestures.

This set of extended techniques can be considerably effective in fundamental development because of the aural skills and embouchure security required. The acoustic benefits of this extended technique allow for a “hocket” melody where the played and sung line alternate rapidly. Multiple compositional effects are employed by interruptive grunts that can alter the dramatic tone of a melodic phrase and infuse theatricality to a musical performance. This chapter overviews how to smoothly transition between vocalizations and playing to achieve these effects.

91 Keberle, 17.

Screams and Noises

Example 4.1 Non-pitched vocalization notation.

![Example 4.1 Non-pitched vocalization notation.](image)

Basic vocalizations are characterized as any noise made with the voice without a pitch being played on the trumpet. These can range from screams, whistles, and grunts, to percussive and non-pitched noises. An aural example of sudden grunts and screams within a musical phrase is provided in the footnotes below.

Sung Pitches

Example 4.2 Notation of sung pitches.

![Example 4.2 Notation of sung pitches.](image)

Sung pitches require accurate intonation and at least a basic grasp of vocal technique to ensure that they are in the correct register and have the proper intervallic relationships both with each other and with any surrounding notes performed on the trumpet. Falsetto pitches require a change in throat position for singers. While some singers may naturally reach certain registers without changing position, those with a

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lower vocal range will need to practicing alternation of tongue and throat position to achieve an uninterrupted shift between registers.95

**Transitional Singing and Playing**

Example 4.3 Notation of alternating sung and played notes.

The goal of transitional singing and playing is to seamlessly shift between played and sung pitches. The level of fluency, required specificity in terms of pitch accuracy, and speed of transition can range from basic, easily-achieved patterns to advanced melodic gestures with rapid interchange between techniques.96 A link to a video providing an example of this type of technique is provided in the footnotes.97

**Fundamental Skills Required for Advanced Vocalizations**

Two of the key problems relating to these techniques that are identified in studies of extended technique practice and pedagogy are the activation of vocalization and the subsequent “reformation” of the embouchure.98 Norman Hunt’s guide groups embouchure formation and tone production development into the same category. He states that “no tone can be produced on a cup mouthpiece instrument unless the lips are

95 Keberle, 17.

96 Denton, 49.


98 Cherry, 53.
set into vibration by air passing between them.” \(^99\) The development of a proper embouchure requires precise alignment of the jaw and placement of the mouthpiece where there is proper cushioning and easy vibration without any “undue pressure.” \(^{100}\)

The reformation of the embouchure is a particularly important fundamental skill for trumpet players, especially those who also want to develop better endurance by practicing rapid removal and re-attack techniques. It is a crucial part of endurance for blood circulation to be maintained in the lips, so it is vital that players develop the skill of fluently readdressing their lips to the instrument during the course of a performance. \(^{101}\)

Vocalizations also require that the player develop their ability in “commencing” articulations (or attack articulations) that require strict “coordination with the embouchure”. \(^{102}\) As with multiphonics, vocalizations furthermore require significant aural skill proficiency, so that these exercises also encourage the performer to build their aptitude for auralization through the practice of maintaining accurate interval relationships between sung and played pitches. The primary fundamentals required for advanced vocalizations are:

- Embouchure Formation
- Immediacy of Production
- Clarity of Articulation
- Register and Dynamic Control
- Aural Skills

\(^{99}\) Hunt and Bachelder, 22.

\(^{100}\) Ibid, 23.

\(^{101}\) Ibid, 33.

\(^{102}\) Ibid, 38.
• Endurance

The first type of vocalization that students ought to study is a combination of basic trumpet pitch control and indeterminately-pitched screams. Next, the development of the falsetto register, if necessary, should be incorporated so that a lower-voiced performer might reach higher pitches than those in their natural vocal range. This is followed by the practice of basic “play-to-sing” exercises, where notes both sung and played are incorporated into single phrases. Lastly, advanced playing and singing techniques are addressed, wherein the sung pitches cover the gamut from mid-range to falsetto, and are alternated with played notes at a rapid pace.

Exercises for Vocalizations

The following exercises are organized below, in order of level and difficulty:

Level One Exercises: Basic Pitches and Screams
Level Two Exercises: Basic Pitches Between Playing
Level Three Exercises: Falsetto Pitches Between Playing
Level Four Exercises: Pointillistic Pitches Between Playing

The purpose of level one exercises is to reaffirm basic embouchure resetting, coordinated with basic vocal sounds like grunts and screams. They are modeled on the emission exercise from Franquin’s complete method.103

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103 Franquin, Methode Complete..., 115.
Franquin’s emission studies’ rules require the removal of the mouthpiece from the embouchure before re-articulating, in order for that articulation to be considered a “first note”. These notes are to be attacked with a soft dynamic and should be repeated if the note is not produced and restarted with a clean articulation. To mitigate the potential frustration involved in such an exacting and repetitive exercise, progress over time is intended to be the primary goal, rather than any perceived “mastery” of the study. This exercise is adapted to develop clear first attacks in conjunction with basic vocalizations, and to lay the groundwork for consistent rearticulation at faster speeds.

The initial articulation exercises of the Arban method are also a great starting point for building vocalization exercises, through their emphasis on two key skill sets in trumpet playing: the perception and reproduction of intervallic relationships and a secure embouchure. The foreword to the initial exercises states that the quality of the sound of the initial attack is an indicator of “relaxed airflow” and a “good embouchure”. One of

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104 Shamu, 51.
105 Ibid., 52.
the major indicators of poor trumpet tone control is the “buzzy beginner sound” caused by bad embouchure formation, which can became a habit that takes years to overcome.\textsuperscript{106}

Example 4.5 First Studies #11 by Jean-Baptiste Arban.

Exercises to develop faster and larger interval negotiation help to build upon the established fundamentals of re-articulation and reformation of the embouchure, while also developing the falsetto needed for singing higher pitches in the context of vocalization techniques. An adaptation of Arban’s \textit{Interval Studies} can assist with the development of vocalizations while simultaneously addressing more fundamental issues, such as articulation in more extreme registers, the regulation of air pressure, and the execution of repeated high notes.\textsuperscript{107}

Example 4.6 \textit{Interval Studies} by Jean-Baptiste Arban.

Developing fluency in performing these expanding intervals leads to automaticity in regards to the rapid airspeed needed for particular techniques (such as “Air-pulse accents” or sudden air bursts), as well as a more nuanced throat technique and aural sensitivity to rapid registral shifts.\textsuperscript{108}

\textsuperscript{106} Arban, 16.

\textsuperscript{107} Ibid., 131.

