AN ASSESSMENT OF EXTANT EUPHONIUM METHODOLOGIES FOR DEVELOPING AND PERFORMING IN THE UPPER REGISTER

Wei Chien Chou, B.M., M.M.

Dissertation Prepared for the Degree of

DOCTOR OF MUSICAL ARTS

UNIVERSITY OF NORTH TEXAS

December 2017

APPROVED:

Brian L. Bowman, Major Professor
Kris Chesky, Committee Member
Donald C. Little, Committee Member
John Holt, Chair of the Division of Instrumental Studies
Benjamin Brand, Director of Graduate Studies in the College of Music
John Richmond, Dean of the College of Music
Victor Prybutok, Dean of the Toulouse Graduate School
This dissertation presents a categorization of existing methodologies of upper register development for euphoniumists with evaluation of effectiveness and current use of these methodologies. The purpose of this study is to provide euphonium musicians as well as educators with essential references and guides to applicable methods for developing the upper register more effectively with greater efficacy. The assessments of current methodologies include three steps: categorization, summarization, and evaluation. To support the significance why it could be more beneficial than the methodology alone, the dissertation will include the examination of the aspect of biomechanics and ergonomics, suggestions, and discussion of particular issues of the upper register.
Copyright 2017

by

Wei-Chien Chou
ACKNOWLEDGEMENTS

I would like to express my gratitude to all my committee members: Dr. Brian Bowman, Dr. Kris Chesky, and Prof. Donald Little, as well as my colleagues. Without their help, I would not be where I am today.

Dr. Bowman has always been one of the greatest inspirations of my musical journey and in my life. Without his delicate instruction, fine musicianship, and wisdom, I would not be a better musician and human being.

Studying under Dr. Chesky to learn about music and medicine is one of the biggest game changers in my musical journey. Research and awareness of this medical field has helped me become an even better musician and teacher.

Prof. Little is always supportive and helpful during my study at UNT and through all my performances.

My colleagues at the UNT College of Music and euphonium studio have also played a vitally important role in my journey here. They are always supportive and have been a wonderful motivation at all times.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>CHAPTER 1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Background and Significance</td>
<td>1</td>
</tr>
<tr>
<td>State of Research</td>
<td>1</td>
</tr>
<tr>
<td>Purpose of the Study</td>
<td>3</td>
</tr>
<tr>
<td>Selection of Methodologies</td>
<td>3</td>
</tr>
<tr>
<td>CHAPTER 2. SUMMARIZATION OF EXTANT METHODOLOGY</td>
<td>5</td>
</tr>
<tr>
<td>Classification</td>
<td>5</td>
</tr>
<tr>
<td>Summarization</td>
<td>5</td>
</tr>
<tr>
<td>General Brass – Instructions without Musical Exercises</td>
<td>5</td>
</tr>
<tr>
<td>General Brass – Instructions with Musical Exercises</td>
<td>18</td>
</tr>
<tr>
<td>General Brass – Exclusive Musical Exercises</td>
<td>22</td>
</tr>
<tr>
<td>Trumpet – Instructions without Musical Exercises</td>
<td>23</td>
</tr>
<tr>
<td>Trumpet – Instructions with Musical Exercises</td>
<td>27</td>
</tr>
<tr>
<td>Horn – Instructions with Musical Exercises</td>
<td>33</td>
</tr>
<tr>
<td>Euphonium – Instructions without Musical Exercises</td>
<td>33</td>
</tr>
<tr>
<td>Euphonium – Instructions with Musical Exercises</td>
<td>34</td>
</tr>
<tr>
<td>Trombone – Instructions with Musical Exercises</td>
<td>35</td>
</tr>
<tr>
<td>Tuba – Instructions without Musical Exercises</td>
<td>39</td>
</tr>
<tr>
<td>Tuba – Instructions with Musical Exercises</td>
<td>40</td>
</tr>
<tr>
<td>Assortment</td>
<td>40</td>
</tr>
<tr>
<td>CHAPTER 3. DISCUSSION</td>
<td>55</td>
</tr>
<tr>
<td>The Utilization of Terms</td>
<td>55</td>
</tr>
<tr>
<td>Mouthpiece Pressure or Mouthpiece Force</td>
<td>55</td>
</tr>
<tr>
<td>Embouchure</td>
<td>56</td>
</tr>
<tr>
<td>Others</td>
<td>57</td>
</tr>
<tr>
<td>Comparison with Current Literature at Medical Aspect</td>
<td>58</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1: Reviewed Methodologies with Corresponding Codes – General Brass ......................... 6
Table 2: Reviewed Methodologies with Corresponding Codes – Trumpet .................................... 7
Table 3: Reviewed Methodologies with Corresponding Codes – Horn, Euphonium, Trombone, and Tuba .......................................................................................................................... 8
Table 4: Suggestions in Physiology (First Half) – General Brass ............................................. 44
Table 5: Suggestions in Physiology (Second Half) – General Brass ........................................ 45
Table 6: Suggestions in Physiology (First Half) – Trumpet ......................................................... 46
Table 7: Suggestions in Physiology (Second Half) – Trumpet ..................................................... 47
Table 8: Suggestions in Physiology (First Half) – Horn, Euphonium, Trombone, and Tuba ...... 48
Table 9: Suggestions in Physiology (Second Half) – Horn, Euphonium, Trombone, and Tuba .. 49
Table 10: Suggestions in Psychology ........................................................................................ 50
Table 11: Exercises of Musical Patterns and Proper Practice Habits – General Brass ............... 51
Table 12: Exercises of Musical Patterns and Proper Practice Habits – Trumpet ....................... 52
Table 13: Exercises of Musical Patterns and Proper Practice Habits – Horn, Euphonium, Trombone, and Tuba ..................................................................................................................... 53
Table 14: Comparison of Woldendorp and Current Study ....................................................... 59
CHAPTER 1
INTRODUCTION

Background and Significance

A euphonium player’s ability to play in the upper register is critical to successfully performing the solo repertoire as well as the standard orchestral and band literature. According to Saito’s research, the tessitura of euphonium solo literatures after 1975 has notably extended in both low and high ranges.\(^1\) Euphonium has relatively sparse methodologies for the development of the upper register, in comparison with other brass instruments. Most of the method books for euphonium are written for beginner and intermediate players with elementary exercises.\(^2\) Trumpet, on the other hand, has the largest quantity and variety of text and method books for developing the upper register.

Existing methodologies for the upper register on all brass instruments comprise a wide variety of opinions and concepts concerning the development and performance in the upper register. Some suggest relatively prevalent and commonly used methods while some others advocate comparatively unconventional methodologies. The problems of developing the upper register for euphoniumists, however, could differ between individuals. Euphoniumists who experience challenges in this register need suitable solutions to their problem. The significance of this study is to provide a wide range of resources of upper register methods for euphoniumists.

State of Research

The earliest methodology specialized for euphonium can be traced back to *The Euphonium and Four-Valve Brasses* by Harold Brasch, a euphonium soloist in the United State


\(^2\) Ibid,” 24.
Navy Band. This methodology, however, merely includes a fingering chart that shows the extreme high register without any instructions of upper register playing.³ The Art of Euphonium Playing (1977) by Arthur Lehman includes the discussion and musical exercises of “High Notes” in one of his topics in Volume 1⁴ as well as two lines of text in Volume 2.⁵ Brian Bowman indicates instructions and exercises for the high range in Practical Hints on Playing the Baritone (Euphonium) (1983).⁶ The Art of Tuba and Euphonium (1992) by Harvey Philips and William Winkle includes several concepts for playing in the upper register.⁷ Rangesongs for Euphonium (2012) by David Vining emphasizes the development of both high and low ranges by means of reoccurring target notes (the highest notes).⁸ In the journals of International Tuba Euphonium Association, which used to be T.U.B.A, there are no articles about the pedagogical studies for euphonium. However, there are two for tuba: “Coping With the ‘Extension Register’”⁹ and “Improving Tone in the High Register.”¹⁰

Euphoniumists frequently borrow methodologies from other brass instruments due to inadequate euphonium methodologies and the instrument’s relatively young evolitional history. The methods, concepts, and philosophies of other brass instruments can become advantageous

⁸ David Vining, Rangesongs for Euphonium. (Flagstaff, AZ: Mountain Peak Music, 2011), i-ii.
¹⁰ Ibid., 96.
references and methods for any brass player who would like to master the ability of performing in the upper register.

Purpose of the Study

The purpose of this study is to review the euphonium’s existing methodologies and theories in order to provide euphonium musicians and educators with essential references and guides to applicable methods, which can be used for developing the upper register more effectively and with greater efficacy. The methods for assessing existing methodologies comprise of:

1. A classification of brass methodologies for the development of the upper register
2. A summarization of the methodology
3. A discussion of the existing methods and current literature in the field of medicine

In addition to assessing existing methodologies, this study includes research regarding science and medicine for euphonium players. Concepts and knowledge of how a human body works may help euphonium musicians coordinate physical elements properly and obtain the upper register with less effort.

Selection of Methodologies

The methodologies that this study uses for assessment come from three main resources: *A Scientific Characterization of Trumpet Mouthpiece Forces in the Context of Pedagogical Brass Literature* by James Ford11, *The Art of Playing Trumpet in the Upper Register* by August William Haas12, and *Trumpet Pedagogy: a Compendium of Modern Teaching Techniques* by

---


David Hickman.\textsuperscript{13} Ford’s dissertation reviews six pedagogical brass methods regarding the definitions and opinions of “mouthpiece forces,” which could greatly impact a player’s development of the upper register. In Haas’s studies, he reviews and summarizes various trumpet methodologies for upper register development on trumpet performance. Hickman’s methodology provides a great resource of methodologies for brasses.

CHAPTER 2
SUMMARIZATION OF EXTANT METHODOLOGY

Classification

The following summaries will include fifteen methodology books for general brasses, thirteen for trumpet, one for horn, four for euphonium, five for trombone, and two for tuba. Table 1, Table 2, and Table 3 show these forty methodologies in chronological order, with corresponding codes to the other tables in this study. These summaries will describe textual books with musical exercises but will exclude those with etudes. Etudes designed for upper range development are best used by players who have access to the upper register but would like to improve in this range.

Summarizations of existing methodologies are classified as: General Brasses, Trumpet, Euphonium, Horn, Trombone, and Tuba. Each classification will be further designated as: “Instructions without Musical Exercises” (Type 1), “Instructions with Musical Exercises” (Type 2), and “Exclusive Musical Exercises” (Type 3). The codes in these tables correspond for the codes used in the tables in Chapter 3.

Summarization

General Brass – Instructions without Musical Exercises

*Brass Facts: A Survey of Teaching and Playing Methods of Leading Brass Authorities* (1960) by Joseph Bellamah includes concepts from a variety of brass musicians and educators. Physical suggestions for developing the upper register include: 1) blowing air faster; 2) directing air upward with more compression on the upper lip; 3) adding stronger air support with the “tightening” lips; 4) blowing air with greater intensity using “high range syllable”; 5) protruding the lower jaw; 6) using a small lip with open in the “moderately” tightened lips; 7) utilizing the
syllable “tee” while tonguing behind the back of the upper teeth; and 8) maintaining the same embouchure for all ranges.

Table 1: Reviewed Methodologies with Corresponding Codes – General Brass

<table>
<thead>
<tr>
<th>Type</th>
<th>Year</th>
<th>Author</th>
<th>Title</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1960</td>
<td>Joseph Bellamah</td>
<td>Brass Facts: A Survey of Teaching and Playing Methods of Leading Brass</td>
<td>GB1</td>
</tr>
<tr>
<td></td>
<td>1961</td>
<td>Rafael Méndez</td>
<td>Prelude to Brass Playing</td>
<td>GB3</td>
</tr>
<tr>
<td></td>
<td>1962</td>
<td>Charles Colin</td>
<td>Vital Brass Notes</td>
<td>GB4</td>
</tr>
<tr>
<td></td>
<td>1964</td>
<td>Donald Reinhardt</td>
<td>The Encyclopedia of the Pivot System for All Cupped Mouthpiece Brass Instruments</td>
<td>GB6</td>
</tr>
<tr>
<td></td>
<td>1964</td>
<td>James Winter</td>
<td>The Brass Instruments: Performance and Instructional Techniques</td>
<td>GB7</td>
</tr>
<tr>
<td></td>
<td>1968</td>
<td>Fay Hanson</td>
<td>Brass Playing: Mechanism and Technic</td>
<td>GB8</td>
</tr>
<tr>
<td></td>
<td>1976</td>
<td>Joseph Bellamah</td>
<td>A Survey of Modern Brass Teaching Philosophies of Today's Leading Brass Specialists Including Trumpet, Cornet, Horn, Trombone, Euphonium and Tuba: Also Including Jazz Approaches to Brass Playing by the Leading Performers</td>
<td>GB10</td>
</tr>
<tr>
<td>2</td>
<td>1953</td>
<td>Leslie Sweeney</td>
<td>Teaching Techniques for the Brasses</td>
<td>GB12</td>
</tr>
<tr>
<td></td>
<td>1980</td>
<td>John Griffiths</td>
<td>Low Brass Guide</td>
<td>GB13</td>
</tr>
<tr>
<td></td>
<td>1991</td>
<td>Norman Hunt, Dan Bachelder</td>
<td>Guide to Teaching Brass</td>
<td>GB14</td>
</tr>
<tr>
<td>3</td>
<td>1991</td>
<td>Keith Johnson</td>
<td>Progressive Studies for the High Register</td>
<td>GB15</td>
</tr>
</tbody>
</table>
### Table 2: Reviewed Methodologies with Corresponding Codes – Trumpet

<table>
<thead>
<tr>
<th>Type</th>
<th>Year</th>
<th>Author</th>
<th>Title</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1985</td>
<td>Delbert Dale</td>
<td><em>Trumpet Technique</em></td>
<td>TP1</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>David Hickman</td>
<td><em>Trumpet Pedagogy: a Compendium of Modern Teaching Techniques</em></td>
<td>TP2</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td>John Haynie</td>
<td><em>Inside John Haynie's Studio: a Master Teacher's Lessons on trumpet and Life</em></td>
<td>TP3</td>
</tr>
<tr>
<td>1</td>
<td>1935</td>
<td>Herbert Clarke</td>
<td><em>Clarke’s Setting Up Drills, Clarke</em></td>
<td>TP4</td>
</tr>
<tr>
<td>1963</td>
<td></td>
<td>Roger Spaulding</td>
<td><em>Double High C in 37 Weeks</em></td>
<td>TP5</td>
</tr>
<tr>
<td>1966</td>
<td></td>
<td>Irving Bush</td>
<td><em>Top Tones for the Trumpeter</em></td>
<td>TP6</td>
</tr>
<tr>
<td>1973</td>
<td></td>
<td>Cat Anderson</td>
<td><em>The Cat Anderson Trumpet Method: a Systematic Approach to Playing High Notes</em></td>
<td>TP7</td>
</tr>
<tr>
<td>1973</td>
<td></td>
<td>Jerome Callet</td>
<td><em>Trumpet Yoga</em></td>
<td>TP8</td>
</tr>
<tr>
<td>1979</td>
<td></td>
<td>Carmine Caruso</td>
<td><em>Musical Calisthenics for Brass</em></td>
<td>TP9</td>
</tr>
<tr>
<td>1988</td>
<td></td>
<td>John Haynie</td>
<td><em>How to Play High Notes, Low Notes, and All those in Between</em></td>
<td>TP10</td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td>Carlton MacBeth</td>
<td><em>The Original Louis Maggio System for Brass</em></td>
<td>TP11</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td>Allan Colin</td>
<td><em>Sequential Studies: A Method for Gaining Proficiency in the Upper Register, 1999</em></td>
<td>TP12</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td>Fred Mills</td>
<td><em>Fred's Favorites: Eight Studies Designed to Increase Air Flow, Range and Sound Quality</em></td>
<td>TP13</td>
</tr>
</tbody>
</table>
Table 3: Reviewed Methodologies with Corresponding Codes – Horn, Euphonium, Trombone, and Tuba

