PERMUTATION PRACTICE: TOWARD THE DEVELOPMENT OF A PRACTICE SYSTEM FOR MULTI-FACETED PERFORMANCE AS SHOWCASED BY JOSIAH WILLIAMS’ MASTER’S RECITAL WITH THREE INSTRUMENTS AND FIVE GENRES PERFORMED

A CREATIVE PROJECT
SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
MASTER OF MUSIC
BY
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I. Introduction

The creative project at hand connects the field of music practice theory with studies describing the lives of freelance musicians. The connection between the two lines of research is a practice system, called Permutation Practice, informed by preparing and performing a degree recital that involved performing on three instruments and five pieces in five distinct musical styles.\(^1\) The practice system is based on mathematics, namely permutations and combinations commonly employed by music composers, and will provide a strong yet flexible format for musicians to apply to daily practice involving multiple skill sets, multiple instruments, and/or multiple styles. The practice system developed for Josiah Williams’ master’s recital meets the need for music students and freelance musicians to deliberately structure their practice in order to reach their goals.

II. Background

Music performance is an extremely competitive field. More than 21,000 students graduate American institutions with music degrees each year.\(^2\) There are not enough full-time performance jobs to satisfy such a large number of graduates. According to data gathered by Joseph Kaufmann, demand by symphony orchestras for performers is at an all-time low.\(^3\) Performers need to adapt to the harsh environment of today’s musical market. One common adaptation is the development of a high level of performance in multiple styles or even on multiple instruments. Artists such as Jim Morrison (jazz trumpet, trombone, varied woodwind and brass), Ingrid Jensen (jazz trumpet and vocals), Aubrey Logan (jazz/pop trombone and

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\(^1\) See Appendix 1 for a copy of the recital program.


vocals), and Bria Skonberg (trumpet and vocals) exemplify the trend. The area of research into the musical lives of freelance musicians has grown contemporaneously to this trend. Freelance music work is a piecing-together of varied and disparate jobs contracted through networking, reputation, and chance. Building a freelance career as an artist necessitates “engagement in multiple short-term jobs involving heterogeneous employers or clients, also called project based or “portfolio” work.” For musicians, freelance work is about “the abilities of performers to play anything at sight, in any style, to follow any conductor no matter what his abilities, and do this efficiently, with precise intonation, phrasing, and attack.” Stephen Cottrell, professor of music at City University of London, describes the problem facing classically trained musicians:

I wish to suggest that these kinds of adaptive strategies, where musicians expand their range of performance skills to cater to a fragmented landscape of different performance opportunities, are particularly noticeable in our own Western urban centres. This is increasingly the case even for musicians who might nominally be described as performers of Western art music, and who are likely to have received the rigorous conservatory training which underpins this tradition, a tradition which might not be thought by many to lend itself comfortably to the kind of adaptability required.

III. Music Practice Literature Review

The need for musicians to develop high levels of skill in multiple areas in order to compete in a fast-paced freelance market is clear and pressing. However, literature on the method for practice of varied skill sets has not yet risen to meet the need.

Harald Jørgensen is considered a leading voice and a founder of the line of music practice research. Susan Hallam includes an essay in the 1997 book edited by Jørgensen about practice theory summarizing the knowledge held in the field at that time. Among other topics, Hallam

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reviews “deliberate practice.” Deliberate practice is described by Ericsson, Krampe, and Tesch-Romer. It is “characterised as goal-oriented, structured, and effortful.” While the descriptions of deliberate practice are useful, the findings of the study also seem to imply that, at some levels of expertise in practice, certain amounts of “non-deliberate practice” take place. Non-deliberate practice over an entire practice session wastes valuable time that the practicer could be using to make themselves into a more marketable artist. In order to facilitate efficient practice, advance planning and structuring of practice time is required.

Matthew Lennex, in his Arizona State University dissertation, offers a few salient points from his observations of the habits of deliberate practicers Alex Iles and Tony Baker. Iles and Baker are two examples of trombonists who have built successful careers performing both in classical and jazz styles. Lennex points out that both trombonists emphasize active listening as part of practice, changing equipment to suit the style being performed, and “balancing practice time” between all styles or equipment setups. According to Lennex, “Both Mr. Baker and Mr. Iles pay close attention to planning their practice sessions to ensure they maintain their technical proficiency on every trombone they use and their artistic voice in each genre.” In other words, in order to find success in multiple genres and/or on multiple instruments, practice planning is required. The practice system established below- developed for the purpose of performing multiple genres on multiple instruments- structures time to encourage deliberate practice.