\textsuperscript{108} Ibid.
As with advanced multiphonic alternation studies, the final exercise is designed for students and performers seeking a virtuosic control of the hocket vocalization technique. *The Marcato Quick Register Change Exercises* in the Flexus book are excellent models in this regard.\(^{109}\) The goal of these is to first develop the strong “long setting” encountered in many Caruso based exercises and then address re-forming the embouchure between alternating sung and played pitches.\(^{110}\) This strikes a balance between fostering the efficiency found in long setting exercises and the security of “first articulation” exercises seen in Franquin. The desired result is twofold: that of attaining consistency in clear re-articulation and the development of long setting endurance.

Example 4.7 Quick Register Changes by Laurie Frink and John McNeil.

\(^{109}\) Frink and McNeil, 104.

\(^{110}\) Ibid., 98.
Level One Exercises

Alternation Between Playing and Vocalizing

The purpose of these exercises are to establish a foundation of production immediacy, embouchure formation, and seamless movement between the trumpet and the voice. The eventual results will allow for rapid hocket performance between the two types of pitch production.\(^{111}\)

Fundamental Technique Involved

- Embouchure Formation
- Immediacy of Production
- Throat Tension Control

Exercise Used

- Merri Franquin’s *Emission Exercises*

Approach

1. Secure Attacks and General Vocalizations

   - Perform at seventy-two beats per minute, as per Franquin’s method.
   - Do not move on from the C until there is an improvement of clarity.
   - Continue chromatically in alternating directions, giving attention to all registers.
   - Maintain a *pp* dynamic to ensure a clear easy and immediate re-articulation.
   - Emphasize extreme clarity, especially in regards to the first note.
   - Aim for the mouthpiece to be on the embouchure within the prior eighth note.
   - Practice vocalizing in upper and lower registers to prepare the throat.

\(^{111}\) Keberle, 20.
Example 4.8 Adapting the *Emission Exercises.*

![Example exercise notation](image)

**Level Two Exercises**

**Alternation Between Playing and Singing Pitches**

These exercises are a primary tool for identifying basic problems with embouchure and sound resulting from re-articulations and basic intervals. Incorporating basic sung interval relationships using a metronome and tuner/drone at a slow tempo will develop both proper resonance and skills in embouchure re-formation.

**Fundamental Technique Involved**

- Immediacy of Production
- Embouchure Formation
- Aural Skills

**Exercise Used**

Jean-Baptiste Arban’s *First Studies, #11*

**Approach**

Alternating in the Middle Register

- Use a tuner extensively to ensure that sung pitches are centered.
- Aim for a pleasing quality of sound and articulation.
- Work to eliminate any fuzzy or dull responses.
- Take advantage of the singing to maintain a relaxed airflow when playing.
- Keep at a moderato tempo and *mf* dynamic.
- Apply the same vocalization methods to studies #12-15 for more variety.
• Continue on when played and sung intervals are both easily centered.

• Do not rush this exercise, as the ability to rapidly perform alternating pitches can take years to perfect.\textsuperscript{112}

Example 4.9 Adapted \textit{First Study}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{example.png}
\caption{Example 4.9 Adapted \textit{First Study}.}
\end{figure}

**Level Three Exercises**

**Increasing Speed and Register of Alternation Exercises**

The goal of these exercises is to increase the speed of alternation between singing and playing while increasing the distance of intervals. The player should work with these exercises in different keys and apply them to the variants within the Arban method book in order to develop versatility and expand the registers they sing. Another goal of these exercises is to begin developing ability to perform “hocket technique”.\textsuperscript{113}

**Fundamental Technique Involved**

• Embouchure Formation

• Immediacy of Production

• Aural Skills

• Clarity of Articulation

\textsuperscript{112} Cherry, 52.

\textsuperscript{113} Keberle, 17.
• Register Control

Exercise Used

• Jean-Baptiste Arban’s *Intervals*

Approach

Alternating *Intervals*

• Transpose the same exercise up one step, continuing chromatically.
• Focus on the upper register in both the trumpet and singing.
• Keep at a p dynamic to avoid straining the voice while practicing falsetto.
• Initially have the eighth note equal the quarter note of the previous exercise.
• Play or sing full measures, aiming to decrease the feel of interval distance.
• Apply vocalization to the other exercises in the method for variety.
• Continue when tempo has doubled and high and low registers are easily reached.

Example 4.10 Adapted Arban *Intervals.*

![Musical notation]

**Level Four Exercises**

**Rapid Alternation in Advanced Registers and Dynamics**

Designed for a more advanced approach to vocalizations, this last set of exercises is focused on pointillistic phrases that incorporate more alternations between articulation and singing, as well as larger intervallic leaps for advanced ear training.

**Fundamental Technique Involved**
• Embouchure Formation

• Immediacy of Production

• Aural Skills

• Clarity of Articulation

• Endurance

• Register and Dynamic Control

Exercise Used

• Laurie Frink’s *Quick Register Etude*

Approach

Extreme Interval Etude

• Start as slowly as needed to maintain clarity of sung and played pitch.

• Practice singing all the pitches and playing all the pitches to develop an aural familiarity and allow the “melodic line” to be phrased.\textsuperscript{114}

• Divide the etude into individual measures to repeat at a slow tempo.

• Always practice with the tuner to assure pitch consistency.

• Push the boundaries of tempo once the etude becomes more developed.

• When the desired tempo is reached, add a dynamic change to each pitch.

Example 4.11 Adapted *Quick Register Exercises.*

\footnote{\textsuperscript{114} Ibid.}
CHAPTER 5

Multiphonics

The term multiphonic, in the context of brass instruments, generally refers to techniques that involve singing while playing. While this is actually a misnomer, since split tones can be classified as multiphonics as well, this is the current nomenclature for the specific extended technique as it is commonly executed. The variety of ways in which composers ask for and performers use multiphonics is continually growing, ranging from indeterminate singing while playing, to the use of specific pitches, timbres, pitch patterns, and glissandi. The resulting aural effect in each case is a result of the relationship between the played and sung notes. As a sung unison initially deviates from a played note, it creates a beating effect when the two frequencies begin to differ by 30Hz or more. Whether this divergence continues in an upper or lower trajectory, the intervals that are formed between the two pitches begin to produce resultant tones.

For instance, singing a pitch that is a major sixth below or a perfect fifth below the played note will produce a resultant tone a major tenth above the sung pitch. A note sung a perfect fifth above the played pitch will produce a resultant tone a major tenth above the latter. This consequently produces all three members of a major triad, with the played note as the root, the resultant tone as the third, and the sung pitch as the fifth. When a sixth is sung above the played note, the resultant tone will create the third of a major triad, with the played note acting as the fifth and the sung note as the root.\footnote{Cherry, 28.}

The variety of advanced, specific multiphonic techniques is still growing, and includes such effects as producing complex cadence patterns on otherwise monophonic
instruments, creating contrapuntal passages between played and sung notes, and various combinations of vocalizations and other techniques, such as trills. Aural examples for each of these techniques are provided in the footnotes.