<table>
<thead>
<tr>
<th>Type</th>
<th>Year</th>
<th>Author</th>
<th>Title</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2</td>
<td>1956</td>
<td>Philip Farkas</td>
<td><em>The Art of French Horn Playing: a Treatise on the Problems and Techniques of French Horn Playing</em></td>
<td>HN1</td>
</tr>
<tr>
<td>Type 1</td>
<td>1992</td>
<td>Harvey Philips, William Winkle</td>
<td><em>The Art of Tuba and Euphonium</em></td>
<td>EU1</td>
</tr>
<tr>
<td>Type 2</td>
<td>1977</td>
<td>Arthur Lehman</td>
<td><em>The Art of Euphonium Playing Volume 1</em></td>
<td>EU2</td>
</tr>
<tr>
<td>Type 2</td>
<td>1983</td>
<td>Brian Bowman</td>
<td><em>Practical Hints on Playing the Baritone (Euphonium)</em></td>
<td>EU3</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>David Vining</td>
<td><em>Rangesongs for Euphonium</em></td>
<td>EU4</td>
</tr>
<tr>
<td>Type 2</td>
<td>1936</td>
<td>Jack Teagarden</td>
<td><em>High Tone Studies for Trombone</em></td>
<td>TRB1</td>
</tr>
<tr>
<td>Type 2</td>
<td>1963</td>
<td>Edward Kleinhammer</td>
<td><em>The Art of Trombone Playing</em></td>
<td>TRB2</td>
</tr>
<tr>
<td>Type 2</td>
<td>1970</td>
<td>Reginald Fink</td>
<td><em>The Trombonist’s Handbook</em></td>
<td>TRB3</td>
</tr>
<tr>
<td>Type 2</td>
<td>1980</td>
<td>Donald Hunsberger</td>
<td><em>Remington Warm-up Studies</em></td>
<td>TRB4</td>
</tr>
<tr>
<td>Type 2</td>
<td>1993</td>
<td>Tom Ervin</td>
<td><em>Rangebuilding on the Trombone</em></td>
<td>TRB5</td>
</tr>
<tr>
<td>Type 1</td>
<td>1996</td>
<td>Brian Frederiksen</td>
<td><em>Arnold Jacobs: Song and Wind</em></td>
<td>TB1</td>
</tr>
<tr>
<td>Type 2</td>
<td>2009</td>
<td>Wesley Jacob</td>
<td><em>Developing High Register on the Tuba</em></td>
<td>TB2</td>
</tr>
</tbody>
</table>

The philosophy for developing the upper register lies in thinking higher. Recommended exercises include buzzing with and without the mouthpiece, practicing the lip flexibility by using the same embouchure in all the tonal ranges, practicing daily as high as possible with all the
dynamics levels, slurring from the middle register to the high one with crescendos, and working on the low and high range using scales and arpeggios.  

Vernon Leidig discusses five physical adjustments for the upper register in *Contemporary Brass Technique: Manual and Study Guide* (1960): 1) high speed of air; 2) more air support; 3) slightly closing lips; 4) rolling-inward lower lips against each other; and 5) the use of syllable “ti” or “te” with tonguing at the “roof of the mouth.” The author explains that the lower lip provides a “wedge” function to stretch the lips to ascend pitch. He further suggests that a player needs to avoid the “death grip” and the air and tongue should do the work for the high range.

The *Prelude to Brass Playing* (1961) by Rafael Méndez includes two physical concepts for developing the upper register: the “shorten portion of vibration” of lips and mouthpiece pressure. Méndez states that when “the (lip) vibrating length is shortened, and a higher note results . . . your ability to produce higher notes will depend greatly upon the portions that you can get to vibrate.” Mouthpiece pressure can be the simplest way to help achieve high notes. The author refers the “strong-playing” with the mouthpiece pressure. This pressure, however, will lead to several negative results including bad intonation, flabby low range, poor articulation style, restricting notes, inconsistent slurring, splitting notes, numbness in the lips, and injured

---

15 Ibid., 28-29.
16 Ibid., 28.
19 Ibid., 22.
20 Ibid., 31-32.
Méndez does advocate that the upper register requires three components: strongly developed embouchure ("tremendous embouchure development"), air support strength ("chest power"), and a well-trained ear ("a well-developed ear").

His suggestions for the high range include: practicing with appropriate rest, avoiding too loud or forced practice, and allowing the muscles to develop "slowly and surely." Méndez recommends exercise to gain "flexibility" for the high range by working on the low range, which helps relax the lips.

Charles Colin, in *Vital Brass Notes* (1962), discusses seven physical adjustments: 1) smaller lip aperture; 2) firmed lip corners; 3) the syllable "ee" with the arched tongue; 4) the same mouthpiece placement in complete range; 5) avoiding excessive mouthpiece pressure; 6) additional "strength" to the embouchure; and 7) the diaphragm. For players wishing to play from the low to high range with a smooth switch, the author suggests "drawing" the lips together by slightly "raising" the bottom lip. This leads to "tightening" the corners of the mouth. This particular lip movement affects the air stream and the resistance on the embouchure. The "compressed" lips cause a smaller opening for the upper register.

Colin suggests "more puckered lips" for ascending notes. To avoid the large open aperture, players can tongue behind the upper teeth, starting their tongue close to the "roof of the mouth." Such motion will decrease the excessive "lip pressure." The "arched tongue" results in more "forceful" air stream, where the tip of the tongue is released to generate much faster lip vibration. The use of the syllable "ee" with the open throat helps air to pass through the "arched tongue." Players use "tu-ee" or "ta-ee"

---

21 Ibid., 22.
22 Ibid., 99.
23 Ibid., 102-104.
25 Ibid., 16.
26 Ibid., 8.
for ascending intervals. However, they should not move the mouthpiece in all the ranges. To avoid excessive mouthpiece pressure and allow the embouchure to vibrate properly, musicians should play towards the mouthpiece instead of “digging into the lips”. Colin indicates that the eye, cheek, and lip muscles can provide “added strength” to the embouchure. High notes require more compression (“tensity”) in the diaphragm. It is important to coordinate the “diaphragm muscle,” the “tongue muscle,” and the “muscle surrounding the embouchure” in order to successfully reach the high register. The author believes that the high range is important but it is not the most critical performance skill to have; a player’s mental and emotional condition could affect their physical abilities. Recommended exercises for the high range include: 1) lip slurs that use the overtone series to gain flexibility and security for close intervals in the extreme upper register; and 2) taking the mouthpiece away from the lips (however, not completely) while inhaling to allow the blood flow back to the lips and enhance endurance.

Philip Farkas, in The Art of Brass Playing: A Treatise on the Formation and Use of the Brass Player's Embouchure (1962), suggests eight physical adjustments for developing the upper register: 1) slightly raising the lower jaw; 2) a small lip aperture shaped like “the end of an

27 Ibid., 14.
28 Ibid., 22.
29 Ibid., 12.
30 Ibid., 9.
31 Ibid., 14.
32 Ibid., 35.
33 Colin, Vital Brass, 27.
34 Ibid., 44.
35 Ibid., 43.
37 Ibid., 40.
38 Ibid., 42.
39 Ibid., 52.
40 Ibid., 8.
41 Ibid., 53.
42 Ibid., 55-56.
43 Ibid., 53.
44 Ibid., 40.
45 Ibid., 41-42.
46 Farkas, The Art of Brass Playing, 42.
47 Ibid., 52.
Pushing the jaw forward and angling the mouthpiece vertically to the upper front teeth (by placing the instrument more horizontally) can help a player to correct the habit of using the “lateral pressure,” which results in “forcing the mouthpiece upward toward the nose.” Farkas explains that the high range requires a well-developed embouchure that disregards “dry” or “moist” lips. Being aware of this provisional but harsh “undue mouthpiece pressure” will help players develop the upper register with proper methods.

In *The Encyclopedia of the Pivot System for All Cupped Mouthpiece Brass Instruments* (1964), Donald Reinhardt speaks on the philosophy of “individualism” categorizing four standard types and five subtypes of embouchure. Embouchure, tongue, and breath are the three main factors that form the upper register. Reinhardt outlines several concepts to develop high range: air direction, air volume, air pressure, syllable/tongue, and diaphragm. Unlike the other authors, Reinhardt indicates nonspecific air direction but explains, “The air column narrows down as it leaves the lungs to pass into the throat passage . . . The air stream, as it leaves the embouchure formation, hits farther back in the mouthpiece (more toward the rim).” Players need to use a smaller quantity of air while applying more air pressure. This prevents over-breathing that results in obstacles to developing the upper register. It is necessary to utilize “greater lip compression (pinching power)” for more velocity and increasing tension of lip vibration. The

---

48 Ibid., 53-54.
49 Ibid., 56.
50 Ibid., 26.
51 Ibid., 53.
53 Ibid., 5.
55 Ibid., 59.
The author illustrates, “The tongue-arch is in a higher position and closer to the roof of the mouth which requires greater air pressure to blow the air through the smaller space.”56 To coordinate the arched tongue position, Reinhardt suggests using these syllables: “EEE-DEEE-TEEE”.57 Players need to employ the “lift” of diaphragm and abdomen with appropriate timing in order to perform a long phrase in the high register.58 The author believes “A squeak of today is a note of tomorrow.” He recommends the exercise “flip up (a rapid, ascending, slurred glissando)” for the “high tone squeakers”.59

_The Brass Instruments: Performance and Instructional Techniques_ (1964) by James Winter discusses the physical adjustment necessary to develop the upper register: air speed, air support, lip aperture, direction of lip rolling, syllable/tongue, and mouthpiece pressure. To obtain the upper register, players need to blow harder for faster air speed with more air support. Reaching the high range requires a smaller aperture by a “very delicate adjustment”: rolling the lips inward.60 A player then utilizes the syllable “ee” (as in “easy”) in the upper register.61 Mouthpiece pressure can result in two things: fatigue while playing in the upper register and failure in developing it.62 The author suggests that individuals “feel comfortable only when the mouthpiece is lying on the lower lip, with the upper rim in the red of the flesh . . . may even exhibit a rolling of the chin, with the consequent loss of the ‘dip’ in the high register.” They may

---

56 Ibid., 79.
57 Ibid., 83.
58 Ibid., 59.
59 Ibid., 162.
60 Winter, _The Brass Instruments_ (Boston, MA: Allyn and Bacon, 1964), 23.
61 Ibid.,18.
62 Winter, _The Brass Instruments_, 24-25.
roll the lower lip inward for the high range.63 Winter states, “Two such are the ‘Pivot’ and ‘Weldon’ Systems, which attempt to concentrate mouthpiece pressure (one hesitates to use the term “pressure”). Any system can be overdone.” “Pivot” advocates that players should pull down the bell for the upper register while “Weldon” believes players should push their jaw forward for the high range.64

*Brass Playing: Mechanism and Technic* (1968) by Fay Hanson presents the following suggestions for physical adjustments: air speed, lip aperture, syllable/tongue, and mouthpiece pressure. Hanson advocates that the combination of lip tension, an arched tongue with the syllable “ee,” and faster air can lead to “good range.” Minimal vibration on the lip surface is key to building the range. Excessive mouthpiece pressure will “cut off” the vibrations of the lips. The author states several philosophies surrounding the mental aspects of developing the upper register: 1) avoid “fear,” which players develop most easily at the beginning; 2) consider the high range as “different” instead of “difficult”; 3) avoid haste when developing the high range; 4) think of the high notes as a horizon instead of “up”; 5) think of “throwing the ball a greater distance”; and 6) play freely without tension. Hanson recommends exercises for range development like adding one ascending step (whole or half) at a time with slow pacing and to look at “objects” while blowing air.65

*Essentials of Brass Playing: An Explicit, Logical Approach to Important Basic Factors That Contribute to Superior Brass Instrument Performance* (1974) by Fred Fox discusses physical adjustment using lip aperture, lip corners, mouthpiece pressure, syllable/tongue, throat, and diaphragm. Fox presents the concept of “corner pair” versus “center pair” of the lips. The

---

63 Ibid., 26.
64 Ibid., 28.
“center pair” or the middle lip muscles change the notes while the “corner pair” should maintain constant tension in all registers. Players tend to compress the “corner pair” muscles and increase the mouthpiece pressure while playing in the higher range.66 Instead, they should consciously train their middle lip muscles to change the aperture inside the mouthpiece to obtain the high range.67 The upper register requires “a gradually smaller vowel sound”68 with the open throat69. Lifting the tip of the tongue to the roof of the mouth helps one to obtain the highest notes in a musical passage.70 Players can use the “kick” in the lower diaphragm for the highest notes by relaxing after the highest notes and using diaphragm strength once again for the next highest notes.71 The other philosophy is to “always think economy when playing” in order to produce more notes with less effort.72 The author recommends exercises including lip slurs using the overtone series to effectively train the “middle embouchure”73 and “slurring up” four step notes with minimum mouthpiece pressure and lip tension.74

A Survey of Modern Brass Teaching Philosophies of Today's Leading Brass Specialists Including Trumpet, Cornet, Horn, Trombone, Euphonium and Tuba: Also Including Jazz Approaches to Brass Playing by the Leading Performers (1976) by Joseph Bellamah contains varying opinions from music professors. Because of the wide range of concepts and suggestions in Bellamah’s book, this summarization quotes suggestions by Leonard Falcone, who was a

67 Ibid., 24.
68 Ibid., 17.
69 Ibid., 22.
70 Ibid., 46.
71 Ibid., 36
72 Ibid., 31.
73 Ibid., 23.
74 Ibid., 31.
professor of baritone horn/euphonium at Michigan State University (1927-1967). Falcone asserts that the high range could be achieved by directing the air stream upward inside the mouthpiece, using greater air support, and applying more mouthpiece pressure “as necessary.”

Musical Performance: Learning Theory and Pedagogy (1985) by Daniel Kohut discusses physical adjustments such as air speed, air volume, air direction, air pressure, air support, jaw, lip aperture, syllable/tongue, mouthpiece pressure, throat, and oral cavity. One can use faster air with less quantity of air as pitch ascends. Some brass players using “upstream embouchure” direct the air upward to play the high range while others using a “downstream” method blow the air stream in a downward direction. Kohut explains the relationship between “breath pressure,” “breath support,” “air volume,” and “air speed”: “it is important that we not confuse air speed with breath pressure, which is regulated mainly by the expiratory muscles. Breath pressure has to do with breath support, which influences both air volume and air speed. The greater the breath pressure (breath support), the greater the combined air-volume and air-speed ratio we have to work with.” To conclude, the greater air pressure is necessary to create a certain speed of air that will help obtain high notes. The jaw moving upward affects a smaller size in the mouth cavity, which results in high notes. Players, however, could overdo this adjustment by rolling the lower lip inward under the upper lip. To correct the inward curling of the lower lip, players should thrust the jaw forward to make both lips even by observing it with a mouthpiece.