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IV. What to Practice

The Permutation Practice system was developed in preparation for a recital featuring 50 minutes of music with 3 instruments (symphonic tenor trombone, small bore tenor trombone, alto trombone) and 5 distinct musical styles (early classical solo, modern theatrical unaccompanied solo, contemporary chamber music, substantial solo sonata, bebop jazz small group). The goal of the system is to evenly distribute practice time between critical skill areas on all instruments. In order to determine what skill areas are necessary to practice, a review of some pertinent literature is appropriate. While the literature reviewed is most relevant to trombone performance, it is the hope of the author that interested practicers could apply the lessons learned and the system developed to a variety of performance areas.

Sources published by the International Trombone Association (ITA) provide some guidance as to what trombonists should be practicing. James Roberts, in a 2002 article published by the journal of the ITA, shares the results from a survey of elite trombonists. The survey, with a sample size of 43, encouraged free responses to questions and therefore collected results that are somewhat sprawling. However, Roberts’ survey is of interest to the trombonist curious about how successful performers in the field spend their practice time. Roberts categorized the responses into common practice areas between all the respondents: Tone quality, breath control, embouchure flexibility, relaxation/ease of playing, articulation, dynamics, range, accuracy/technique, mental concentration. Interestingly, the survey questions also accounted for meta-practice techniques such as goal setting and record keeping. Roberts’ list covers the fundamental elements of music practice as seen by a trombonist.

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Anecdotal support is offered in the Buddy Baker Tenor Trombone Handbook, a compilation of handouts written by the titular trombonist with over 30 years of university teaching experience at Indiana University and University of Northern Colorado. He advises readers to practice “so that time is not wasted and your practice time becomes more effective.” His method prescribes downward slurs, legato exercises, flexibility, staccato tonguing, multiple tonguing, and warm down.\(^\text{10}\)

In addition to field-specific periodicals and pedagogical anecdotes, skills critical to practice can be found in documents used to assess music performance. In the book Benchmarks in Action, MENC doles out assessment techniques created in response to the national standards set by the National Education Goals of 1990 and the Goals 2000: Educate America Act of 1994. The book discusses methods and provides test questions and sample assessment forms for music. Pertinent to the current study are the materials on Advanced Level Instrumental Performance (the highest level discussed in the book). The sample assessment highlights the following facets:

… play the pitches with no technical difficulty… play the rhythms accurately… The beat is steady… responsive to dynamics, tempo, style, and expression as indicated in the music… familiar with major stylistic characteristics of the literature performed… tone quality is excellent … intonation and breath support are excellent.\(^\text{11}\)

To summarize, the elements of music that are nationally recommended for assessment include: technique/accuracy, rhythm/tempo, expression/style, tone, and intonation.

A second resource geared toward music educators’ assessment of performance comes from an article by Frederick Burrack in the Music Educators Journal. Burrack offers assessment forms for individual students and large groups. The individual form covers “Tone Quality, Pitch


Accuracy and Intonation, Rhythmic Accuracy, Musical Interpretation, Articulation and Technique.\textsuperscript{12}

To distill the pertinent elements of music for recommended practice even further, a vast majority of the elements above can be grouped into the categories: tone, technique, style/expression. It is not the scope of this study to prescribe specific passages or exercises for practice but rather to describe a system for organizing practice. However, because the Permutation Practice examples to follow come from the preparation of Josiah Williams’ master’s recital, it is worthwhile to note the following guiding principles. With the goal at hand of performing a recital with 5 specific pieces in mind, practicing REPERTOIRE can be used to focus on stylistic and expressive elements, as the pieces of music are ultimately what will be heard by the audience. Tone or SOUND is commonly practiced using long tones or listening to recordings. Technique can be developed through scalar exercises and practicing SCALES.\textsuperscript{13}

So, the problem becomes to develop a system of deliberate practice to equally distribute practice time between Sound, Scales, and Repertoire, all under the conditions of three different instruments.