**Vocalizing While Playing**

Example 5.1 Non-specific notation for singing while playing.

Vocalizing while playing is achieved through the simple mechanic of producing vocal noises while sustaining an audible vibration on the trumpet.¹¹⁶ These can include a variety of sounds, including grunts, screams, or commonly, sustained vocal pitches.¹¹⁷

**Upper Resultant Multiphonics**¹¹⁸

Example 5.2 Singing a perfect fifth above a played note.

Notation for singing a perfect fifth above note: Additional resultant tones produced:

If the voice sings a perfect fifth or major sixth above a played pitch, resultant tones of a major triad will resonate. If it is a perfect fifth, the third will resonate above and a second tonic (the played pitch) will resonate beneath.

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¹¹⁷ Cherry, 26.

Example 5.3 Singing a major sixth above a note.

Notation for singing a major sixth above note:  Additional resultant tones produced:

If a major sixth is sung above a played note, the tonic of the triad of which it is the third will resonate above and below the played pitch, with the latter acting as the fifth of the chord. These resultant tones resonate due to the acoustic features present in the natural harmonic series.¹¹⁹

**Lower Resultant Multiphonics** ¹²⁰

Example 5.4 Singing a major sixth below a note.

Notation for singing a major sixth below a note:  Additional resultant tones produced:

If a major sixth and perfect fifth are sung below the played pitch, two resultant chords will be produced as well. If the major sixth is sung below, the minor third, fifth, and minor seventh will result with the played tone acting as the tonic.

Example 5.5 Singing a perfect fifth below a note.

Notation for singing a perfect fifth below a note:  Additional resultant tones produced:

If the fifth below is sung, it will act as the tonic with the resultant third being produced.

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¹¹⁹ Cherry, 28

**Contrapuntal Multiphonics**

Example 5.6 Notation of some possible contrapuntal multiphonics and resultant tones.

Because of the potential for harmonic complexity in these techniques, there is the chance for both sung and played notes to intertwine. The movement between interval relationships allows for sudden shifts in the harmonic content from the resultant tones. Some intervals do not produce easily heard resultant tones but create a ring from close proximity, a precursor to beating. ¹²¹

**Beating Multiphonics**

Example 5.7 Notation of beating multiphonic, with speed changes indicated by feathered beaming.

Beating is the sound created by producing two tones of nearly the exact same frequency, with only slight deviation between them. The aural perception of this beating sound is caused by the ear’s ability to distinguish two separate tones combined with this perception’s distortion by the response of the cochlea hairs, which overlap in vibration due to close proximity of the frequencies (approximately 30Hz). ¹²² This beating will seem to slow down as the distance between two frequencies increases until two separate

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semitones are discernible. This can be replicated by singing while playing and slowly sliding the vocal tone above or below the played pitch.

**Vocal Glissando**

Example 5.7 Notation of a vocal glissando

![Notation of a vocal glissando](image)

Vocal glissandi are executed by singing and playing a pitch of the same frequency, then glissing the sung tone downward or upward to a large interval (a sixth or greater). The goal is to maximize the resonance of the resultant tones produced by the glissando, much like the manner in which the overtones produced in a buzzed glissando are emphasized. The technique produces the resultant harmonics which, if it is done quickly enough, will begin to evoke a descending sensation similar to that of a Shepard tone. One newly-discovered advanced multiphonic technique is the “vocal sweep” where the sung note begins with the played note and then rapidly descends to a large interval (major sixth or greater), producing a descending resultant tone quality similar to sine wave modulation. This effect is one of the newer multiphonic techniques to enter the repertoire, and has only recently been used in the concert music of contemporary composers.

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125 Ibid.,
Fundamental Skills for Producing and Preparing Multiphonics

In Cherry and Tribuzi’s studies, there are three skills required in preparing multiphonics that bear directly upon trumpet fundamentals, which are accordingly of interest in this essay and proposed technical studies. The first is tone production: Singing while playing forces the player to perform with an open, rather than “closed throat,” which Hunt associates with poor tone quality.126 The second is described as an “aural demand” level, which deals with a musician’s ability to produce a note and recognize the interval needed to sing relative to that note.127 The third skill is dynamic control, particularly the ability to control a note at a soft dynamic while singing loudly, as is often required to produce resonant resultant tones.128

Cherry states that due to the “breathy quality” required of two coexisting notes, it is significantly harder to maintain production of multiphonics on the trumpet than it is with the larger mouthpieces and air columns of other brass instruments.129 Keberle states that, to develop easy production, “long tones in the middle register” combined with basic singing on “any pitch” should be practiced.130 Jones’ performance guide to Ticheli’s First Voice mentions the need for embouchure stability in successfully performing multiphonics, especially when attempting to overcome production problems.131 Hunt

126 Hunt, 33.
127 Tribuzi, 75.
128 Cherry, 36.
129 Ibid, 37.
130 Keberle, 18.
131 Jones, 24.
points out that a common pitfall encountered by students of higher brass instruments, particularly when performing in the upper register, is to substitute a “tight throat” for a controlled aperture. This poor habit can potentially be overcome through the practice of sung multiphonics, which require an open throat.

While not specifically relating to the trumpet, Jen Baker’s article on the technical execution of multiphonics on the trombone states that this instrument shares the same foundational requirements. Baker states that to properly perform multiphonics on a trombone there are three required fundamentals: control of the played pitch (production), vocal pitch accuracy (aural skills), and dynamics (both between the two pitches and generally, throughout the range of the instrument). The consensus of these studies helps to bolster the assertions made here relating to the fundamental techniques that can be improved through the practice of multiphonics. All of these skills may benefit from development of this technique:

- Tone Production
- Aural Skills
- Intonation
- Throat Tension Control
- Dynamic Control

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Exercises Adapted for Multiphonics

The exercises to develop multiphonics are organized by their focus on the primary fundamentals listed above, beginning with the first (tone production), and adding more advanced techniques, which develop further fundamental skills in each set. These levels are based on fundamental priority and also the order of difficulty:

Level One Exercises: Basic Singing and Playing
Level Two Exercises: Singing Below and Resultant Pitches
Level Three Exercises: Singing Above and Resultant Pitches
Level Four Exercises: Combined Moving Played Pitches and Sung Pitches
Level Five Exercises: Advanced Exercises for New Effects: Beating and Vocal Glissandi

Level one exercises are modeled on previous studies that focus on initial production, in order to develop the basic ability to sing while playing. Once the ability to sing and play simultaneously is achieved, the exercises cultivate the ability to change pitches on the trumpet while still singing. Arban’s *First Studies* are used for initial production exercises:
Example 5.9 Complete Method for Trumpet by Jean-Baptiste Arban.