77 Ibid., 196.
78 Ibid., 192.
79 Ibid., 193.
visualizer. The smaller lip aperture leads to faster air, which is necessary for playing in the upper register. The author suggests that advanced brass players should use the “tee” syllable for a more arched tongue position in the high range. The arched tongue that influences the throat, air speed and air direction can help players develop the upper register by using a proper breathing system and embouchure. Kohut recommends that public school brass students working to develop the upper register should avoid this syllable/tongue adjustment but focus. Instead, they should focus on faster air, greater air pressure with lip slurs, and the pivot system that helps the direction of air stream. Too much mouthpiece pressure is a “cheap” way to obtain higher notes, which leads to fatigue and endurance issues in the embouchure. Tightening the throat causes a “pinched” tone quality in the upper register.

**General Brass – Instructions with Musical Exercises**

Leslie Sweeney, in *Teaching Techniques for the Brasses* (1953), outlines three general reasons for challenges while playing in the upper register: 1) “the use of pressure”; 2) insufficient air support; and 3) impatience. The author discusses the “no-pressure system” and the “pressure system” for the upper register. These systems involve physical adjustments that include air pressure, air support, diaphragm, air direction, air column “size,” syllable/tongue, oral cavity, and mouthpiece pressure. The author advocates that the “no-pressure system” helps players to develop the upper register with efficiency while the “pressure system” leads to frequent exhaustion in the lips. The “no-pressure system” involves coordinating the embouchure,

---

81 Ibid., 196.
82 Ibid., 193.
83 Ibid., 213.
84 Ibid., 209.
the diaphragm, and the tongue. Players “increase the tension of the muscles of the lips” to play the overtone series when applying greater air pressure. This leads to a higher frequency of the lip vibration. Diaphragm strength can help greater air pressure to “lift” pitches. This “voluntary tension of the muscles of the embouchure” comes with a slightly different “size” and “direction” of the air stream, which players can adjust using the “channel over the tongue” (oral cavity) into a smaller size by using the syllable “tee”. Thinking of “tee” will help the muscles of the face, lips, tongue, diaphragm, and air to develop the upper register. The “pressure system” includes “forcing the mouthpiece tighter against the lips to obtain the higher tones.” The author advocates that well-developed muscles of the embouchure will help reduce the mouthpiece pressure for playing in the upper register. Players need to avoid the “excessive pressure” that usually comes with “haste” by changing their practice habits. They also need to change their philosophies on the problem, relaxing, and being aware that the “force” is harmful. Students without well-established fundamentals should not attempt to play the high range, so they can avoid developing the bad habit of using excessive mouthpiece pressure. Another factor that affects properly developing the high range includes selecting a mouthpiece. A “broad cup” and inadequate choke will result in difficulty obtaining the high range.

By practicing good habits (i.e. no haste and relax), practicing with appropriate rest, and developing clear tone quality, players can avoid misused pressure in the high range. Lip slurs using the overtone series help players to develop the required muscles of embouchure and diaphragm, both which aid the air support and pressure for playing in the upper register.

---

86 Sweeney, Teaching Techniques, 47.  
87 Ibid., 48.  
88 Ibid., 6-7.  
89 Sweeney, Teaching Techniques, 34.
Removing contact between the mouthpiece and the lips can reduce tiredness caused by excessive pressure.90

*Low Brass Guide* (1980) by John Griffiths discusses three important elements for developing the upper register: 1) “focus”: the shape of the lip aperture is a “flatten oval” consistent in all ranges; 2) ”direction”: directing the air stream downward; and 3) “speed”: faster air stream.91 He also talks about physical adjustments like jaw, air speed, air direction, air pressure, diaphragmatic support, lip aperture, syllable/tongue, throat, and mouthpiece pressure. The author explains that extending the high range requires adjusting of the jaw by moving it upward and backward. This leads to a faster air stream and air pushing downward toward bottom of the mouthpiece.92 The jaw, however, should be flexible.93 The higher a player wishes to play, the greater speed94 and pressure95 of the air stream he/she needs to employ. The upper register requires more air pressure instead of muscular tension. Griffiths uses a unique analogy of singers’ falsetto. The falsetto produced by the vocal cord has a relatively relaxed tension. Likewise, a brass player could relax facial muscles to produce freer air support and flow. Players who struggle with the high range use more muscles than air.96 The “diaphragmatic support” and consistent air flow are necessary for developing the upper register.97 To retain the lip aperture shaped as “a flatten oval” in complete ranges, the author indicates that players “contract” the

---

90 Ibid., 48.
92 Ibid., 43.
93 Ibid., 59
94 Ibid., 59.
95 Ibid., 16.
96 Ibid., 59.
97 Ibid., 16.
aperture instead of “puckering” or changing into a “slit” shape.\textsuperscript{98} A slightly arched tongue may help the direction of the upper register’s air column.\textsuperscript{99} The author advocates a tongue position that retains “ahh” with an open throat at all times but will go higher as the pitch ascends. Players should avoid using “eeh” since this overemphasized syllable compresses tone quality. Recommended for the “all-purpose shape” is “tauw” with slight changes for an extreme register.\textsuperscript{100} Players need to use minimum mouthpiece pressure for the upper register. Increasing mouthpiece pressure is necessary only for the ascending register since no pressure will cause the loss of controlling tone quality. Excessive mouthpiece pressure negatively impacts endurance. The statement “Do not make your biceps be a substitute for a well-formed embouchure” implies that gripping the instrument too strongly could create excessive mouthpiece pressure and affect the embouchure.\textsuperscript{101} The larger rim of a mouthpiece results in difficulty developing the upper register while the small bores may make it rather easy. Recommended exercises include wide intervals, pedal notes, nose breathing, mouthpiece practice, and ascending chromatically to one’s highest note and backward to an octave lower. The wide intervals and pedal notes will help a player improve flexibility in the jaw muscles, which could benefit the high range. Nose breathing, which allows the jaw to remain in position, will help develop endurance. Mouthpiece practice and chromatic exercise help players to extend the ranges. In order to play successfully in the high range, a player should practice in the same range, including playing the high parts in duets and other high range exercises.\textsuperscript{102}

\textsuperscript{98} Griffiths, \textit{Low Brass}, 28.
\textsuperscript{99} Ibid., 59.
\textsuperscript{100} Ibid., 68.
\textsuperscript{101} Ibid., 62.
\textsuperscript{102} Ibid., 60.
Guide to Teaching Brass (1968) by Norman Hunt and Dan Bachelder discusses physical adjustments including air direction, lip aperture, syllable/tongue, jaw, and mouth cavity. Most brass players gradually direct the air stream downward as pitches ascend. By changing the direction of air, a faster vibration in the upper lip is produced, which results in the higher range. The authors indicate that some individuals with the opposite function of the upper and bottom lips may employ the “upward” air to the high range. To obtain the highest notes, players need to use an arched tongue, which results in an “ee” position and “the minimum opening of the lips.” Players adjust the “shape” of the oral cavity by changing the tongue position for “a full sound” from the low to high range. A tongue that is too flat results in upper register failure. A tongue that is too high (close to the roof of the mouth) and the space between the upper and lower jaws that is too closed may lead to a “pinched” tone quality. A high and loud note, however, needs a flatter tongue and a larger oral cavity, in comparison to a low and soft note. The tongue position is modified as suggested above if the volume remains the same. A mouthpiece with a narrow and shallow cup may be relatively easy and responsive for playing in the upper register. The author recommends an exercise of lip slurs using the overtone series that a player should practice smoothly without tension.

General Brass – Exclusive Musical Exercises

Progressive Studies for the High Register (1991) by Keith Johnson exclusively includes musical exercises with little commentary. The author advises that a player should practice all

104 Ibid., 35.
105 Ibid., 19.
106 Ibid., 41.
107 Ibid., 100.
exercises in the book and with the best tone quality and musically.

*Trumpet – Instructions without Musical Exercises*

*Trumpet Technique* (1985) by Delbert Dale discusses physical adjustments for the upper register like air speed, air direction, lip aperture, direction of lip rolling, lip corners, oral cavity, syllable/tongue, and mouthpiece pressure. Fast breath exhalation can help produce high notes and ease any tension in the lips.\(^{108}\) The author indicates nonspecific air direction (i.e. downward and upward) for the upper register; however, he states: “higher notes are produced by the air stream hitting close to the inside lower edge of the rim of the mouthpiece.”\(^{109}\) The upper register requires a smaller size of lip aperture surrounded by the contracted lip muscles. Dale provides his personal “formula” to form this lip aperture for the upper register:

1. A slight rolling in of the upper lip
2. Pulling the upper lip backward against the teeth – but not by mouthpiece pressure
3. A balanced tension of the muscles of both lips – especially in the corners – pressing against each other – but still retaining the red-shaped aperture)\(^{110}\)

The muscles of lip corners need to develop more strength than the center so that players can reach the high range with better stamina.\(^{111}\) The arched and relatively tense tongue with “ee” is essential for an “attack” in the high range.\(^{112}\) The cavity inside the mouth needs to become smaller for the upper register. Dale states: “the inside of the mouth and the throat (the oral cavity) resemble the organ pipe; a smaller tone chamber for the higher notes.” A progressively raised tongue coordinated with the syllables “AAHH-U-EE” helps a player to smoothly produce notes


\(^{109}\) Ibid., 21.

\(^{110}\) Ibid., 29.

\(^{111}\) Ibid., 22.

\(^{112}\) Ibid., 58.
from the low to the upper register.\textsuperscript{113} To successfully perform the smaller intervals of the overtone series in the upper register (i.e. a two-note lip slur/lip trill), players change the back tongue position rapidly by using the syllables “too-ee-oo-ee” with a proper embouchure.\textsuperscript{114} The only purpose of mouthpiece pressure on the lips is to seal the air between the lips and the mouthpiece. Dale advocates the “light-pressure system” to develop the upper register.\textsuperscript{115} Young students without a proper embouchure for the upper register may apply “excessive pressure.” While practicing lip slurs, students need to ensure they strictly exercise the lips and avoid applying extra mouthpiece pressure.\textsuperscript{116} Other concepts include: 1) a mouthpiece with a larger cup may result in relative difficulty playing in the upper register but proper practice with endurance, lip slurs, and long tones can help the student control this register; 2) keeping the lips fresh at all times by resting appropriately; 3) avoiding the “double embouchure” (changing embouchure) by working on both the low and high ranges, especially for beginner students; 4) a faster lip vibration can produce the upper register; and 5) ensuring the upper register sounds stronger by playing with ease.\textsuperscript{117} Recommended exercises include lip buzzing for relaxation in the lips after warm-ups and the developing strength,\textsuperscript{118} starting a note that is easy for a player by adding one ascending step at a time, and using lip slurs, scales, chromatic scales, and arpeggios.\textsuperscript{119} Arpeggios can help players improve their range and endurance.\textsuperscript{120}

\textsuperscript{113} Ibid., 29.
\textsuperscript{114} Ibid. 54.
\textsuperscript{115} Dale, \textit{Trumpet Technique}, 24.
\textsuperscript{116} Ibid., 29.
\textsuperscript{117} Ibid., 28-29.
\textsuperscript{118} Ibid., 21.
\textsuperscript{119} Ibid., 29.
\textsuperscript{120} Ibid., 62.
Trumpet Pedagogy: a Compendium of Modern Teaching Techniques (2006) by David Hickman consists of relatively comprehensive concepts and methods for developing the upper register of trumpet. It also cites philosophies from various educators and musicians. Detailed concepts include “Dental Considerations” referring to different types of teeth condition and dental issues,121 “Embouchure Formation and Control,” discussing jaw, mouthpiece, pivot system, tongue, air, lip, mouthpiece placement, mouthpiece pressure, tension of muscles, and “Mouthpieces Design and Function”.122 The author explains that developing strength in the upper register requires a different training strategy to develop endurance.123 In order to gain and improve strength in that register, a player may utilize isometric exercises, which overloads the system and stimulates the muscles. Recommended exercises for developing strength in the upper register are long tones, buzzing with and without mouthpiece, and lip “bends” (the ability to move the center of pitches with the motion of lips instead of changing the fingers), and holding devices like a pencil or “Chop-Sticks” by the lips.124 Lengthened practice with less intense exercises (“low level”) helps the circulation in the muscle cells and blood so that a player’s endurance improves gradually.125 Hickman states that breathing fully with relaxation, a correctly puckered embouchure, greater breath support from the abdominal area, a properly arched tongue, and confidence can help alleviate any inconsistency in the upper register. To solve this inconsistency issue, players should develop the high range with a proper warm-up every day and use “gradually ascending exercise” (i.e. chromatic scales) for steady extension in the upper register. Recommended materials include: Advanced Range, Technique & Interval Studies by

121 Hickman, Trumpet Pedagogy, 37.
122 Hickman, Trumpet Pedagogy, 43-130.
123 Ibid., 197.
124 Ibid., 198-204.
125 Ibid., 197.
Irving Bush, all the studies by Herbert L Clare, *Advanced Lip Flexibilities* by Charles Colin, *Daily Drills and Technical Studies* by Max Schlossberg, and *Top Tones* by Walter M. Smith.126

*Inside John Haynie's Studio: a Master Teacher's Lessons on Trumpet and Life* (2007) by John Haynie discusses the physical adjustments for the upper register like air speed, air resistance, jaw, lip corners, syllable/tongue, the pivot/head position, mouthpiece pressure, and airway. A decreased airway size and more air stream resistance produced by the jaw and tongue going upward results in faster air, right for playing in the upper register.127 Haynie states that the concurrent coordination of “contracting and relaxing tongue,” “arching and flattening the tongue,” and “pivoting the instrument and head” is essential to regulating pitches.128 The muscles of lips contract with the corners of the “mouth” when notes ascend.129 Players gradually change their tongue position from “ah” to “ee” when playing the lowest to the highest notes. Haynie believes that each note requires a different tongue position coordinated with the facial muscles.130 In addition, mouthpiece pressure increases in the upper register131 and players need to adjust their head position to keep the airway open.132 He also outlines a philosophy of using exercises to develop the upper register. A mindset free from fear, a body without tension, and a suitable mouthpiece will help a player achieve the high range with less effort. It is also necessary for a player to develop the ability of playing higher than one’s “performance range.” Recommended exercises include buzzing with and without a mouthpiece, lip slurs, long tones in all the registers.

---

126 Ibid., 221.
128 Ibid, 6.
129 Ibid., 29.
130 Ibid., 7.
131 Ibid., 56.
132 Ibid., 39.
and fast slur exercises from low to high with glissando. Suggested materials are Earl Iron’s *Twenty-Seven Groups of Exercises*, Haynie’s *High Notes, Low Notes, and All Those in Between*, and Clarke’s *Technical Studies* (played an octave higher).\(^{133}\)

*Trumpet – Instructions with Musical Exercises*

Herbert Clarke suggests chromatic scales, scale patterns, and arpeggios in *Clarke's Setting Up Drills: Calisthenic Exercises for the Cornet, Trumpet or Baritone* (1935). The author discusses that using “wind power,” lips, mouthpiece placement, and mouthpiece pressure will help develop the high range. Clarke states that it is essential for students to utilize “the proper amount of the wind power” to regulate notes between the low and high range.\(^{134}\) In order to produce even tone quality in all the ranges (low, middle, and high), players need to ensure they can produce equal lip vibration by placing the mouthpiece one half on the upper lip and the other on the bottom. Limiting the minimum mouthpiece pressure on the bottom lip can help with a better vibration in the upper lip and improve stamina.\(^{135}\) Other concepts in the book include having a positive mindset (“ease and confidence”)\(^{136}\) and avoiding an attempt to develop the high register until well-proper fundamentals are in place.\(^{137}\) Recommended exercises consist of chromatic scales, scales, and arpeggios in various keys.