V. Development of Permutation Practice System

In order to connect the current research on theory of practice with descriptive studies of successful contemporaries, a day-to-day system of practice is developed that takes into account the skills demanded of today’s freelance musicians. The system is inspired by the efforts given in preparing a degree recital requiring three instruments (alto trombone, symphonic tenor trombone, small bore tenor trombone) and five styles (unaccompanied expressionist/maximalist, early


classical chamber solo, major contemporary sonata, contemporary chamber group calypso fusion, and bebop jazz). The practice system employs the set theory mathematics of permutations and combinations in order to evenly distribute deliberate practice over multiple skills and instruments.

Permutations and combinations are used by composers of twentieth-century serial music. For the benefit of all readers, the figure below provides a review of the definitions for permutations and combinations:

![Figure 1. At-a-glance definitions and formulae for permutations and combinations.](image)

<table>
<thead>
<tr>
<th>Permutations</th>
<th>Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A permutation is an ordered subset (i.e. attention is paid to the order of selection or arrangement) of a particular set of objects.</td>
<td>A combination is any subset of a particular set of objects, regardless of the order of selection.</td>
</tr>
<tr>
<td>$n!/(n-r)!$</td>
<td>$n!/r!(n-r)!$</td>
</tr>
</tbody>
</table>

In the Ball State University course MUST 621, “Analytical Techniques,” combinations and permutations are applied to determine the available permutations of sets of pitches for the creation of new serial music. Permutations are also applied to determining the voice leading possibilities between two chords of different types. In Milton Babbitt’s *Composition for 12 Instruments*, the first movement is based on an all-combinatorial row with only 6 possible hexachords. In Anton Webern’s *Symphonie Op. 21*, the retrograde symmetry of the original row affects the statistics of its combinations and permutations. Composers in the twentieth-century academy knew how to deliberately practice their craft, and the same set theory mathematics will

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15 Jody Nagel, “Combinations and Permutations” (handout, MUST 621, Ball State University, Muncie, IN, 2010).
16 Jody Nagel, “Four Essential Formulas” (handout, Ball State University, MUST 621, Muncie, IN, 2010).
be key to developing the Permutation Practice System. As a tool for ordering groups of items and generating systematized variety, set theory is safe and effective. Their appropriate application to the topic of deliberate practice allows for a method of time distribution and practice planning that balances practice evenly between all desired skills.

In the problem at hand, there are three skills (long tones, scales, repertoire) to practice in three ways (symphonic F-attachment tenor trombone, straight small bore tenor trombone, alto trombone). The problem of combining these two groups is an ordered association problem.

In an ordered association, groups are calculated based on combining two subsets under the conditions of order and self-association. For example, consider six baseball teams in a league and how many games they will play between all teams, and whether or not a scrimmage counts as a game. A scrimmage (a team playing a game against itself) serves as the example for self-association. Order in this example would mean, when Team 1 plays Team 2, whether it matters if the game is 2 vs. 1 or 1 vs. 2. In baseball it makes a difference because one team must start at-bat and one team must start fielding. So, the problem of how to practice three skills on three different instruments is an ordered association problem. For the preparation of the recital, order matters and self-association is acceptable. The formula to calculate this kind of association is: \( Y = N^2 \). \(^{17}\)

In this case, \( Y = 3^2 = 9 \). As seen in the figure below, now there are nine possibilities: Long Tones (tenor), Long Tones (small bore), Long Tones (alto), Scales (tenor), Scales (small bore), Scales (alto); Repertoire (tenor), Repertoire (small bore), Repertoire (alto).

\(^{17}\) Ibid.

\(^{18}\) Jody Nagel, “Four Essential Formulas” (handout, Ball State University, MUST 621, Muncie, IN, 2010).
Now, the baseline of desired practice conditions is defined. Permutation Practice uses permutations and combinations to evenly distribute practice time between all practice conditions. There is a set of nine practice conditions. For the recital, the goal was to practice three practice conditions each day and practice on each instrument each day. So, the problem is to calculate subsets of three from a set of nine items. If the order does not matter (1-2-3 is the same as 3-2-1), there are eighty-four combinations possible. If all three instruments must be played each day under each condition it is a different problem. In this problem, there are only three objects in the set and three objects in the subset, but the order matters. For example, practicing Scales (alto), Repertoire (small bore), Long Tones (tenor) is different from practicing Repertoire (small bore), Long Tones (tenor), Scales (alto). So, it is a permutations calculation. \(\frac{3!}{(3-3)!} = 6\).