As stated in the preface to the Arban Studies, the goal of the original exercises is to “establish a natural tongue attack and a steady controlled air flow balanced with minimum mouthpiece pressure”. There are three ways in which these studies can be adapted: with the sung and played note stopped and re-articulated, with the sung note stopped and re-articulated while the played note is sustained, and with the played note stopped and re-articulated while the sung note is sustained. The goal of these exercises is to avoid any loss of production in either the sung or played note throughout.

In incorporating pitched singing and dynamics into the same exercise, the Schlossberg *Basic Drills* are used as a model here. This decision was influenced by the fact that the purpose of all of his exercises are “to maintain steady flow of air into the

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133 Arban, 17.
trumpet for the duration of a note or phrase.”\textsuperscript{134} The exercise modeled here is the \textit{Long Note Drill} number two, adding vocals to the fifth and sixth above and below to establish an ease of resultant tone production with dynamics.

Example 5.10 \textit{Daily Drills and Technical Studies} by Max Schlossberg.

For the development of more rapid multiphonic movement, an adaptation of Clarke’s \textit{Third Study} is used. This exercise alternates between having the played note and the sung note held as the given pitch in the original exercise. A variant to this exercise is to invert the procedure and have the sung multiphonics move below the played pitch.

Example 5.11 \textit{Third Study} by Herbert L. Clarke.

Stamp’s basic warm up is used for the development of multiphonic counterpoint, fostering the development of harmonic accuracy in the intervallic relationships between the voice and the trumpet. The goal of this exercise is to maintain production while crossing voices and to develop a stable embouchure without “pulling the pitch in the

\textsuperscript{134} Schlossberg, 1.
direction of the slur”. Stamp’s *Bending Study* is adapted to incorporate the use of beating, produced by both sung glissandi and lip bends.  

Example 5.12 *Bending Study* by James Stamp.

Stamps’ *Octave Studies* are used for the phonic sweep technique, alternating between singing and playing, with the same emphasis on not changing the lip position and just alternating the air.  

Example 5.13 *Octave Studies* by James Stamp.

**Level One Exercises**

**Basic Singing and Playing**

The goal of these exercises is to establish singing while playing. There can be many production issues when attempting to sing while vibrating the aperture. Patience is key and more advanced multiphonic techniques can be attempted once both forms of production are maintained consistently together.

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135 King, 29.
136 Stamp, 21.
137 Ibid., 23, 30.
**Fundamental Technique Involved**

- Tone Production
- Throat Tension
- Aural Skills

**Exercise Used**

- Jean-Baptiste Arban’s *First Studies*

**Approach**

**Basic Singing and Playing**

- Start at forty beats per minute.
- Flap lips and “siren” with the voice to establish production and loosen embouchure.\(^\text{138}\)
- Do not worry about the actual pitch being sung.
- If initiating the singing proves difficult, attempt to start the note or sing.
- Attempt to slur the intervals at first.
- Focus on making the played pitch centered and keeping the throat open.
- Try to project the voice out of the mouthpiece.
- Practice experimentation with various vocal dynamics and the effects they have on the pitch.\(^\text{139}\)
- Be sure to maintain a “steady tone” of both pitches as a goal to this exercise.\(^\text{140}\)

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\(^\text{138}\) Cherry, 40.

\(^\text{139}\) Tribuzi, 75.

\(^\text{140}\) Ibid.
Example 5.14 Adapted Arban *First Studies.*

![Sheet music image]

**Level Two Exercises**

**Developing Resultant Tones**

The next set of exercises works to develop resultant tones. The goal is to create a clean sounding resonant chord with the two notes being played. Often the voice or trumpet can be out of balance dynamically, so the primary focus of the player should be on pitch and dynamic balance.

**Fundamental Technique Involved**

- Tone Production
- Throat Tension
- Aural Skills
- Intonation
- Dynamic Control

**Exercise Used**

- Max Schlossberg’s *Long Note Drills*

**Approach**

Developing Resultant Tones Above and Below

- Alternate and repeat between any of the twelve choices.
• The development of these come from “experimentation”.141

• Attempt these exercises at first without tempo.

• Use a tuner and sing/play the pitches individually.

• Strive for a “locked in” interval that resonates the resultant pitches fully.142

• Use a drone to build resonance of the interval and the resultant tones produced.

• Make sure the sung pitch is in “balance” with the played pitch like a “duet of equals”.143

• Add tempo once both the resultant tones sustain consistently.

• Continue chromatically downward for upper resultants, and upward for lower resultants when the dynamics in the final crescendo/decrescendo are a true ff/pp.

• Practice starting and stopping one pitch while holding the other for “better control” of production.144

Example 5.15 Adapted Schlossberg Drills.

141 Cherry, 40.

142 Jones, 106.

143 Ibid.

144 Cherry, 43.
Level Three Exercises

Increasing Multiphonic Speed

These exercises are designed to advance the flexibility of the vocal and playing range in relationship to each other. The goal of the student should be to maintain the resonating balance achieved in a good resultant long tone, even when moving between intervals at a faster rate.

Fundamental Technique Involved

• Throat Tension
• Tone Production
• Aural Skills
• Intonation
• Dynamic Control

Exercise Used

• Herbert L. Clarke’s *Technical Study #3*

Approach

Moving Multiphonic Intervals

• Start at a slow pace aiming for fluid movement in both the singing and the playing.

• Attempt the same “siren” sounds in the intervals applying a glissando to the vocals.\(^{145}\)

• Focus on developing resonance in the intervallic relationships.

• Keep at a soft dynamic until consistent resonant production is achieved.

• Do not sacrifice sound and production consistency for speed.

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\(^{145}\) Cherry, 41.
Example 5.16 Adapted Clarke *Third Study.*

**Level Four Exercises**

**Multiphonic Counterpoint**

The goal of these exercises is to achieve a virtuosic level skill of multiphonic movement. The resultant chords should be ringing and production should remain intact throughout.

**Fundamental Technique Involved**

- Tone Production
• Throat Tension

• Aural Skills

• Intonation

• Dynamic Control

Exercise Used

• James Stamp’s *Basic Warm Up*

Approach

Developing Two Autonomous Lines

• Begin with the example at the start of the subchapter, working measure by measure.

• Focus on developing a discernable and well-formed shift between harmonies in the resultant chords. 146

• Once two moving parts are successful, attempt moving in “non-parallel” directions. 147

• Move slowly enough that the harmonic changes are discernable.

• Work to make clear changes in resultant tones quicker.

• Once the exercise is easier to perform, slowly crescendo and decrescendo to add dynamic control.

• Continue down chromatically once the exercise is easily performed.

• Focus on making it as easy and resonant as possible.