*Double High C in 37 Weeks* (1963) by Roger Spaulding suggests physical adjustments like air pressure, diaphragm, air speed, jaw, lip (corners), and syllable/tongue. Spaulding states that air pressure increases more when pitches ascend. Diaphragm strength helps “the proper

\(^{133}\) Ibid., 27-29.


\(^{135}\) Ibid., 4.

\(^{136}\) Ibid., 3.

\(^{137}\) Ibid., 16.
pressure on the lungs.” To reach the upper register, it is best to produce faster air that one can
“squeeze and force” out of the lungs by diaphragmatic strength and abdominal muscles and full
air volume in the lungs.\textsuperscript{138} More lips in the mouthpiece and a lifting-upward jaw can provide
“cushion and resistant support” for the high range.\textsuperscript{139} It is necessary for the lips to “compress” or
“pucker (not smile or stretch)” for greater resistance that can help with strength and
concentration. Players should “anchor” the tip of the tongue on the bottom of the lower teeth
while “arching” the center of the tongue produces the greatest power and resistance for the upper
register.\textsuperscript{140} Spaulding believes that confidence and physical exercises (sit-ups, leg-ups, push-ups,
chin-ups, and running) will assist in reaching the high range.\textsuperscript{141} His philosophies also include: 1)
changing mouthpieces will improve the upper register; 2) thinking an octave lower than the
written notes; 3) the psychological factors that affect the functions of muscles;\textsuperscript{142} and 4) never
warming up before practicing his recommended routine.\textsuperscript{143} The author uses the scientific theory
of “suspended incubation” to schedule alternating days as “practice days” and “rest days.”\textsuperscript{144} By
alternating practice and rest days, embouchure muscles become stronger through the recovery of
muscular fibers and cells.\textsuperscript{145} Provided musical exercises include long tones, scales, chromatic
scales, arpeggios, and pedal notes. The pedal notes help lip tissues to recover from practicing the

\textsuperscript{139} Ibid., 13.
\textsuperscript{140} Spaulding, \textit{Double High C}, 10.
\textsuperscript{141} Ibid., 8-11.
\textsuperscript{142} Ibid., 12-13.
\textsuperscript{143} Ibid., 15.
\textsuperscript{144} Ibid., 14.
\textsuperscript{145} Ibid., 7.
When following this program, a player must complete his physical work-out before practicing the exercises in this book.

*Top Tones for Trumpet* (1966) by Irving Bush discusses two physical suggestions for playing the upper register: increasing air speed and utilizing the syllables “Oo-Ee-Oo.” “Oo” is for the middle and low register while “Ee” is for the upper register. The tongue has to remain tension-free when a player uses the syllable “Oo-Ee-Oo.” A player should employ these syllables with more accuracy when the intervals increase. Concepts for developing the upper register include thinking correctly, practicing accurately and slowly, sustaining the consistency and evenness of tone quality in all the registers, and practicing with appropriate rest. Interval studies in chapters titled half steps, whole steps, thirds, fourths, fifth, sixths, and octaves develop the changing tongue syllables “Oo-Ee-Oo.” Bush suggests single tonguing and multiple tonguing, as well as practicing with written articulations.

*The Cat Anderson Trumpet Method: a Systematic Approach to Playing High Notes* (1973) by Cat Anderson excludes any suggestions for upper register physical adjustments. Philosophies for developing the high range include practicing daily without tension and faith in “will-power.” Players need to believe they can play as high as they wish. Recommended exercises include long tones, scales, triads, and arpeggios.

*Trumpet Yoga* (1973) by Jerome Callet outlines relatively distinct suggestions for the upper register. The physical adjustments include air “power”, diaphragm, lip aperture, lip corners,

---

146 Ibid., 13.
147 Ibid., 14.
149 Ibid., 17.
direction of lip rolling, syllable/tongue, oral cavity, throat, mouthpiece placement, and the
distance between the upper and lower teeth. Callet advocates that unrolling lips, properly held
facial muscles, and greater “wind power” will lead to “a true range.” Tightening up the
“abdominal walls” for exhaling without tension on the shoulders can assist in slurring a “soft
third space ‘C’ to a high ‘C’.” The air pressure controls the size of lip aperture. By unrolling the
lips with at least one quarter of an inch distance between the upper and bottom teeth, the aperture
of lips moves closer for the upper register, with decreased compression by the arm. To keep
unrolled lips in the complete registers, players pull the corners of the mouth and cheeks upward
against the air flow for the upper register. Callet explains that rolling the lips can lead to thin
tone quality and restrict flexibility in the upper register. Due to the relatively strong facial
muscles pulled by the cheeks and the corners of the mouth, the author advocates that using the
syllables “too-eee-ooo-eee” with an arched tongue and a decreased size of oral cavity will restrict
air power and result in negatively developing the upper register. Keeping the throat open is
essential for playing in the upper register. Players wishing to develop a better range by using
Callet’s methods need to place the mouthpiece higher on the bottom lip and reduce the grip of
the arm when playing the double high “C.” Recommended exercises include pedal notes, wide
intervallic jumps, chromatic scales, and scales.\footnote{152}

\textit{Musical Calisthenics for Brass} (1979) by Carmine Caruso is another book that excludes
specific physical adjustments for the upper register. A player should use interval studies as high
as possible, even though the tone quality at the beginning might not sound pleasant. The quality,
however, will improve because muscles will learn to achieve their proper position. To increase
the high range, Caruso suggests this routine: “Play as high as you can go until no sound comes

\footnote{152 Jerome Callet, \textit{Trumpet Yoga} (New York, NY: Charles Colin, 1973), 4-12.}
out of the horn, but make sure that you complete the effort to play the particular interval. Take
the horn away from your lips and rest ten or fifteen seconds. Then pick up where you left off and
go higher, again until no sound comes out of the instrument. That is the end of this study. Stop
for fifteen minutes or more and then repeat the study. PRACTICING IN THIS MANNER WILL
INCREASE YOUR HIGH REGISTER. “\textsuperscript{153} This type of training process is similar to what
dancers and gymnasts do before their workouts and performances.\textsuperscript{154} Caruso suggests that a
player should tap his foot during all exercises since synching one’s body and timing is important.
Recommended exercises include long tones, scales, and arpeggios.\textsuperscript{155}

In \textit{How to Play High Notes, Low Notes and All those in Between} (1988), John Haynie
indicates the same concepts mentioned in \textit{Inside John Haynie’s Studio: a Master Teacher’s
Lessons on Trumpet and Life}. When trumpeters play ascending pitches, the trumpet inclines
downward and the “forehead tips backward very slightly.” Haynie specifies that players with
abnormal teeth and jaw position (“lower teeth are farther forward than the upper teeth when the
jaw is clamped”) should pivot in reverse.\textsuperscript{156} Recommended exercises include playing a pattern
that uses chromatic scales, lip slurs, and scales played with a metronome.

\textit{The Original Louis Maggio System for Brass} (1993) by Carlton MacBeth discusses three
physical adjustments: 1) the embouchure in the high range should remain similar to the low
range; 2) the tongue should be placed in a “hissing” position; and 3) the throat should maintain
“AH”.\textsuperscript{157} The author claims that using “AH” in the throat will help a player produce proper air

\textsuperscript{154} Ibid., 53.
\textsuperscript{155} Caruso, \textit{Musical Calisthenics}, 11.
\textsuperscript{156} John Haynie, \textit{How to Play High Notes, Low Notes and All those in Between} (New York, NY: Charles Colin,
stream for all the registers. Philosophies for the upper register include: 1) beginning small and growing bigger; 2) playing as high as possible with pedal notes in between; 3) a third below one’s highest note is the “practical range”; and 4) the pacing of developing this register will differ between individuals. The author suggests that a player should alternate slurring and tonguing exercises daily.158

Allan Colin advocates the importance of “driving” air that is supported by the diaphragm in *Sequential Studies: A Method for Gaining Proficiency in the Upper Register* (1999). A player should play the provided exercises in twelve keys. When tired, a player should rest by removing the mouthpiece completely away from the lips. Colin recommends that players should exercise patterns using broken scales in thirds.159

*Fred's Favorites: Eight Studies Designed to Increase Air Flow, Range and Sound Quality* (2009) by Fred Mills outlines three suggestions for air application: 1) strong, free, and even air flow; 2) faster air rather than forcing air;160 and 3) keeping the air moving “forward” instead of “up and down.”161 His philosophies include thinking of the notes on a horizontal line rather than up and down and imagining the air “going straight through the horn and out the bell.”162 Intervals of fifth and sixths are good exercises for training a player’s ear and strengthening range. A player should sustain consistent tone quality and strong breath flow while playing scales and arpeggios.163

---

158 Ibid., “Lesson IV Extreme Registers”
161 Ibid., 34.
162 Ibid., 22.
163 Ibid., 34.
Horn – Instructions with Musical Exercises

Philip Farkas suggests four important physical factors for developing the upper register in *The Art of French Horn Playing: a Treatise on the Problems and Techniques of French Horn Playing* (1956): 1) using diaphragm strength to drive the air; 2) keeping the jaw low; 3) having a superior and well-established embouchure; and 4) ensuring a smaller lip aperture. Farkas recommends three hints for the embouchure: 1) “flicking” the lips; 2) the “gold fish mouth;” and 3) utilizing the “P” syllable. Additional suggestions include: 1) preventing bad habits; 2) avoiding excessive pressure; and 3) not grabbing the horn by the left hand too strongly.164

Euphonium – Instructions without Musical Exercises

*The Art of Tuba and Euphonium* (1992) by Harvey Philips and William Winkle discusses eight physical adjustments: air direction, air pressure, jaw, lip corners, lip tension, embouchure, syllable/tongue position, oral cavity, the pivot, and the distance between the upper and lower teeth. The upper register requires having greater air compression with a downward air stream.165 To play the register from the middle to the upper, players take four actions: 1) move the lower jaw progressively upward; 2) keep the lips together; 3) add gradual tension to the embouchure by “pursing toward the center of the embouchure;” and 4) softly “pull down (anchor/strengthen)” the corners of the mouth. Players adjust the instrument “forward” slightly in order to adapt the raising jaw.166 The bottom lip should “tauter” when the register ascends.167 Adjusting the jaw and embouchure for the upper register results in moving up the tongue and creating a smaller oral cavity. However, tongue position in the upper register for euphonium and tuba should never be

---

166 Ibid., 28.
167 Ibid., 26.
“high in the oral cavity.”\textsuperscript{168} The syllable “ee” is suitable for the upper register.\textsuperscript{169} “Very short strokes” of the tongue is suitable for producing better clarity and faster tonguing speed in the extreme high range. Teeth should move close together with space in between\textsuperscript{170} Progressively developing the range extension will help build great stamina, avoid “register breaks” (a different embouchure for various registers), and prevent “facial contortions” including puffed cheeks and a loose embouchure.\textsuperscript{171} The author recommends a mouthpiece that has a medium depth of cup in order to accommodate both the low and high range.\textsuperscript{172}

\textit{Euphonium – Instructions with Musical Exercises}

\textit{The Art of Euphonium Playing Volume I} (1977) by Arthur Lehman discusses three suggestions for developing the upper register: 1) applying minimal mouthpiece pressure; 2) tightening up the abdominal and trunk muscles; and 3) utilizing the syllable “TAA-HEE” or “HEE” to form the “vocal cavity.” Lehman explains that the increasing range requires more pressure instead of excessive pressure. His philosophies include maintaining a positive attitude and practicing with appropriate rest. The author also recommends that players exercise using arpeggios in the high range, with crescendos and flexibilities, using the overtone series.\textsuperscript{173}

In \textit{Practical Hints on Playing the Baritone (Euphonium)} (1983), Brian Bowman advocates eight physical adjustments for developing the upper register: 1) blowing harder to create faster air; 2) directing the air stream downward, almost to the chin; 3) using a lesser volume of air; 4) having a firm embouchure with more pressure on the bottom lip; 5) using a

\textsuperscript{168} Ibid., 34.
\textsuperscript{169} Ibid., 30.
\textsuperscript{170} Ibid., 34.
\textsuperscript{171} Ibid., 28.
\textsuperscript{172} Ibid., 62.
\textsuperscript{173} Lehman, \textit{The Art of Euphonium}, 18.
smaller lip aperture; 6) having firm lip corners; 7) not raising the chin up; and 8) arching the
tongue by saying “Tee.” Blowing harder to increase speed requires a player to have a well-
developed embouchure. Players need to develop their “inner mouthpiece control.” Inhaling fully
is essential for players to have enough air supply and pressure for the upper register. Bowman
indicates that these tips can be helpful for most of players while some might find that doing the
opposite may work better. The author’s philosophies for playing in the upper register include
being patient, practicing, and “shooting” the air at a distant target. He recommends chromatic
scales and scale-like patterns.174 Using a vibrato or moving the jaw in the upper register may
solve the “lock-jaw” issue that prohibits one from producing great tone quality in this register.175

_Rangesongs for Euphonium_ (2011) by David Vining suggests that a player should use
faster moving air with more intensity in the upper register. The systematic design of reoccurring
“target” notes (the highest note) within musical phrases will help a player with his endurance and
range. A player has to prepare a thorough and proper warm-up before practicing the exercises in
this book.176

_Trombone – Instructions with Musical Exercises_

Jack Teagarden, in _High Tone Studies for Trombone_ (1936), outlines that faster air, more
air pressure, an open but smaller lip aperture, and an arched tongue with the syllable “tee” can
lead to successfully developing the upper register. Teagarden states, “quantity of breath
determines volume and does not materially assist in the playing of high tones.” Players need to
be aware of how much volume of air is being used. Philosophies for studying this register
include: always preventing any type of forcing, proper rest, and a thorough warm-up as an

174 Bowman, _Practical Hints on Playing the Baritone_, 18-22.
175 Ibid., 22.
176 Vining, _Rangesongs_, ii.
The Art of Trombone Playing (1963) by Edward Kleinhammer include five physical suggestions for the upper register: air direction, lip aperture, direction of lip rolling, syllable/tongue, and mouthpiece pressure. For ascending pitches, players blow air downward to the bottom of the mouthpiece and slightly adjust the mouthpiece downward without overdoing it. A smaller aperture of the lips slightly rolling inward helps ascending notes. The author indicates it may be beneficial if the bottom lip turns inward more. The embouchure changes in the extreme high register are smaller and more sensitive. For adjusting the syllable/tongue, players apply the syllable “whoo” as if having a “hot potato” in the mouth and should avoid the syllable “e.” Applying minimum mouthpiece pressure on the lip can lead to more notes in the overtone series, a better tone color, and easier vibration. Players need to avoid increasing tension on the left arm while pitches ascend. Kleinhammer also outlines three common physical habits that lead to failure in the high range: 1) mouth musculature that is too tense; 2) tightness in the upward “clamping” jaw; and 3) a compressed throat. His philosophies for the upper register include developing to extend the upper register progressively, avoiding getting discouraged by the splitting notes in the high range, and having a feeling of great security. Recommended exercises include practicing the mouthpiece alone, playing scales and flexibilities while adding one step higher each time, practicing upward glissandi on a mouthpiece visualizer while observing in a mirror to avoid unnecessary tension, and slowly playing ascending scales and arpeggios, both

179 Kleinhammer, The Art of Trombone, 47.
180 Ibid., 27.
slurred and tongued. In addition, the author claims it is important to practice with rest to prevent tired lips.\textsuperscript{181}

Reginald Fink’s \textit{The Trombonist’s Handbook: A Complete Guide to Playing and Teaching the Trombone} (1970) discusses the use of air and the oral cavity for playing in the upper register. Many players have improved their ability in the upper register after learning to control their air support. The upper register requires superior and relaxed tone production. Fink refers to the Bernoulli’s principle relative to playing the upper register on the trombone. The “hot potato” sensation in the mouth by Kleinhammer proves that the upper register needs a player to employ slow air with a large column for high pressure air. Fink does not specify the velocity of air that a player should use for the upper register. He does claim that “the higher notes must be played with a faster moving and thinner air stream” theory is an error. Air support is important but a player should avoid forcing the air. Lip slurs from the low to high range will relax and open the oral cavity setting. Recommended exercises include lip slurs using the overtone series and arpeggios.\textsuperscript{182}

\textit{Remington Warm-up Studies} (1980) edited by Donald Hunsberger includes exercises written by Emory Remington, with commentary. Remington believes that the “harmonic series patterns” exercises can help a player develop facial and abdominal muscle strength. A player should both slur and tongue these exercises. The syllable “Tah” tongued behind the upper teeth with “the explosive push of the breath” is recommended for all articulations. Philosophies include playing with a relaxed body and a feeling of security. Remington recommends an

\begin{flushleft}
\textsuperscript{181} Ibid., 45-47.
\end{flushleft}
exercise of lip slurs using the harmonic series.\textsuperscript{183} In order to prevent injuries, students without well-developed fundamentals should not practice these exercises.\textsuperscript{184} 

\textit{Rangebuilding on the Trombone} (1993) by Tom Ervin outlines a variety of aspects regarding the upper register: endurance, intonation, fitness, accuracy, reliability, and agility. Ervin advocates these physical adjustments for the upper register: air pressure, lip aperture, lip corners, syllable/tongue, and the pivot. More air pressure (by blowing harder) and a smaller lip aperture (like a “flattened drinking straw”) help playing in the upper register.\textsuperscript{185} Ervin explains that the “pivot” changes the angle of instrument, which may affect the relative proportion of lips or change the direction of the air stream. The author notes he "dips" or "raises" his head when pitches ascend. He suggests that some players may reverse these particular actions.\textsuperscript{186} Ervin also outlines eight habits to avoid when developing the upper register: excessive mouthpiece pressure, the syllables “TAA-HEE,” smiling, resetting the mouthpiece, overbiting the lips, gripping the horn too tightly, different tonguing articulation in the upper register, and having tension in the neck, shoulder, and jaw. Overdone mouthpiece pressure can negatively impact tone quality and endurance and shorten one’s career. The common syllables “TAH-EEE” by arching the tongue can lead to a “hissing noise” on low brass instruments. Players should keep the mouth corners firm instead of smiling. “Resetting” and “rotating” the mouthpiece is improper. Players with a lip overbite can correct this by blowing straight down the bore of the mouthpiece. Gripping the instrument too strongly does not help develop the high range.\textsuperscript{187} However, a smaller mouthpiece

\begin{itemize}
  \item \textsuperscript{183} Donald Hunsberger, \textit{Remington Warm-up Studies} (Athens, OH: Accura Music Inc., 1980), 34.
  \item \textsuperscript{184} Ibid., 35.
  \item \textsuperscript{185} Tom Ervin, \textit{Rangebuilding on the Trombone} (n.p.: Tom Ervin, 1993), 3.
  \item \textsuperscript{186} Ibid., 7.
  \item \textsuperscript{187} Ervin, \textit{Rangebuilding}, 16-17.
\end{itemize}
and instrument could help a player develop this register with more ease.\textsuperscript{188} Recommended exercises include tonguing and slurring Remington’s “Security in the High Range,” scales, arpeggios, and mouthpiece practice. Exercises particularly designed for developing “endurance” include ascending scale patterns and playing Marco Bordogni’s \textit{Melodious Etudes} in higher keys.\textsuperscript{189} Players who tout the effects of mouthpiece practice state that it can improve endurance.\textsuperscript{190} Practice sessions with appropriate rest are necessary for developing the high range without exhaustion.\textsuperscript{191}

\textit{Tuba – Instructions without Musical Exercises}

In \textit{Arnold Jacobs: Song and Wind} (1996) by Brian Frederiksen, Arnold Jacobs states that the rate of air flow is low in the extreme upper register of the tuba: ten liters per minute.\textsuperscript{192} Jacobs believes that pressure increases while the flow decreases when playing the high range. “Severe isometric contraction” is unnecessary for developing the high range since Jacobs believes that “we do not have to work very hard when we play in the high range.”\textsuperscript{193} Jacobs’s philosophy for playing in the high range is to “Control the sound to control the meat. Think less of the muscles fibers and think like a great artist.”\textsuperscript{194} After observing his teacher “shifting the mouthpiece placement up where he would play into the small section of the mouthpiece near the bottom when he would go up to high G” and applying the same method, Jacobs states that he could play the extreme upper register.\textsuperscript{195} High pitches require a small “embouchure surface” and

\begin{itemize}
  \item[\textsuperscript{188}] Ibid., 7.
  \item[\textsuperscript{189}] Ibid., 18.
  \item[\textsuperscript{190}] Ibid., 23.
  \item[\textsuperscript{191}] Ibid., 3.
  \item[\textsuperscript{192}] Brian Frederiksen, \textit{Arnold Jacobs: Song and Wind}, ed. by John Taylor (Gurnee, IL: Windsong Press, 1996), 120.
  \item[\textsuperscript{193}] Frederiksen, \textit{Arnold Jacobs: Song and Wind}, 121.
  \item[\textsuperscript{194}] Ibid., 123.
  \item[\textsuperscript{195}] Ibid., 125.
\end{itemize}
blowing hard. To avoid the negative effect by blowing too hard, players practice the “zero-in” on the lip buzz in the lower range and sustain the same feeling in the upper octave. A player should develop both the low and high ranges. One recommended exercise to improve the intonation in the high range is to practice the written pitches an octave lower.

*Tuba – Instructions with Musical Exercises*

*Developing High Register on the Tuba* (2009) by Wesley Jacob suggests a player should keep an open throat in the high range. To obtain an accurate pitch in the high register, players need to remember how the tongue, lips, and breath coordinate. Philosophies include: 1) expecting some length of time to develop strength in the upper register; 2) not using a different mouthpiece for the upper register; 3) achieving a well-developed mid range before developing the high; 4) “attacking” (tonguing) the high range confidently and accurately; and 5) having appropriate rest schedules. Recommended exercises include long tones, lip slurs with the overtone series, and sole mouthpiece practice with piano. It is important to practice with a metronome starting at the slowest tempo.

**Assortment**

The forty reviewed methodologies discuss and indicate a wide variety of suggestions and concepts for developing in the upper register. This assortment includes three categories: *Suggestions in Physiology, Suggestions in Psychology,* and *Recommended Exercises with Proper Practice Habits.* The following tables exhibit these categories with individual items referred by

---

196 Ibid., 126.
197 Ibid., 151.
198 Wesley Jacob, *Developing High Register on the Tuba* (Maple City, MI: Encore Music, 2009), 18.
199 Ibid., 19.
200 Ibid., 9.
201 Jacob, *Developing High Register on the Tuba,* 3.
each methodology. Students and educators may look for initial concepts in developing the upper register on euphonium via these tables. The summarizations in the previous section indicate further detailed discussion and instruction.

Table 4, 5, 6, 7, 8 and 9 show the aspect of physiology. Most of the methodologies discuss physical adjustments, consisting of air speed, air direction, air volume, air pressure, air support, air column, diaphragm, lip aperture, lip corners, direction of lip rolling, lip tension, lower jaw, the distance between the upper and lower teeth, syllable/tongue position, oral cavity, throat, embouchure, mouthpiece pressure, mouthpiece position/placement, the pivot system, and others. Some of the terms referred in the methodologies are relatively abstract and may lead to varying interpretations by different readers. The following chapter will discuss this issue further.

Syllable/tongue position is the method discussed most commonly in the reviewed methodologies while lip aperture, mouthpiece pressure, air speed, and embouchure are only relatively prevalent methods. Most of the methodologies that discuss air speed refer to “faster” air while Fink advocates that slower air can assist with playing in the high range. Opinions of air direction comprise of a variety of directions including “upward,” “downward,” “upward or downward,” “more toward the rim,” “close to the lower rim,” and “forward.” Methodologies that refer to air volume mostly indicate that there should actually be less air volume for the upper register. All the reviewed methodologies that discuss air pressure state that the pressure should be greater or increase. There should be also greater air support.

Methodologies that discuss “diaphragm” include various opinions of function like “strength,” “support,” and “tighten.” Those methodologies concerning lip aperture for the upper register indicate that size should be small/ smaller/closer. A few emphasize the aperture should be “open” while staying smaller. Lip corners also involve relatively various opinions including
“firm,” “pulling,” “tension,” compress and pucker,” “pull upward,” “pull downward,” and “no
smiling.” Most of the methodologies referring to the direction of lip rolling state the lips should
roll “inward.” Most of the methodologies that discuss lip tension state that tension should be
greater while one indicates it should be “a balanced tension.” There are various opinions on the
lower jaw. Approximately half of these methodologies regarding this aspect state that the lower
jaw should be “raising/upward” while the other half advocates that the lower jaw should stay
down or not go upward. There is also one opinion that the lower jaw should be “protruding.”

Most of the methodologies that discuss the syllable/tongue position for the upper register
prefer that the syllable with a higher/arched tongue position like “ti,” “tee,” or “ee.” Only a few
of these methodologies state that players should avoid the syllable with an arched tongue
position; instead, players should use syllables with a lower tongue position like “ahh” or “whoo.”
Approximately half of the methodologies discussing the oral cavity indicate that the space should
be smaller while a few advocate “no decreasing size” and “open.” Most of the methodologies
that discuss the throat for the upper register state that the throat should stay open, while some
indicate it should be relaxed.

Concepts regarding the embouchure for the upper register consist of various aspects like
“strong,” “correct,” “same for all the ranges/avoid double embouchure,” and “properly puckered.”
Most of the methodologies referring to embouchure state that a proper embouchure plays an
important role in the development of the upper register; however, the term “embouchure” could
be relatively abstract. Avoiding excessive mouthpiece pressure is the most widely mentioned
concept in the methodologies that discuss mouthpiece pressure, while some methodologies state
that players should apply minimum pressure. A few authors also state that applying minimum
mouthpiece pressure to the lower lip can aid with playing in the upper register. Half of the
methodologies that discuss the position/placement of the mouthpiece state that the position should remain the same for all ranges, while a few indicate “shifting the mouthpiece placement,” “equal on the upper and lower lip,” and “higher on the lower lip.”

Symbol “---“ in Table 4, 5, 6, 7, 8 and 9 indicates the methodologies excluding suggestions of physical adjustments; “*” has further discussion in Chapter 3; “V” has more details in the previous summarization; and the texts underlined are relatively unique method. None of the methodologies for general brasses indicates the distance between the upper and lower teeth; thus, Table 4 eliminates this item.
<table>
<thead>
<tr>
<th>Term Code</th>
<th>Air Speed</th>
<th>Air Direction</th>
<th>Air Volume</th>
<th>Air Pressure</th>
<th>Air Support</th>
<th>Air Column</th>
<th>Diaphragm</th>
<th>Lip Aperture</th>
<th>Lip Corners</th>
<th>Direction of Lip Rolling</th>
<th>Lip Tension</th>
<th>Lower Jaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB1</td>
<td>Faster</td>
<td>Upward</td>
<td>More</td>
<td>More</td>
<td>Small, open</td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td>Inward</td>
<td>Greater lip compression</td>
<td></td>
<td>GB1</td>
</tr>
<tr>
<td>GB2</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td>Raising</td>
<td></td>
<td>GB2</td>
</tr>
<tr>
<td>GB3</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB3</td>
</tr>
<tr>
<td>GB4</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB4</td>
</tr>
<tr>
<td>GB5</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB5</td>
</tr>
<tr>
<td>GB6</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB6</td>
</tr>
<tr>
<td>GB7</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB7</td>
</tr>
<tr>
<td>GB8</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB8</td>
</tr>
<tr>
<td>GB9</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB9</td>
</tr>
<tr>
<td>GB10</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB10</td>
</tr>
<tr>
<td>GB11</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td>Close up</td>
<td>Small, open</td>
<td>Protruding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB11</td>
</tr>
<tr>
<td>GB12</td>
<td>Slightly different</td>
<td>More</td>
<td>Sufficient</td>
<td>Slightly different size</td>
<td>Strength</td>
<td>Increasing</td>
<td>Upward, forward</td>
<td>GB12</td>
<td>GB12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB13</td>
<td>Faster</td>
<td>Downward</td>
<td>More</td>
<td>Support</td>
<td>Smaller, flatten oval</td>
<td>Upward, backward</td>
<td>GB13</td>
<td>GB13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB14</td>
<td>Upward, Downward</td>
<td>More</td>
<td>Support</td>
<td>Minimum opening</td>
<td>Not too closed to the upper jaw</td>
<td>GB14</td>
<td>GB14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Suggestions in Physiology (Second Half) – General Brass