146 Denton, 42.

147 Cherry, 4.
Example 5.17 Adapted Stamp Basic Warm Up.

Level Five Exercises

Beating and Vocal Glissando

These newer multiphonic exercises have received little attention in the teaching community, but both are called for in major contemporary works and also serve the development of fundamental skills. The goal of both exercises is to be as flexible as possible, in order to control the speed at which the beats are being produced and to maintain resonance in the vocal glissando.

Fundamental Technique Involved

- Tone Production
- Throat Tension
- Aural Skills
- Intonation
- Dynamic Control

Exercises Used

- James Stamp’s Bending Exercise
• James Stamp’s *Octave Exercise*

**Approach**

1. Beats and Bends

- Work without a fixed tempo.
- Focus on holding a tuned unison pitch between the voice and the played note.
- Slowly experiment with slight adjustments upwards and downwards in the voice, while maintaining the same pitch on the trumpet.
- Do the same with the trumpet’s pitch, while maintaining a fixed pitch in the voice. Follow the same approaches as the previous exercise.
- Work to slowly build the beating effect.
- Attempt to control the speed of the beats.

2. Vocal Glissando

- Start very slowly to gain control of the vocal glissando.
- The played note will want to fall with the sung glissando, attempt to stay firm with the played pitch.
- Focus on the resultant tones that appear throughout the octave glissando.
- As with the contrapuntal multiphonics, try to establish autonomy for the sung and played passages.
- Push the extremes of dynamics and register changes as the effect develops.
- Try to get the speed of the glissando as fast as a played octave leap.
Example 5.18 Stamp *Bending Exercise*, adapted to focus on producing beats.

Example 5.19 Adapted Stamp *Octaves*, incorporating vocal glissandi.
Slide and Valve Techniques

Slide and valve manipulation, as extended techniques, are most commonly associated with alterations to the color and pitch of the tone produced by a particular fingered set of pistons. Tribuzi points out that the most common valve technique is “half-valve,” however it can be argued that slide techniques employ more effort than any half-valved techniques resulting from the alternate fingerings required. The earliest type of advanced slide technique was the extension of both slides in order to reach a semitone lower than the lowest fixed non-pedal tone note on the trumpet. Slide technique has, however, also been expanded to facilitate the production of microtones, by using alternate fingerings to perform quartetones or other microtonal intervals. It should be noted that, for all intents and purposes, quartetones and microtones are often considered to be synonymous, unless a composer specifically requires a pitch between semitones different than that of the quartetone, which is not frequently encountered. Lastly, the use of slide removals allows for an “effortless hocket between two timbral systems” and the option for sound to move in “two directions.” The successful performance of advanced slide and valve techniques requires flexibility with pitch control and dexterity in coordinated hand movements—the development of both of these has intrinsic value for the musician at any level of trumpet performance.

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148 Tribuzi, 34.
149 Keberle, 21.
150 Ibid., 22.
151 Tribuzi, 36.
Half-valve Pitches

Example 6.1 Notation for half-valve technique.

Producing half-valved pitches requires holding the valve between the out and in position of the piston while playing. The resultant sound is a pitch that is “muffled” but “clearly audible”. The produced frequency is within the proximity of the pitch that is produced when the same note is performed normally.

Half-valve Glissandi

Example 6.2 Notation of a half valve glissando.

A half-valved glissando is the smooth transition between adjacent partials encountered in standard glissando technique, with the addition of the half-valve timbral alteration, creating a fluid glissando with the same muted effect produced by the basic half-valve pitch technique. These glissandi can range from basic intervals to multiple octaves in distance. An example of this technique is provided in the footnotes.

Valve Tremolo

Example 6.3 Notation for valve tremolo.

152 Keberle, 30.
153 Cherry, 90.
Rapidly pressing an alternate fingering for the same pitch will create a valve tremolo. The pitch itself acts as a “long tone” without air interruption, with the slide position and fingerings allowing for consistency of frequency.\textsuperscript{155}

**Slide Glissandi**

Example 6.4 Notation of slide glissandi.

![Slide Glissandi Notation](image)

Slide glissandi are produced by the movement of the slide to either lead into or away from a pitch. The movement of the third and first slide allow for semitonal bends, either from above or below, when the slide is fully returned. The precise control of this manipulation can allow for slides to move up or down “through” a pitch using alternate fingerings.\textsuperscript{156} An example of a microtonal musical passage using slide glissandi is provided below.\textsuperscript{157}

**Slide Removals**

Example 6.5 Notation of slide removals.

![Slide Removals Notation](image)


\textsuperscript{156} Cherry, 113.

By removing a slide, an alternate pitch will result and create an “echo” effect.\(^{158}\) The dynamic of the resulting sound will vary depending on the centered level of the desired pitch and the specific valve being removed. The idiosyncrasies of individual instruments’ reactions after slide removals can vary greatly, which has resulted in many extended technique exercises in the past to include of the specific model for which they were designed.\(^{159}\) An example of a musical passage using slide removals is provided in the footnotes.\(^{160}\)

**Fundamental Skills Required for Slide and Valve Techniques**

Half-valved effects and glissandi are heavily reliant on lip-based pitch control. They require both “rapid flexibility with exact pitches”\(^{161}\) and the ability to control the “natural breaks” in sound when producing each partial in the overtone series.\(^{162}\) Lip flexibility is essential to “center and manipulate” half-valved pitches. Valve tremolo is a technique that ought to be more thoroughly addressed in pedagogical literature than it currently is, specifically in terms of developing the required dexterity and coordination in hand movements, though the technique has long been used, found in trumpet literature. While some valve tremolos can be achieved with little trouble, others require absolutely

\(^{158}\) Cherry, 115.

\(^{159}\) Denton, 58.


\(^{162}\) Ibid., 82.
autonomous digital dexterity with the first through third valves. As Cherry stated, “knowledge of alternate fingerings...cannot be overvalued” and “unfriendly fingering combinations” should be given due attention in developing facility in this technique.\textsuperscript{163} This sentiment is also encountered in finger-speed methodologies for basic dexterity development.

Slide glissandi and removals add a new dimension of difficulty and precision to both lip flexibility and hand dexterity, requiring committed practice to obtain technical proficiency. Slide removals furthermore require a recognition of an instrument’s “intonation tendencies,” and the student must be acutely aware of the particular characteristics of their instrument.\textsuperscript{164} As with half-valve techniques, slide removals also require lip flexibility to “adjust the pitch substantially by using the embouchure,”\textsuperscript{165} also known as “lipping” the pitch.\textsuperscript{166} In addition to lip flexibility, slide adjustment to correct the intonation of pitch requires practiced finger coordination. One major contribution to developing proficiency in “slideless” technique comes from Attilio Tribuzi. His chart of tendencies and alternate fingerings are provided here as an aid for students in determining the general intonation tendencies of each slideless valve combination.\textsuperscript{167} The list of fundamentals developed by this set of techniques is as follows:

- Lip Flexibility
- Aperture Control

\textsuperscript{163} Ibid., 93.
\textsuperscript{164} Ibid., 123.
\textsuperscript{165} Keberle, 33.
\textsuperscript{166} Denton, 58.
\textsuperscript{167} Tribuzi, 30.
• Aural Skills
• Intonation
• Finger Dexterity and Coordination

As with transitional tonguing, the goal of these exercises is to seamlessly transition between each technique, in order to master their underlying fundamental requirements and to develop their fluency. These exercises are organized to focus first on developing lip flexibility, then on attaining the coordination and dexterity required to perform the techniques rapidly.