<table>
<thead>
<tr>
<th>Term Code</th>
<th>Syllable/ Tongue</th>
<th>Oral Cavity</th>
<th>Throat</th>
<th>Embouchure</th>
<th>Mouthpiece Pressure</th>
<th>Mouthpiece Position/ Placement</th>
<th>The Pivot System</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB1</td>
<td>“Tee”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB2</td>
<td>“Ti” or “tē”, tonguing at the roof of the mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB3</td>
<td></td>
<td></td>
<td>Development</td>
<td>Avoid excessive pressure</td>
<td></td>
<td></td>
<td>Chest power*</td>
<td></td>
</tr>
<tr>
<td>GB4</td>
<td>“Ee,” arched tongue</td>
<td></td>
<td></td>
<td>Strong</td>
<td>Avoid excessive pressure</td>
<td>Same all the time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB5</td>
<td>“Ee”</td>
<td></td>
<td>Correct</td>
<td>Avoid “undue” pressure</td>
<td>Same all the time</td>
<td></td>
<td>Avoid lateral pressure</td>
<td></td>
</tr>
<tr>
<td>GB6</td>
<td>“EEE,” “DEEE,” “TEE,” arched tongue</td>
<td></td>
<td></td>
<td>One of the main factors</td>
<td></td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>GB7</td>
<td>“Ee”</td>
<td></td>
<td></td>
<td>Result fatigue and failure</td>
<td></td>
<td></td>
<td>V</td>
<td>The Weldon System, blow harder</td>
</tr>
<tr>
<td>GB8</td>
<td>“Ee,” arched tongue</td>
<td></td>
<td></td>
<td>Avoid excessive pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB9</td>
<td>“Smaller vowel sound”</td>
<td></td>
<td></td>
<td>Open</td>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Apply more “as necessary”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB11</td>
<td>“Tee”, arched tongue</td>
<td></td>
<td>Smaller</td>
<td>No tightening</td>
<td>Avoid excessive pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB12</td>
<td>“Tee”</td>
<td>Smaller channel over the tongue</td>
<td></td>
<td>“The voluntary tension of the muscles of the embouchure”*</td>
<td>Avoid excessive pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB13</td>
<td>“Ahh,” or modified “tauw,” avoid “eeh”</td>
<td></td>
<td>Open</td>
<td>Minimum</td>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GB14</td>
<td>“Ee,” arched tongue</td>
<td>Adjusting the “shape”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term Code</td>
<td>Air Speed</td>
<td>Air Direction</td>
<td>Air Volume</td>
<td>Air Pressure</td>
<td>Air Support</td>
<td>Air Column</td>
<td>Diaphragm</td>
<td>Lip Aperture</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>---------------</td>
<td>------------</td>
<td>--------------</td>
<td>-------------</td>
<td>------------</td>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td>TP1</td>
<td>Faster</td>
<td>“Close to the lower rim”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP2</td>
<td></td>
<td></td>
<td>Abdominal support</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP3</td>
<td>Faster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP4</td>
<td></td>
<td></td>
<td>Proper amount</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP5</td>
<td>Faster</td>
<td></td>
<td>More</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP6</td>
<td>Faster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>More</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>More</td>
<td></td>
<td></td>
<td>Tighten</td>
</tr>
<tr>
<td>TP9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>More</td>
<td></td>
<td></td>
<td>Unrolling</td>
</tr>
<tr>
<td>TP10</td>
<td>Faster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP12</td>
<td></td>
<td></td>
<td>Driving</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP13</td>
<td>Faster</td>
<td></td>
<td>Forward</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term Code</td>
<td>Syllable/Tongue</td>
<td>Oral Cavity</td>
<td>Throat</td>
<td>Embouchure</td>
<td>Mouthpiece Pressure</td>
<td>Mouthpiece Position/Placement</td>
<td>The Pivot System</td>
<td>Others</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>-------------</td>
<td>--------</td>
<td>------------</td>
<td>--------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>--------</td>
</tr>
<tr>
<td>TP1</td>
<td>“Ee,” more intense tongue</td>
<td>Smaller</td>
<td>Avoid double embouchure</td>
<td>Avoid excessive pressure</td>
<td></td>
<td></td>
<td>“Pulling the upper lip backward against the teeth”</td>
<td></td>
</tr>
<tr>
<td>TP2</td>
<td>V</td>
<td>Properly puckered</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td>Airway is open by adjusting the head position</td>
<td></td>
</tr>
<tr>
<td>TP3</td>
<td>“Ee,” changing tongue position</td>
<td>Increasing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP4</td>
<td>The tip of tongue on the bottom teeth, arch the center</td>
<td>Minimum to the lower lip</td>
<td>Equal on the upper and lower lip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP5</td>
<td>“Ee”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP6</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>TP7</td>
<td>No “eee”, no arched tongue</td>
<td>No decreasing size</td>
<td>Open</td>
<td>Higher on the lower lip</td>
<td>Wind power,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP8</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>TP9</td>
<td>“Ee,” changing tongue position</td>
<td>---</td>
<td>---</td>
<td>Higher on the lower lip</td>
<td>Wind power,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP10</td>
<td>Hissing manner</td>
<td>“AH”</td>
<td>Remain similar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term Code</td>
<td>Air Speed</td>
<td>Air Direction</td>
<td>Air Volume</td>
<td>Air Pressure</td>
<td>Air Support</td>
<td>Air Column</td>
<td>Diaphragm</td>
<td>Lip Aperture</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>----------------</td>
<td>------------</td>
<td>--------------</td>
<td>-------------</td>
<td>------------</td>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td>HN1</td>
<td></td>
<td>Drive air</td>
<td>Smaller</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU1</td>
<td>Downward</td>
<td>More</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pulling downward</td>
<td>Close with space</td>
</tr>
<tr>
<td>EU2</td>
<td>More</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU3</td>
<td>Faster</td>
<td>Downward, upward</td>
<td>Less</td>
<td></td>
<td></td>
<td></td>
<td>Smaller</td>
<td>Firm</td>
</tr>
<tr>
<td>EU4</td>
<td>Faster</td>
<td>More</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB1</td>
<td>Faster</td>
<td>V</td>
<td></td>
<td></td>
<td>Resistant</td>
<td></td>
<td>Open but smaller</td>
<td>Small</td>
</tr>
<tr>
<td>TRB2</td>
<td>Downward</td>
<td>More</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Smaller</td>
<td>Inward</td>
</tr>
<tr>
<td>TRB3</td>
<td>Slower</td>
<td>More</td>
<td>Large</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB5</td>
<td></td>
<td>More</td>
<td>Smaller, flattened straw</td>
<td>No smiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TB1</td>
<td></td>
<td>Small</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TB2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 9: Suggestions in Physiology (Second Half) – Horn, Euphonium, Trombone, and Tuba

<table>
<thead>
<tr>
<th>Term Code</th>
<th>Syllable/ Tongue</th>
<th>Oral Cavity</th>
<th>Throat</th>
<th>Embouchure</th>
<th>Mouthpiece Pressure</th>
<th>Mouthpiece Position/ Placement</th>
<th>The Pivot System</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>HN1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Well-developed</td>
<td>Avoid excessive pressure</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>EU1</td>
<td>“Ee”, never high position</td>
<td>Smaller</td>
<td></td>
<td>Pursing toward embouchure, remain the same embouchure, prevent pulled cheeks and loose embouchure</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>EU2</td>
<td>“Hee”</td>
<td></td>
<td></td>
<td>Well-developed embouchure</td>
<td>Minimum</td>
<td></td>
<td></td>
<td>“Hee” to form the vocal cavity</td>
</tr>
<tr>
<td>EU3</td>
<td>“Tee,” raising tongue</td>
<td>Well-developed embouchure</td>
<td>More on the bottom lip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blow harder</td>
</tr>
<tr>
<td>EU4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minimum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB1</td>
<td>“Tee,” arched tongue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB2</td>
<td>“Whoa,” avoid “e,” “hot potato sensation in the mouth”</td>
<td>Relaxed</td>
<td>Extreme sensitivity for the extreme upper notes</td>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB3</td>
<td></td>
<td>Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB4</td>
<td>“Tah” for all exercises</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB5</td>
<td>No “hee”</td>
<td></td>
<td></td>
<td></td>
<td>Avoid excessive pressure</td>
<td>Same all the time</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>TB1</td>
<td></td>
<td>Smaller “surface of embouchure”</td>
<td>“Shifting the mouthpiece placement”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blow harder</td>
</tr>
<tr>
<td>TB2</td>
<td></td>
<td>Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Approximately one half of the methodologies discuss suggestions regarding the mental aspect of playing. These suggestions relate to the concepts of how a player “thinks,” “feels,” or “images” in order to have a positive mindset for developing the high range. Table 10 shows the assortment of these suggestions regarding a player’s psychology.
<table>
<thead>
<tr>
<th>CODE</th>
<th>Suggestions in Psychology</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB1</td>
<td>• Think higher</td>
</tr>
<tr>
<td>GB4</td>
<td>• High range is important but not the most important thing</td>
</tr>
<tr>
<td></td>
<td>• The mental affects the physical</td>
</tr>
<tr>
<td>GB5</td>
<td>• Awareness of the disadvantage of excessive mouthpiece pressure</td>
</tr>
<tr>
<td>GB6</td>
<td>• Think of “individualism”</td>
</tr>
<tr>
<td></td>
<td>• “A squeak of today is a note tomorrow”</td>
</tr>
<tr>
<td>GB8</td>
<td>• Avoid fear (especially beginner)</td>
</tr>
<tr>
<td></td>
<td>• Different instead of difficult</td>
</tr>
<tr>
<td></td>
<td>• Think of throwing the ball a greater distance</td>
</tr>
<tr>
<td></td>
<td>• Horizontally instead of up</td>
</tr>
<tr>
<td></td>
<td>• No haste</td>
</tr>
<tr>
<td>GB9</td>
<td>• Think economy</td>
</tr>
<tr>
<td>TP2</td>
<td>• Confidence</td>
</tr>
<tr>
<td>TP3</td>
<td>• Fear free</td>
</tr>
<tr>
<td>TP4</td>
<td>• Ease and confidence</td>
</tr>
<tr>
<td>TP5</td>
<td>• Confidence</td>
</tr>
<tr>
<td></td>
<td>• Mental affects physical</td>
</tr>
<tr>
<td></td>
<td>• Think of an octave lower than the written music</td>
</tr>
<tr>
<td>TP6</td>
<td>• Think correctly</td>
</tr>
<tr>
<td>TP7</td>
<td>• “Will-power”- believe in playing high</td>
</tr>
<tr>
<td>TP13</td>
<td>• Think of note horizontally</td>
</tr>
<tr>
<td></td>
<td>• Imagine the air going out the bell</td>
</tr>
<tr>
<td>EU2</td>
<td>• Positive</td>
</tr>
<tr>
<td>EU3</td>
<td>• Be patient</td>
</tr>
<tr>
<td>TRB2</td>
<td>• Don’t get discourage by the bad tone quality in the upper register</td>
</tr>
<tr>
<td></td>
<td>• Security</td>
</tr>
<tr>
<td>TRB4</td>
<td>• Security</td>
</tr>
<tr>
<td>TB1</td>
<td>• “Control the sound to control the meat. Think less of the muscles fibers and think like a great artist.”</td>
</tr>
<tr>
<td>TB2</td>
<td>• Confidence</td>
</tr>
</tbody>
</table>

Methodologies excluding suggestions regarding psychology: GB2, GB3, GB7, GB10, GB11, GB12, GB13, GB14, TP1, TP8, TP9, TP10, TP11, TP12, HN1, EU1, EU4, TRB1, TRB3, and TRB5.
Recommended exercises consist of musical patterns and proper habits for general practice as well as designated exercises. Examples of frequently recommended exercises as musical patterns or as written studies in these methodologies include: scales, arpeggios, lip slurs with overtone series, chromatic scales, long tones, glissandi, pedal tones, lip bends, mouthpiece buzzing, and free lip buzzing. Table 11, 12, and 13 show recommendations in the reviewed methodologies. Methodologies GB 5, 7, 10 and 11 exclude exercises and practice habits.

Table 11: Exercises of Musical Patterns and Proper Practice Habits – General Brass

<table>
<thead>
<tr>
<th>Pattern Code</th>
<th>Scales</th>
<th>Arpeggios</th>
<th>Lip Slurs with Overtone Series</th>
<th>Chromatic Scale</th>
<th>Long Tones</th>
<th>Glissandi</th>
<th>Pedal Tones</th>
<th>Lip Bends</th>
<th>Mouthpiece Buzzing</th>
<th>Free Lip Buzzing</th>
<th>Other/Practice Habits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB1</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Play as high as you can daily at different dynamic levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Use exercises beginning in middle register and slurring to the high with crescendos</td>
</tr>
<tr>
<td>GB2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>No “death grip”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Let the breath and the tongue do the work</td>
</tr>
<tr>
<td>GB3</td>
<td>V</td>
<td></td>
<td>V</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A well-developed ear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with proper rest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Avoid too loud and force</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Muscles should develop slowly and surely</td>
</tr>
<tr>
<td>GB4</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remove mouthpiece away from the lips</td>
</tr>
<tr>
<td>GB6</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Prevent over breathing</td>
</tr>
<tr>
<td>GB8</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Play without tension</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Add one ascending step at a time slowly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Look at an object while blowing air</td>
</tr>
<tr>
<td>GB9</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shouldn’t develop the high range without good fundamentals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consideration of mouthpiece selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with proper rest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Produce clear tones</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remove mouthpiece away from the lips</td>
</tr>
<tr>
<td>GB12</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Nose breathing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Include high range duets and practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Proper warm-up</td>
</tr>
<tr>
<td>GB13</td>
<td>V</td>
<td></td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Play musically and with best tone quality</td>
</tr>
</tbody>
</table>
## Table 12: Exercises of Musical Patterns and Proper Practice Habits – Trumpet

<table>
<thead>
<tr>
<th>Pattern Code</th>
<th>Scales</th>
<th>Arpeggios</th>
<th>Lip Slurs with Overtone Series</th>
<th>Chromatic Scale</th>
<th>Long Tones</th>
<th>Glissandi</th>
<th>Pedal Tones</th>
<th>Lip Bends</th>
<th>Mouthpiece Buzzing</th>
<th>Free Lip Buzzing</th>
<th>Other/Practice Habits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Consideration of mouthpiece selection&lt;br&gt;Keep lips fresh&lt;br&gt;Avoid double embouchure&lt;br&gt;Practice with proper rest&lt;br&gt;Play with ease</td>
</tr>
<tr>
<td>TP2</td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Proper warm-up&lt;br&gt;Breath fully and relax</td>
</tr>
<tr>
<td>TP3</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>No muscle tension (relax)&lt;br&gt;Develop a higher range than the actual performing range</td>
</tr>
<tr>
<td>TP4</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Don’t develop the high range without good “wind power”</td>
</tr>
<tr>
<td>TP5</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Physical exercises&lt;br&gt;Mouthpiece isn’t the answer&lt;br&gt;No warm-up before these routines&lt;br&gt;Practice with proper rest</td>
</tr>
<tr>
<td>TP6</td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Practice accurately and slowly&lt;br&gt;Consistency&lt;br&gt;Slur and tongue the exercise&lt;br&gt;Practice with proper rest</td>
</tr>
<tr>
<td>TP7</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Practice daily without tension</td>
</tr>
<tr>
<td>TP8</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Wide intervals&lt;br&gt;Decrease arm pressure/grip</td>
</tr>
<tr>
<td>TP9</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Practice the interval studies as high as possible&lt;br&gt;Develop from something bad to good&lt;br&gt;Foot tapping</td>
</tr>
<tr>
<td>TP10</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Use a metronome</td>
</tr>
<tr>
<td>TP11</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Slur and tongue the exercise&lt;br&gt;Start small and grow big&lt;br&gt;Play as high as possible with pedal notes in between&lt;br&gt;A third lower than a player’s highest note is the performing range</td>
</tr>
<tr>
<td>TP12</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Practice with proper rest&lt;br&gt;Remove mouthpiece away from the lips</td>
</tr>
<tr>
<td>TP13</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V</td>
<td>Consistency&lt;br&gt;Strong air flow</td>
</tr>
</tbody>
</table>
Table 13: Exercises of Musical Patterns and Proper Practice Habits – Horn, Euphonium, Trombone, and Tuba

<table>
<thead>
<tr>
<th>Pattern Code</th>
<th>Scales</th>
<th>Arpeggios</th>
<th>Lip Slurs with Overtone Series</th>
<th>Chromatic Scale</th>
<th>Long Tones</th>
<th>Glissandi</th>
<th>Pedal Tones</th>
<th>Lip Bends</th>
<th>Mouthpiece Buzzing</th>
<th>Free Lip Buzzing</th>
<th>Other/Practice Habits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HN1</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“Flicking”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Don’t grab the horn too strongly</td>
</tr>
<tr>
<td>EU1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Prevent pulling the horn too strongly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consideration of mouthpiece selection</td>
</tr>
<tr>
<td>EU2</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tongue the notes in different octaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with proper rest</td>
</tr>
<tr>
<td>EU3</td>
<td>V</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inner mouthpiece control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Breathe fully</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shooting air at a distant target</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Vibrato to help unlock the jaw</td>
</tr>
<tr>
<td>EU4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>With reoccurring target notes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Proper warm-up</td>
</tr>
<tr>
<td>TRB1</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Slur and tongue the exercises</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Add one ascending note at a time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Avoid too strong hand gripping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop gradually</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with mirror and visualizer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with proper rest</td>
</tr>
<tr>
<td>TRB2</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Slur and tongue the exercises</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Relax body</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shouldn’t play the exercises before well-development</td>
</tr>
<tr>
<td>TRB3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Slur and tongue the exercises</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Smaller mouthpiece</td>
</tr>
<tr>
<td>TRB4</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Slur and tongue the exercises</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Avoid forcing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Proper warm-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with proper rest</td>
</tr>
<tr>
<td>TB1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Don’t work too hard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice octave lower than written pitches</td>
</tr>
<tr>
<td>TB2</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>It takes a long time to develop the upper register</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Don’t change the mouthpiece for upper register</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tongue confidently and accurately</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with metronome at the slowest tempo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Practice with proper rest</td>
</tr>
</tbody>
</table>
In conclusion, the level of prevalence of how the reviewed methodologies discuss particular methods might not directly reflect each method’s effectiveness and current use in the brass pedagogical field. Evaluating the effectiveness of these methods reveals limitation at some extent. One can presume that these particular methods/concepts have helped the authors/educators themselves and their students to develop the upper register efficiently. Further examination for the effectiveness of these methods, however, needs to involve concerns for individual physiological differences and/or include scientific-based and real case studies.
CHAPTER 3

DISCUSSION

The Utilization of Terms

The use of a term may lead to a reader’s confusion, therefore, a different interpretation, which can directly impact one’s development in the upper register. The same word may mean different things in different circumstances while different words may have the same meaning in other cases. The use of terms may not only cause the reader’s confusion but also difficulty for further research in the medical field. Discussions involve many terms that are relatively abstract like “mouthpiece pressure” and “embouchure.” There are other referred terms that may lead to confusion and uncertainty.