Level One Exercises: Half-valve, Half-valve Glissandi, and Slide Removals

Level Two Exercises: Scales Using Slide Glissandi and Valve Tremolos

Level Three Exercises: Scales Exercises Using Slide Glissandi and Removed Slides

Level Four Exercises: Slow Transitional Scalar and Intervalllic Exercises

**Exercises for Slide and Valve Techniques**

Because Franquin’s method for flexibility relies on the harmonic series utilized by the piston trumpet, his exercises provide an excellent model for developing the first basic needs of pitch and aperture control on a cylindrical brass instrument when developing general flexibility.\(^{168}\) Despite being titled “Slurs for lip flexibility”, Franquin’s exercises “force the student to navigate among harmonics over a broad range”, in a way “unlike Arban, Forestier, or Saint-Jacome”.\(^{169}\)

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\(^{168}\) Shamu, 69.

\(^{169}\) Ibid.
Increased flexibility and aperture control leads to greater agility and faster movement through the harmonic series.\textsuperscript{170} The exercise used here is adapted from the third volume of Franquin’s complete method, starting with normally-produced trumpet pitches and then transitioning to either slideless or half-valved pitches, while using a tuner to ensure correct intonation.\textsuperscript{171} The half-valve glissando is incorporated into the second set of these exercises, once basic embouchure control has been established.

The slow scalar patterns in the Schlossberg book are used as models for exercises focused on lip bends and alternate fingering tremolos.\textsuperscript{172} These alternate between bending the glissandi and moving to an alternate note based on the out-positioned slide. The exercises should be practiced until rapid tremolos on any finger pattern can be performed with equal ease and the out-positioned slide intonation is centered.

\begin{itemize}
\item \textsuperscript{170} Ibid., 70.
\item \textsuperscript{171} Ibid., 125.
\item \textsuperscript{172} Schlossberg, 2.
\end{itemize}
Example 6.7 *Daily Drills and Technical Studies* by Max Schlossberg.

The exercises used for rapid hand-coordination and the incorporation of slide microtones are based on the Stamp *Scale Velocity* exercises.\(^{173}\)

Example 6.8 *Warm-Ups and Studies* by James Stamp.

\(^{173}\) Stamp, 25.
Instead of initial marcato attacks, valve tremolo and half-valve are used to establish embouchure control and warm up the fingers. The goal of these exercises is to build to a steady pace and fluidly transition between the techniques, establishing a proficiency in both the dexterity and flexibility.

Example 6.9 Removed slide tendency chart by Attilio Tribuzi.
Level One Exercises

Long Tones using Half-valve, Half-valve Glissandi, and Slide Removals

The goal of these exercises is to establish a stable flexible embouchure to control half-valve pitches and slide removals and to then extend them into glissandi for better aperture control. These exercises should be continued until the alternate fingerings are familiar, and until proper intonation and smooth glissandi between partials has been achieved through embouchure control. Most often, the notation for the realized pitch is written in the separate staff, however these exercises are written to incorporate the removed notes as one autonomous pitch.\textsuperscript{174} While fingerings are provided, they are designed to offer an initial suggestion and other options ought to be experimented with,

\textsuperscript{174} Cherry, 115.
consulting Tribuzi’s chart of alternate fingerings and tendencies for possible solutions. These exercises use only single slide removals, since they contain the most combinations of slide removal-produced pitches.

**Fundamental Technique Involved**

- Lip Flexibility
- Aperture Control
- Aural Skills
- Intonation

**Exercise Used**

- Merri Franquin’s *Harmonics*

**Approach**

1. Establishing Intonation of Equipment Effects

   - Use the tendency chart and a tuner to test tendencies. Alternate between playing the pitches without effects.
   - Develop aperture and slide position strategies to approach each effect.
   - As with played notes, aim to develop a center of the pitch.
   - Interchange between the three slide variants is fine.
   - Keep a balance between the time spent on slide and valve variations.

2. The Variations to the Exercise

   - Practice with a tuner and without altering the pitch through half-valves to first secure the pitch.

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175 Tribuzi, 38-39.
176 Cherry, 93.
177 Tribuzi, 31.
• When practicing the halve-valve glissandi, increase the intervals to a fifth, and then an octave.

• Slowly move the valves up and down very slightly when going through natural breaks in the harmonics.  

Example 6.10 Adapted Franquin Harmonics.

Example 6.11 Variations to the exercise.

Second Slide Variation:

3rd Slide Variation:

178 Cherry, 82.
Level Two Exercises

Long Tones in Scalar Movement Using Slide Glissandi and Valve Tremolos

To develop better dexterity and coordination in preparation for faster slide glissandi and slide-removal fingerings, this set of exercises is based on slow scalar patterns and emphasizes unconventional fingerings for the tremolos.

Fundamental Technique Involved

- Lip Flexibility
- Slide and Valve Coordination
- Aperture Control
- Aural Skills
- Intonation

Exercise Used

- Max Schlossberg’s *Long Note Drills*

Approach

Slide Bends and Valve Tremolos

- Focus on the first part of the exercise to assist in coordination.
- Once the bend becomes more fluid, move on to the valve tremolo.
• Work to develop a smooth tremolo and bend in all finger pattern variations.

• The extended slide correlates with the fingering of the first note.

• Add articulations to the first held note, with increasing distance between pitches.  

• Alternate between glissando and articulation to practice rapid movement.

Example 6.12 Adapted Schlossberg Drills with variations.

Valve Tremolo Variation:

Valve Tremolo Variation with Extended Slide:

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179 Denton, 43.

180 Cherry, 96.
Alternate Fingerings

(Ex. 6.12, cont’d)

Level Three Exercises

Interval and Scale Exercises Using Glissandi and Removed Slides

To obtain improved speed and dexterity in both glissandi and slide removals, Arban’s *First Studies* exercises number seventeen through forty-five provide excellent models. Each set of these exercises is grouped by speed and expanding range. The exercises first focus on removed slides to further challenge the required dexterity and immediacy of embouchure control at fast speeds. The alternately-valved pitches and half-valved pitches should be repeated as a standard played pitch to assure intonation.

Practicing both the scalar and interval exercises using half-valved glissandi will also help the performer to “smooth out the break in the harmonic series”.

Fundamental Technique Involved

- Lip Flexibility
- Aperture Control
- Aural Skills
- Intonation
- Finger Dexterity and Coordination

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182 Cherry, 95.
183 Ibid., 96.
Exercise Used

• Jean Baptiste Arban’s *First Studies, Seventeen through Fourty-Five*

Approach

Increasing Dexterity in Slide Technique

• Play through the three chromatic scales.

• Develop a familiarity with the tendencies of each slide.

• Write in the alternate fingerings to any of the Arban Exercises.

• Focus more on pitch than speed.

• Follow the adaptive approach for half-valve glissandi below as an alternative to slide removals.

• Apply these techniques for glissandi and slide removals to any of the exercises discussed in this section.

Example 6.13 Arban *First Study* and example of half-valve glissando variation.
Now that the basic foundation has been established for all five of these techniques, the next set of exercises focuses on building fast-paced coordination, dexterity, and ear training. The slurred chromatic passages can be replaced by half-valve
glissandi. For further study of slide removals, the fingering charts included here can be used with the diatonic version of these exercises in the Stamp method book.

**Fundamental Technique Involved**

- Finger Dexterity
- Slide Coordination
- Aural Skills
- Intonation

**Exercise Used**

- James Stamp’s *Scale Velocity*

**Approach**

**Advanced Scalar Exercises**

- Practice the individual quartertones with a tuner to ensure accuracy.

- Begin with slow practice to coordinate the slide with the alternate valve.\(^{184}\)

- Smooth progression both up and down the microtonal scale is the goal.

- When the C-based scale is played fluidly, continue to transpose the exercise up a semitone, as high as possible.

- Remember that this technique requires muscle-memory learning and can take a significant amount of time to master, but is considerably the most precise way of performing rapid microtonal passages.\(^{185}\)

- Skip notes of the scale to create arpeggios which include microtonal intervals.

- Variations to this exercise include replacing chromatic movement with a half-valve glissando and utilizing Tribuzi’s fingerings with slide removals for the chromatic scale instead of quartertones.

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\(^{184}\) Ibid., 109.

\(^{185}\) Tribuzi, 23.
Example 6.15 Adapted Stamp *Scale Velocity* with fingerings for each key.

Concluding Remarks

In compiling these exercises and working through the ways in which modern developments in extended technique for the trumpet can be fused with some of the oldest pedagogical methods associated with the instrument, I have developed a deeper understanding of both, as well as a profound enthusiasm and sense of justification for incorporating these techniques into the college-level curriculum. It is clearly inevitable, given the trends in modern composition and performance, that all trumpet players, no matter their genre of focus, will encounter some of these techniques as they pursue their careers. It is consequently reassuring to note the significant increase in general interest regarding these techniques and the literature into which they are incorporated by scholars, students, and pedagogues. It is also my sincere hope that these exercises will allow
teachers to demonstrate contemporary techniques to students who otherwise would not necessarily incorporate them into their practice routines.

There will always be further need to build upon exercises akin to those presented here, as the repertoire and gamut of extended techniques evolves over time. The more research that is done by scholars and performers alike, the more resources will be available for those wishing to incorporate these techniques into their practice and performance. Furthermore, it is hoped by this author that introductory methods for extended techniques grounded in familiar pedagogical procedures, such as those proposed in this essay, will provide for the college-level trumpet student a level of accessibility and approachability not always inherent to the literature in which these techniques are frequently encountered. Another way in which researchers could contribute to contemporary trumpet pedagogy is through broader studies of the success rates of various approaches to teaching and practicing contemporary trumpet techniques.

It seems appropriate to close this essay with one final caveat. While the teaching of extended techniques is slowly gaining wider acceptance and presents exciting fertile ground for new approaches in performance, composition, and pedagogy, it is only a fraction of the well-rounded skill-set that must be possessed by a successful interpreter of contemporary trumpet literature.
APPENDIX

This appendix is intended as a partial index of pertinent scholarship published on contemporary works that contain extended techniques for the trumpet. It consists of general guides to extended technique, and performance guides for specific works. Additionally, two annotated bibliographies are included here that catalog pieces using these techniques and the specific devices that they contain. A list is provided in each source of examples of works using various combinations of extended techniques, as well as studies that the authors propose will assist the trumpeter in preparing a given composition for performance.

1. Annotated Bibliographies


- Paul Bradley Ulrich, “An Annotated Bibliography of Unaccompanied Trumpet Solos Published in America” (DMA diss., University of Illinois at Urbana-Champaign, 1989).

These are two annotated bibliographies that use extended techniques as an organizing factor. Justus’ and Ulrich’s bibliographies catalog specific works and briefly describe the techniques they utilize. Justus also provides a brief glossary of these techniques. His bibliography details unaccompanied trumpet works and describes to what degree specific techniques are employed. Justus also provides details regarding range requirements and proposed level of proficiency required for attempting each

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186 Justus, v.
work. Ulrich uses a differently organized approach in his bibliography, dividing works first by three time periods, and then organizing them by whether or not they use contemporary techniques to a significant extent. Amongst the details he provides are a grading scale of difficulty based on range, fundamental skills, and quantity of new techniques used. Ulrich also provides a listing of the specific techniques involved. In his conclusion, he also makes generalizations about the frequency with which certain extended techniques were used by composers during different eras of recent history.

Teachers interested in pieces published between 1989 and 1995 may appreciate the descriptions of specific works from this period included in Justus’ bibliography. Unfortunately, the information is not organized in a way that facilitates locating works based on specific techniques or levels of difficulty. Ulrich’s bibliography, on the other hand, provides instructors the ability to seek out pieces specific to the current techniques their students are learning and the level of difficulty and consequent preparation each might require.


Written in 1974, Smoker’s study was one of the earliest works of scholarship to explore extended technique for the trumpet. Although it details fewer techniques, the
organizational strategies he employed have provided a template for many of the guides developed since. Smoker’s impetus for conducting this study was the sudden influx of new techniques and genre-specific sounds written for the trumpet in the previous twenty-five years.\textsuperscript{192} His dissertation provides a list of newly discovered trumpet techniques and effects, suggestions for performing them, and a list of notations and symbols found in the contemporary repertoire at the time of the study.\textsuperscript{193} Smoker also includes an annotated bibliography of extant research relating to the works he surveyed. Though it is somewhat dated, limited as it is to works and techniques developed prior to 1974, this bibliography includes pieces that contain shakes, tremolos, flutter-tongue, microtones, and half-valve techniques, which instructors can use to find historically emergent notation practices of extended techniques or peruse as a repertoire guide for themselves or their students.