*Mouthpiece Pressure or Mouthpiece Force*

James Ford explains why mouthpiece “force” is a more suitable term than mouthpiece “pressure” for brass pedagogy. Brass methodologies frequently use the term “pressure” in two areas: “air pressure” that is involved with an oral cavity and the “mouthpiece pressure” between the lips and mouthpiece. Ford indicates that the “pressure” between the lips and mouthpiece is the amount of “force,” a term that people commonly confuse with “pressure.”

One of the issues in reviewing varying methodologies is revealed when the term “pressure” occurs in different phrases. While some use the term “mouthpiece pressure,” others describe the action as pressure “on the lips.” Charles Colin, Clarke, Bowman, and Ervin use this description in their methodology. Some also use nonspecific “pressure” by using the term “pressure.” Instances of this term are included in the methodologies by Hunt and Bachelder who

---


state “play relaxed, no pressure”\textsuperscript{204} and Philips and Winkle who say “this will help avoid bad habits of too much pressure.”\textsuperscript{205} Without reading the context thoroughly, the reader may misinterpret the author’s original concept and adjust different “pressure” to their practice. It is essential for a musician to have full awareness of these two terms in order to avoid misunderstanding the meaning and method.

*Embouchure*

The term “embouchure” in brass pedagogical literature has varying definitions. In *The Art of Brass Playing*, Farkas explains “embouchure” as “The mouth, lip, chin, and cheek muscles, tensed and shaped in a precise and cooperative manner, and then blown through for the purpose of setting the air-column into vibration when these lips are placed upon the mouthpiece of a brass instrument.”\textsuperscript{206} Some of the methodologies suggest the embouchure’s characteristics: “remaining the same,” “strong,” “correct,” “properly pucker,” “well-developed,” “pursing toward,” “preventing being loose,” or “smaller surface of embouchure.” At the same time these methodologies discuss adjustments on the lips, the tongue, the jaw, cheeks, the distance between the upper and bottom teeth, and the oral cavity for the playing in the upper register. The “embouchure” without indicating particular body parts and instructions may become a relatively vague and broad term for the reader. It is essential, then, for the reader to read all the instructions, including any detailed progressive steps in order to thoroughly understand the concepts of the authors.

The definition of “embouchure” in the medical field, however, reveals a different perspective. In an article of the journal of Medical Problems of Performing Artists (PMMA),

\begin{flushleft}
\textsuperscript{204} Philips and Winkle. *The Art of Tuba and Euphonium*, 100.
\textsuperscript{206} Farkas, *The Art of Brass Playing*, 5.
\end{flushleft}
Woldendorp et al. pose the explanation for “embouchure”: “the process needed to adjust the amount, pressure, and direction of the air flow (generated by the breath support) as it travels through the mouth cavity and between the lips, by the position and/or movement of the tongue, teeth, jaws, cheeks, and lips, to produce a tone in a wind instrument.” In comparison to the definition by Farkas, this definition refers to the embouchure as the “process” of lip and air components working together while Farkas indicates the embouchure is the “body part” working with air. The “process,” however, reveals nonspecific indication of how the “process” changes with the “force” over time. According to research by the Texas Center for Music and Medicine, mouthpiece “force” tends to increase after a long period of practice. This increasing force may lead to a different “process.” Students need to be aware of the changing force overtime while practicing. Several reviewed methodologies indicate the importance of appropriate rest between practice sessions in order to avoid applying excessive “force” that may tire the lips and muscles around the lips.

**Others**

Other terms that may result in confusion include “chest power,” “this voluntary tension of the muscles of the embouchure,” “wind power,” and “short strokes of tonguing.” “Chest power” is a relatively abstract term since Méndez indicates nonspecific instruction for “chest power.” The term “embouchure” in the description “the voluntary tension of the

---


211 Clarke, *Clarke’s Setting*, 3.

212 Philips and Winkle, *The Art of Tuba and Euphonium*, 34.
muscles of the embouchure” leads to some confusion since “embouchure” itself involves various aspects of physical parts mentioned above. “Wind power” can be related to “air”; however, the aspect of using air is unclear. Philips and Winkle state that “short strokes of tongue” works best for clarity and speed in the extreme high range without specific instructions.

Comparison with Current Literature at Medical Aspect

The research by Hiroko Furuhashi et al. in 2017 indicates that the tongue “protruded forward and upward” happens when playing in the higher pitch. This result is observed by the technology of the cine magnetic resonance imaging, which includes the playing tasks of “pitch” and “dynamics” changes by eighteen “healthy” trumpet players ranging between twenty-one and sixty-six years old. Most of the reviewed methodologies indicate that an arched tongue and syllables with a higher tongue position can help a brass musician play in the upper register.

The article of Woldendorp et al. published in December 2016 discusses the “High-Pitched Tone” in the table “Overview of Actions to Produce a High- or Low-Pitched Note in Brass Playing.” In comparison to the physical adjustments found in the reviewed methodologies, Table 14 shows the list of reviewed items in the paper by Woldendorp et al. and methods in the forty methodologies.

The different uses of term and categorization are limited to the complete comparison of these two lists. Several authors of the reviewed methodologies discuss the pivot system along with adjustments of head position. These authors suggest that students should consider the opposite or different adjustments taking into account his/her own individual physical features. The findings of Woldendorp et al. reveal relatively abstract and general views regardless of the

---


214 Woldendorp and the others, “Fundamentals of Embouchure”, 239.
individualism and the force overtime. In addition, the medical field is lacking literature that examines methodologies in the upper register for euphonium and other brass instruments.

Table 14: Comparison of Woldendorp and Current Study

<table>
<thead>
<tr>
<th>Term</th>
<th>Woldendorp et al.</th>
<th>Chou</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pronouncing vowel</td>
<td>Phonetic “I”</td>
<td>Syllable</td>
</tr>
<tr>
<td>Tongue configuration</td>
<td>Flat (low) tongue</td>
<td>Tongue position</td>
</tr>
<tr>
<td>Lip configuration</td>
<td>Hard/thin</td>
<td>N/A</td>
</tr>
<tr>
<td>Lip opening</td>
<td>(Very) small</td>
<td>Lip aperture</td>
</tr>
<tr>
<td>Lip top (vertical string length)</td>
<td>Short</td>
<td>N/A</td>
</tr>
<tr>
<td>Mandible position</td>
<td>Frontal (forward-protracted)</td>
<td>Lower jaw</td>
</tr>
<tr>
<td>Head position</td>
<td>Neutral/backward and upward</td>
<td>N/A</td>
</tr>
<tr>
<td>Inclination edge incisors with reference to the instrument</td>
<td>More transverse (± 135°)</td>
<td>N/A</td>
</tr>
<tr>
<td>Position of mouthpiece</td>
<td>Lower (less vertical length of upper lip)</td>
<td>Mouthpiece position/placement</td>
</tr>
<tr>
<td>Pivoting of the instrument</td>
<td>Downward</td>
<td>Pivot system</td>
</tr>
<tr>
<td>Direction of air stream</td>
<td>Straight/upstream</td>
<td>Air direction</td>
</tr>
<tr>
<td>Embouchure motion</td>
<td>Upper lip upward over the incisors</td>
<td>N/A</td>
</tr>
<tr>
<td>Tension of embouchure-related muscles</td>
<td>Higher</td>
<td>N/A</td>
</tr>
</tbody>
</table>
CHAPTER 4
PARTICULAR ISSUES FOR THE UPPER REGISTER

This section includes suggestions for those particular issues that have little or no discussion or study. These issues may include:

- How to gain better endurance
- Improving access to the notes above the tenth partial
- Practical fingerings for the extremely high range
- Intonation
- The use of vibrato

Most of these issues may not have absolute solutions or definitive answers. The scientific approach to athlete training and suggestions mentioned in some of the methodologies could be applied to developing the upper range and in brass instruments.

Studies and Suggestions for Strength and Endurance

Two of the forty reviewed methodologies discuss specific issues for developing the upper register while the other methodologies discuss more general methods. Hickman’s *Trumpet Pedagogy: A Compendium of Modern Teaching Techniques* states that training methods for developing strength are different from methods for developing endurance. Ervin’s *Rangebuilding on the Trombone* discusses many issues affecting the high range including: position, strength (muscle building), endurance, and flexibility.

Hickman explains that a player gains muscular strength due to increasing muscle volume. Muscular hypertrophy, which is a process of increasing the volume of muscles, leads to the development of strength. The “overload system” (intensive contraction on muscles beyond normal needs) exercise normally continues for a few seconds and includes a few minutes of rest afterwards. A player exercising this training method repeats this sequence until he/she is unable
to tolerate the load. Brass players wishing to develop their embouchure strength in the upper register may use principles that are similar to previously mentioned theory.

Isometric exercise, which is static contraction, can benefit one’s development of embouchure strength. The static contraction includes an exercise where one pushes against an immobile target. Long tones and flexibilities (“moving long tones”) may be appropriate exercises for brass players wishing to enhance their strength for the upper register. Hickman recommends utilizing particular devices to develop strength. Clint McLaughlin advocates that the strategy of using detailed instructions and “putting a pencil between your lips” during a ten-week routine can help brass players with their embouchure strength. There are similar devices to this “pencil” strategy but with various weights that include Chop-Sticks of Liemar Technologies and “Die Lippen-hantel” offered by a Germany company. Other recommended exercises to develop strength include lip buzzing, mouthpiece buzzing, and lip bends. In addition, brass players may consider “timing” for their practice routine. Based on the theory said above, brass players should practice strength exercises for a shorter period of time, followed by a longer period of rest.

Endurance improves through greater blood circulation by using repetitive “under-load” exercises. These types of exercises demand slight contractions of muscles for a prolonged period of time. Ervin recommends a scale pattern within five notes in the extreme upper register and

---

216 Ibid., 197.
Bordogni’s *Melodious Etude* played in higher keys to improve endurance.\(^{220}\) Playing the scale pattern corresponds with the theory of “small muscular contractions” because close intervals require minimum movements on the lips. Practicing these relatively familiar melodious studies in higher keys may help brass players to enhance their endurance due to the length of playing time. Ervin states players should avoid exhaustion when doing this exercise.

A person’s likelihood of developing muscular strength is genetic and remains unchanging due to the established number of muscular fibers at birth, while training for endurance has more to do with “exerted force.”\(^{221}\) Thus, brass players working on strength and endurance need to be aware of their own physiological needs and adjust exercise routines accordingly.

In conclusion, combining science and recommendations from these methodologies, a player wishing to master strength and gain endurance could follow these training principles:

- **Strength:** exercises of long tones and flexibilities using the overtone series and arpeggios, practicing for multiple shorter durations, and resting for longer durations in between.
- **Endurance:** an exercise of ascending and descending scale pattern sequence within five steps in the upper register as well as practicing melodic studies in higher keys, over a long period of time.

**Problems for Further Study**

There are other issues regarding how to conquer difficulty of playing notes above the tenth partial, the use of vibrato, intonation, and practical fingering. These may be problems that need further study.

---


\(^{221}\) Åstrand and Rodahl, *Textbook of Work Physiology*, 422.
Notes Above the Tenth Partial

Kleinhammer explains that the overtone series in the upper register include six whole steps, so the tension of embouchure demands extreme sensitivity to gain accuracy. Notes above the seventh partial that are played continuously move close together. Thus, a minimum embouchure change coordinated with a balance of air and muscles might help. Gaining notes above the tenth partial, however, needs further examination since repertoire in recent decades utilizes this range.

Vibrato and Intonation

The combination of a greater compression of air, mouthpiece on the lips, and jaw in the upper register results in the jaw becoming rather stiff, restricting the movement that is necessary for creating vibrato. Individuals might use the “pivot” system to figure out their needs for this particular adjustment. Players should utilize vibrato to open and free the embouchure, which can develop the upper register. Bowman suggests players should use vibrato to help the issue of “lock-jaw.”

Intonation in the extreme upper register can become particularly sharp or flat. A practical solution to adjust intonation is to use different fingerings in the upper register. Fingering, however, is also an issue for further study. Fingering in the upper register on different brands and models of euphonium can differ from one to another because of specialized designs and different sizes between each brand or model.

---

222 Kleinhammer, The Art of Trombone, 46.
223 Bowman, Practical Hints, 22.
CHAPTER 5

RESEARCH OF BIOMECHANICS AND ERGONOMICS

Explanation of Basic Tone Production on Brass Instruments

Prior to discussing the terms “biomechanics” and “ergonomics,” this section explains the principles of tone production on brass instruments, which requires efficient vibration of “lip reeds.” Lip vibration, however, needs a harmonious coordination between these components: air pressure, the placement of tongue, the size of vocal cavity, formation of lips, and muscular tension.

Definition of the Term “Biomechanics” and “Ergonomics”

Examining the musical aspects of biomechanics and ergonomics shows that these two studies could be more beneficial than using methodology alone. This section discusses further research that shows evidence of how physiological features and musical equipment could impact how a euphonium musician develops the upper register.

According to the Oxford English Dictionary, biomechanics means “the branch of science concerned with the application of mechanical principles to the movement and structure of living organisms.” Peter McGinnis explains in *Biomechanics of Sport and Exercise*: “The prefix *bio* indicates that biomechanics has something to do with living or biological systems. The root *mechanics* indicates that biomechanics has something to do with analysis of forces and their effects. So it appears that biomechanics is the study of forces and their effects on living systems.”

---


systems.”227 Playing an instrument can be the force that directly impacts a musician’s “living organism” and physiological factors. Thus, awareness of biomechanics can be helpful for musicians.

The definition of ergonomics in the Oxford English Dictionary is “the scientific study of the efficiency of man in his working environment.”228 The International Ergonomics Association (IEA) explains:

Ergonomics (or human force) is the discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that uses theory, principles, data and methods to design in order to optimize human well-being and overall system performance. Ergonomists contribute to the design and evaluation of tasks, jobs, products, environments and system in order to make them compatible with the needs, abilities, and limitations of people. Ergonomics helps harmonize things that interact with people in terms of people’s needs, abilities and limitations.

There are three types of ergonomics: physical, cognitive, and organizational. Physical ergonomics can be the greatest resource for euphonium musicians and educators because of its association with physical activity that frequently corresponds with topics like postures, materials handling, repetitive movements, work related musculoskeletal disorders, workplace layout, and health.229

Application of Biomechanics to Philosophy of Upper Register

The primary purpose of biomechanics in sports is twofold: 1) to prevent and aid in the recovery of injury and 2) to improve an athlete’s performance. Both purposes are interrelated because one cannot perform well with injuries.230 The concept of biomechanics can help any euphonium musician who wishes to improve their ability of playing the upper register. Several

230 McGinnis, Biomechanics of Sport, 3.
Methodologies reviewed earlier advocate the importance of practice with proper resting schedules and suggest players relax while working the upper register. Over-practicing can possibly lead to permanent injury that prevents a player from obtaining the high range, which ultimately inhibit their development. Suitable rest and relaxation will help one recover and continue the training process with better efficiency.

McGinnis outlines three ways to assist athletes who wish to master their performance results: technique, equipment, and training. Teachers/coaches play an important role in deciding what actions can help athletes improve their techniques. It is therefore, necessary for euphoniumists who would like to master their upper register skill with experienced teachers/musicians who can provide guidance with suitable methods. Equipment that athletes use can be a vital factor that affects their performance. This principle can be applied to euphoniumists as well: using unsuitable equipment like oversized euphonium models and mouthpieces can lead to some difficulty in developing the upper register. Euphoniumists should take in consideration using proper equipment.

Selection of euphonium models and mouthpieces can be factors that impact properly developing the upper register. Ervin indicates that a smaller mouthpiece and instrument can help a player develop the upper register with less effort. Several authors state that a mouthpiece with a wide cup can lead to playing the upper register with difficulty. Oversized euphoniums and mouthpieces frequently demand more air volume and support, which require greater air pressure and force. If one’s muscular strength and dental structure are incapable of providing greater air pressure, playing the upper register will be much more difficult. Beginner and intermediate

---

231 Ibid., 3-7.
232 Ervin, Rangebuilding, 7.
students must select their euphonium and mouthpiece carefully since they need to develop good habits and build confidence.

Players need to understand their own physical features in order to make appropriate adjustments and use methods accordingly. Variations between physiological configurations of individuals can not only generate different results but also require different adjustments in the upper register. Dental structure and jaw position could diametrically affect the angle of mouthpiece placement, which dominates the direction and pressure of air stream. In order to produce a good tone quality and an accurate sound, a player should adjust their position of holding the instrument and their mouthpiece placement. Based on Ford’s research of mouthpiece “force” on trumpet playing, the mouthpiece “force” tends to increase when the register ascends. The increasing mouthpiece “force” in the upper register can lead to either ease or difficulty caused by different dental structures with different models of euphoniums and mouthpieces. This leads to two considerations:

1. Do all the physical adjustments suit different physiological features?
2. How do different euphonium models and mouthpieces affect the upper register?

Several reviewed methodologies indicate individual concerns. Reinhardt specifies the concept of “individualism” of brass players and categorizes embouchure types in order to help players analyze their own embouchure and choose the correct type. Dale discusses how different jaw positions and dental situations might lead to different levels of difficulty in players’ tone production. He then provides suggestions for players who have a teeth overbite with a

---

receding jaw.\textsuperscript{236} Haynie in \textit{How to Play High Notes, Low Notes, and All those in Between} suggests that players with a teeth underbite should use the pivot system by reversing the way that players with an overbite angle their mouthpiece and instrument.\textsuperscript{237} Bowman recommends that most players should direct the air stream downward to help their upper register while some might find the opposite direction works better.\textsuperscript{238} Winter provides suggestions for individuals with a special embouchure.\textsuperscript{239} Kohut\textsuperscript{240}, Hunt, and Bachelder\textsuperscript{241} refer both upstream and downstream embouchures and suggest individuals adjust accordingly.

Euphoniumists who have relatively inadequate physiological features need to be aware and explore physical solutions to aid their development in playing the upper register. Cumulative and frequent failures when playing the upper register may create insecurity and anxiety, which would negatively impact performance. Thus, being aware of one’s own needs and body structure could help players solve this problem with less effort.

Players must also be aware that all methods for practice can be temporal. David Winter states: “All the biomechanical variables are time-varying.”\textsuperscript{242} Thus, students practicing over a long period of time need to adjust the external “force” via mouthpiece, instrument, and arm pressure in order to develop the upper register with more efficiency.

Being aware of biomechanics can benefit an athlete’s performance and help analyze any cause of injury. Comprehending biomechanics provides guidance for a therapist and a trainer in

\textsuperscript{236} Ibid., 16.
\textsuperscript{237} Haynie, \textit{How to Play High}, 3.
\textsuperscript{238} Bowman, \textit{Practical Hints on Playing the Baritone}, 19.
\textsuperscript{239} Winter, \textit{The Brass Instruments}, 26.
\textsuperscript{240} Kohut, \textit{Musical Performance}, 196.
\textsuperscript{241} Hunt and Bachelder, \textit{Guide to Teaching Brass}, 18.
prescribing medications and suitable exercises. A musician’s practice in the upper register (and in general) can be compared to an athlete’s exercises. Both require muscular systems to coordinate and balance so that training can be maximized training, leading to their best performance. Thus, both musicians and educators should have full awareness of biomechanics and study it in order to efficiently develop the capability of playing the upper register.

Application of Ergonomics to Philosophy of Upper Register

From the point of view of ergonomics, euphoniumists need to select "suitable" equipment and coordinate with proper tools in order to meet one’s need and limitation. Euphoniums that weigh between eight and ten pounds can become heavy after a long period of practice sessions. Some people have rather long arms while others have shorter ones. Muscular strength of the arms, back, and shoulders differs between individuals. Players with weaker strength might increase unnecessary tension while playing due to exhaustion when holding the euphonium.

Popular support tools, like a lap block/cushion (made of cloth or towel), the Ergobrass support system, or a Hand Strap can help euphonium players reduce unnecessary tension in the arms, shoulders, back, and neck area. Excessive tension in these areas greatly impacts a player’s facial muscles when performing in the upper register. A common issue for euphonium players is their sitting posture, because they tend to place the euphonium on their lap. The unified height of euphoniums generally does not match the length of a player’s torso completely. The playing posture as well as the placement of the mouthpiece and instrument may be incorrect and negatively impact a player’s performance in the upper register. With the assistance of a block/cushion or the Ergobrass support system, a player can adjust the placement of their instrument and mouthpiece with more ease. The Hand Strap, which reduces the grip on a

euphonium player’s left hand, can help the left hand relax and avoid applying excessive mouthpiece pressure. Euphoniumists standing for practice and performance can utilize the Ergobrass support system and Hand Strap to reduce exhaustion caused by the weight on the left arm. These two tools can also help their playing postures, along with using a suitable position of the instrument and mouthpiece.

More suitable placement angles for the euphonium and mouthpiece can improve coordination of air direction, lip vibration, and mouthpiece pressure. In addition to the benefits of reduced muscular tension and easily adjusting the instrument and mouthpiece position, the support of an appropriate placement angle means that a player can improve his playing posture. A correct posture will affect their breathing system and support greatly.
CHAPTER 6
WELLNESS FOR THE DEVELOPMENT OF THE UPPER REGISTER

The Maintenance of Lips and Facial Muscles

Maintaining the lip and facial muscles is crucial for euphoniumists since brass players utilize “lip reeds.” “Lip reeds,” however, are unlike the replaceable reeds on the woodwind instruments. In a 2014 survey, the lips and jaw were the most prevalent sites for performance-related pain. Euphoniumists must be fully aware of and take great precaution to avoid injuries of the lips and its surrounding areas. The following sections will discuss two common embouchure health issues including a pimple/cold sore around the lips and fatigue of the facial muscles.

Pimple/Cold Sore around the Lips

A pimple/cold sore can lead to pain, discomfort, and inappropriate facial tension, all of which can have negative impact on a brass player’s ability to play. The causes of a pimple (one type of acne) include: hormone changes during a female’s premenstrual period, oil or grease from cosmetics or the environment, pressure from sport helmets and tight outfits/clothes, external irritants from pollution or humidity, picking at scars, scrubbing the skin roughly, and stress. The triggers to a cold sore are: exposing the lips to sunlight, stress, exhaustion/fatigue, dental treatment, oral trauma (a wound to the lips or cut from shaving), cold/flu, allergies of food, menstrual period, and pregnancy. Because of these causes, brass musicians should pay attention to both physiological and psychological stresses.


External excessive pressure likely induces acne or a cold sore on the skin because of “the pressure from sport helmets and tight clothes.” Mouthpiece pressure can be external pressure applied to brass musicians’ lips. Brass players tend to employ greater mouthpiece pressure and grip the instrument more strongly to the lips while playing in the upper register. This excessive pressure on the lips possibly leads to acne/cold sore. It is also important to prevent grease/oil from being applied to the lips. Female brass musicians need to be careful with lip cosmetic use and be alert to possible symptoms during their menstrual period or pregnancy. Male players need to avoid cutting the area around the lips while shaving.

Suggestions to prevent acne/cold sore symptoms include:

• Minimizing the mouthpiece pressure and preventing from gripping the instrument too strongly
• Washing the mouthpiece every time before playing (in order to cleanse any grease/germs left from a previous practice)
• Rinsing the skin area around lips every time before and after playing in order to reduce the grease secreted by skins and negatively influential substances in a player’s surroundings
• Brushing teeth before playing to reduce any grease/oil (in the mouth) that likely moves to the mouthpiece rim and the lips.
• Avoiding touching the skin around the lips due to hands carrying germs and unknown grease/oils
• Avoiding practice with excessive exhaustion
• Being careful with diet and exercise
• Taking care of one’s mental state in order to avoid stress

Fatigue on the Embouchure

Muscles around the facial areas frequently become fatigued and stiff after a player consistently practice the high range for a long time. Developing embouchure strength is important for playing in the upper register; however, overly massive muscular fibers may hinder
the lips from vibrating properly. More importantly, over-practicing can result in permanent and expensive damages that profoundly impact a brass musician’s career.

Brass players need to practice the upper register with frequent rest in order to allow facial muscles to recover sufficiently. Rest will also improve muscle strength. Relaxing the muscles of the lips, cheeks, and jaw is necessary. Playing the pedal low tones between exercising the upper register and post-practice warm-down can help loosen tense muscles on the cheeks as well as the lower jaw. This exercise helps the jaw to develop more flexibility. The “VIBRASS embouchure revitalizing” device could possibly loosen the lips and lip area muscles when used by brass and double reed musicians. VIBRASS advocates that this “massage device” can help relieve any tiredness on the lips and facial muscles within five to ten minutes because the vibrating mouthpiece can massage the lips and improve blood circulation. Players should not use this device more than two minutes before playing in a concert.

Awareness of Wellness for Brass Musicians

Respiratory System

Air is one of the essential components of developing the embouchure for the upper register on brass instruments. The condition of the respiratory system, however, can differ between individuals. Lung capacity varies due to different body sizes and breathing conditions. A poor playing posture can negatively affect one’s breathing and placement of the instrument and mouthpiece. A bad physiological posture has a negative impact on respiratory muscles.

A common respiratory disease is asthma. Asthma tightens airway muscles, which narrows the airway, so asthmatics experience difficulty inhaling and exhaling.\textsuperscript{249} Difficulty in breathing influences a brass musician’s use of air on the instrument. In addition to regular pharmacological treatments, brass players experiencing asthma may consider managing their breathing better by adjusting/aligning their physiological posture.

Chiropractic care is a typical treatment for musculoskeletal or spinal problems including pain in the back and neck.\textsuperscript{250} Although using medication to treat asthma is more popular, Graham’s study indicates that chiropractic treatment helps asthmatics improve symptoms and reduce the frequency of asthma attacks.\textsuperscript{251}

Coleman’s study shows that the “Straighten Up” exercises ("posture exercises")\textsuperscript{252} can reduce the number of incidences asthmatics experience by waking up from an asthma attack at night.\textsuperscript{253} Frequently interrupted sleep can lead to chronic diseases and harmful health conditions, which can negatively impact musicians’ professional developments and performances. Chiropractic treatment and the “Straighten Up” exercise routine can become complementary resources for brass musicians with asthma to manage their respiratory system better and improve their performance in the upper register (and in general.)


\textsuperscript{250} Mary I. Hawkins, “Chiropractic Care and Acupuncture Attitudes, Beliefs and Behaviors of Health Educators” (PhD diss., University of Arkansas, 2006.), 52-53.

\textsuperscript{251} Graham and Pistolese, “An Impairment Rating Analysis” 5.

\textsuperscript{252} Coleman, “The Association between Asthma”, 29.

\textsuperscript{253} Ibid., 73.
Hydration

Water is vitally important and essential for living.\textsuperscript{254} There is no literature that indicates drinking water is particularly beneficial for a brass player’s lip tissues. However, other literature reveals that hydration can improve the health and efficiency of vocal folds. Hydration definitely benefits singers and patients with voice disorders.\textsuperscript{255}

In addition to one’s general health, the study of Popkin et al., however, reveals that water can help one’s “physical performance” and “cognitive performance.”\textsuperscript{256} The study states that “Under relatively mild levels of dehydration, individuals engaging in rigorous physical activity will experience decrements in performance related to reduced endurance, increased fatigue, altered thermoregulatory capability, reduced motivation, and increased perceived effort.” Mild dehydration may lead to cognition and emotional problems.\textsuperscript{257} Drinking water has very little negative impact on one’s health.\textsuperscript{258} Still, brass musicians need to be aware of their water intake and stay hydrated in general and during practice sessions.


\textsuperscript{258} Ibid., 15.
CHAPTER 7
CONCLUSION

The forty reviewed brass methodologies regarding the topic of performing in the upper register include a wide variety of suggestions and theories. The assortment of recommended methods reveals that some methods are more prevalent than others. Some theories are rather unique. The use of terms for similar suggestions and theories, however, can lead to confusion and misunderstanding. The reader studying these methodologies needs to be aware of the context in order to avoid any misinterpretation. Euphonium musicians must further examine and classify bewildering terms so they can employ the recommended methods and principles more efficiently.

In addition to the lack of study and suggestions for particular issues in the upper register, most of the methodologies include no science-based evidence or studies of real cases to support the effectiveness of their recommended methods. So that euphonium musicians can have specific perspectives and guidance to choose methods suitable to their needs, solutions to particular issues of high range, evaluations of effectiveness, and current use of these systematic assortments need further study.

The study of biomechanics and ergonomics may provide resources for euphoniumists wishing to master their ability in the upper register by taking individual physiological features and needs into consideration. Students and educators alike need to keep in mind that practicing always includes a temporal component so they can adjust methods accordingly. Aforementioned devices that attempt to help reduce tension in the arm, neck, and lips would be likely effective, although further research is still needed to prove their effectiveness. Brass musicians also need to be aware of and concerned with wellness, which can help them to maintain their body from experiencing physiological injuries and negative psychological impact.
In conclusion, the purpose of this study is to review extant brass pedagogical books in order to provide euphoniumists with resources to develop the upper register properly and efficiently. This study will hopefully encourage more research in this area.
REFERENCES

Reviewed Methodology


Referred Methodology


*Books*


*Journal*


*Dissertation*


*Online Resource*


Questions and Answers about Acne."What Causes Acne?." National Institute of Arthritis and Musculoskeletal and Skin Diseases. 
https://www.niams.nih.gov/Health_Info/Acne/default.asp#acne_c

VIBRASS. “VIBRASS embouchure revitalizing.” VIBRASS
http://www.vibrass.at/index.php/product/vibrass-3/?lang=en

Others