Using a format similar to Smoker’s study, Tribuzi surveys the development of extended techniques for the trumpet through 1992. Accordingly, he adds multiphonics, slide techniques, and glissandi. He catalogs extended techniques in terms of five parameters: the notation, how the sound is produced, preparation, practicality, and the resulting sound.\textsuperscript{194} In each chapter of his study, Tribuzi provides various forms of notation that have been used by composers to call for a specific extended technique.\textsuperscript{195}

\textsuperscript{192} Ibid., 7.
\textsuperscript{193} Ibid., 12.
\textsuperscript{195} Tribuzi, 5.
He then describes the mechanics of producing the extended technique, as well as the preparation requirements. One of the biggest contributions he makes is in addressing practical issues. For example, he provides original charts for pitch tendencies with slide removals and details supplementary charts found in his research for different vocalizations required in specific works. A discography is also provided, to assist performers in locating a recording of the work they are performing to provide aural examples of techniques. For any performer or instructor whose student is performing a piece with an extended technique, Tribuzi’s survey and guide may be a beneficial source for explicating the notation and providing practical strategies for specific extended technical demands.


Cherry’s guide and survey is one the most useful studies regarding new techniques. Her study focuses on three aspects regarding extended technique: (1) how often it is taught in colleges and to what degree; (2) how to approach specific contemporary works as a pedagogue; (3) how to teach the extended techniques found in these works. Her study revolves around twenty pieces that require these techniques and includes a performance guide for each of them, as well as a detailed overview of the challenges facing the trumpeter. She surveyed 166 colleges in the U.S. and Canada to collect details

196 Ibid., 33.
197 Ibid., 38, 77.
198 Ibid., 91.
relating to the performance and pedagogy of extended techniques. Her results demonstrated an interest in extended techniques in the pedagogical community, and also proposed the need to develop initiation exercises for extended techniques prior to studying specific works. Based on the pieces she used in her “Guided Approach”, she developed exercises for initiation, focused mainly on multiphonics and flutter-tonguing. She categorizes pieces by institutional level in order to allow contextual opportunities for younger students to attempt extended techniques: She deemed two appropriate for the high school level, six for the undergraduate level, seven for the graduate level, and five for the advanced or professional level. For each of the twenty works, her guides provide the length, range requirements, technical details, required extended techniques, and performance notes given by the composer, if any. This study is an invaluable resource for instructors looking for repertoire containing extended techniques that fit within the limitations of their students’ fundamental development. Most of the pieces that Cherry includes contain advanced extended techniques, which she considers suitable for the level of advanced undergraduate and higher, which correlates with the desired strategies of standard trumpet curriculum.

199 Cherry, 171.

200 Ibid., iii-iv.

201 Ibid., 267-269.

Denton’s etudes for extended techniques include flutter-tonguing, doodle tonguing, valve techniques, microtones, slide removals, and vocalizations. His study can be characterized as an etude book for extended techniques, akin to the etude books by Theo Charlier.\(^\text{202}\) While there were previous trumpet etudes written in the contemporary style, there were “no trumpet etude books that focus exclusively on extended techniques”\(^\text{203}\). Denton suggests that the student attempt these etudes once fluent with the extended techniques and perform them as a way to solidify their skills. His section on doodle-tonguing discusses placement tongue and transition between single-, double-, flutter-, and doodle-tonguing\(^\text{204}\). His etude on slide removals challenges both the lip control required to produce the correct alternate pitch and the coordinated movement of the remaining slide\(^\text{205}\). Lastly, Denton presents exercises for multiphonics and vocalizations—singing while playing or in between played notes\(^\text{206}\). His notation is modeled after specific works containing the extended techniques and become progressively more difficult, combining different varieties of techniques as the method advances\(^\text{207}\). This study provides a great tool for musicians and instructors seeking


\(^{203}\) Denton, 1.

\(^{204}\) Ibid., 7.

\(^{205}\) Ibid., 58.

\(^{206}\) Ibid., 49.

\(^{207}\) Ibid., 2.
alternative approaches to specific contemporary works. Based on the grading chart of Paul Ulrich’s annotated bibliography, Denton also provides a graded list of repertoire that can be approached through the practice of his etudes.208


Performance guides exist for specific trumpet works by Stanley Friedman, Robert Erikson, and Frank Ticheli, all of which serve to assist the performer in executing the techniques called for by these composers. The guides included here have a direct bearing on pieces by these composers which feature extended techniques discussed in this study. There are two performance guides to the works of Stanley Friedman. Scott Meredith’s study on Solus breaks the piece into movements, providing a serial analysis of the work and outlining the extended techniques in each movement.209 In describing the technical requirements for each section, Meredith provides strategies for addressing specific problems which might arise, such as replacing growling with flutter-tonguing if the technique is “impossible”.210 His “Technical Considerations” chapter provides instructional guidelines for each of the techniques involved in the work.211


209 Meredith, 6.

210 Ibid., 11.

211 Ibid., 28.

  Sullivan outlines the history of Friedman’s compositional output, discussing the context in which his single movement and multi-movement works were written.212 His appendices provide program notes for Friedman’s works, as well as the extended techniques required in each. His Appendix C also provides three preparatory studies for specific passages in Solus.213


  Keberle’s overview of notation and approach to the multitude of contemporary techniques in the works of Robert Erickson is a great resource for preparing this composer’s works, and provides practical approaches for vocalizations and slide techniques. His study is an extensive resource both for notational examples and descriptions of fundamental technical issues encountered during performance preparation. Keberle divides his chapters on extended techniques into two separate parts: the first describing the techniques, particularly their practical and fundamental requirements and the second delineating the ways these techniques were used in Erikson’s compositions.214 His description of the use of each extended technique

212 Sullivan, 4.
213 Ibid., 74.
214 Keberle, 13, 34.
provides extensive detail on how to execute the effects properly. For example, Keberle’s explanations of metallic valve sounds thoroughly details the exact motions and mechanics required by the composer to produce the desired sonic result.215

- Courtney Dion Jones. “Extended Techniques and Vocal Simulations in Frank Ticheli’s First Voice for Solo B-flat Trumpet.” (DMA diss., University of California, Los Angeles, 2015.)

Jones’ guide to Ticheli’s First Voice is couched as a pedagogical and analytical outline to teaching the composition, based on his interviews with the composer.216 He provides transcripts of her conversations with Ticheli, which are particularly illuminating, as Ticheli demonstrates many of trumpet techniques himself during their interview. Jones then develops his approaches to the techniques in Ticheli’s work based on his personal instructions.217 As with the guides to Friedman and Erikson’s works, Jones provides context to the notated techniques in the piece. He also provides a glossary with notation and definitions for each technique.218 These specific pieces are fairly advanced, and the guides are a good resource for any performer interested in preparing them.

215 Ibid., 27.
216 Jones, 48.
217 Ibid., 125.
218 Ibid., 7.
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