There are six ways to practice all three instruments with all three conditions each day. For the preparation of the recital, the six ways were assigned to six days of the week with a rest day and each practice condition was assigned an equal time allotment. So, each week contained a balanced amount of time for each skill on each instrument. For example, in a two-hour daily practice session, forty minutes are assigned to Long Tones on tenor, forty minutes are assigned to Scales on alto, and forty minutes are assigned to Repertoire on small bore trombone.
In order to demonstrate the flexibility of applying the Permutation Practice system it will be beneficial to walk through structuring the practice time of a hypothetical player with slightly different goals. Take Player A, a college freshman Music Education major with a primary instrument of tenor trombone. Player A has received great instruction and so knows the importance of practicing fundamentals like long tones, lip slurs, articulation, multiple tonguing, and sight reading. However, with the pressures of Player A’s degree program and time constraints, they have found it difficult to accomplish everything every day in limited practice sessions. Player A has goals to improve as a sight reader and begin doubling on bass trombone,

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19 For a more universal handout on the Permutation Practice System, please see Appendix 2.
but has recently received feedback from their instructors that their articulation is unclear, inconsistent, and has a long way to go. Player A wants to practice fundamentals, articulation, and sight reading under the conditions of both tenor and bass trombone. As an added consideration, Player A wants to “double down” on articulation practice, and spend a greater amount of time on articulation regardless of instrument.

Player A has the overall goal of even practice distribution between practice conditions and instrument types. They do not need to touch every skill each day or each practice session.

As seen in Figure 3, Articulation is weighted by its double representation as a practice condition. There are now eight practice conditions, or four practice conditions on tenor and bass trombone each. So, the problem is to calculate subsets of four from a set of eight. Order does not matter in this case. Practicing fundamentals, then sight-reading, then articulation, then articulation again is the same to Player A as the reverse. The formula for calculating combinations is \( \frac{n!}{r!(n-r)!} \) or \( \frac{8!}{4!(8-4)!} = 70 \). There are seventy ways to practice four out of the eight practice conditions. In seventy four-component practice sessions, even practice would be distributed to all conditions. However, in this large quantity of subsets, not every practice session will include enough articulation practice to please Player A.

If Player A wants every practice session to flow in the order of Figure 3, then it becomes a counting problem. There are only eight ways to start from fundamentals on Tenor and follow with sight-reading, articulation, and articulation again played on either tenor or bass. If Player A wants to include the option to begin practice with fundamentals on bass, then the possibilities double to include the mirrored options. Sixteen structured practice sessions might be more manageable than seventy unordered ones. The final step, then, is to plug in the amount of time
devoted to each practice condition and start the rotation. Player A could choose to spend fifteen minutes on each practice condition and execute a different rotation each day.

Figure 3. A hypothetical Permutation Practice example for Player A.

<table>
<thead>
<tr>
<th></th>
<th>Tenor</th>
<th>Bass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals</td>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td>Sight-Reading</td>
<td>3.</td>
<td>4.</td>
</tr>
<tr>
<td>Articulation</td>
<td>5.</td>
<td>6.</td>
</tr>
<tr>
<td>Articulation</td>
<td>7.</td>
<td>8.</td>
</tr>
</tbody>
</table>

VI. Contribution and Suggestions for Further Research

The really exciting work begins when treating all the practice conditions as a set with no restrictions for order or self-association. Without these restrictions, it is possible to rotate through permutations of all the items in the set to create exponentially more structures for future practice sessions. For instance, if all 9 practice conditions in the first example were treated equally (it doesn’t matter if 3 conditions are practiced each day or if each instrument is practiced each day),
then there are $9!/(9-3)!$ permutations or 504 variable ways to order the practice of any three conditions.

Imagine substituting individualized variables into the labeled spots in figure 2. What if instead of different instruments there were different genres of music? What if each label designated a different piece of music under three different focus conditions? What if there were 4 rows and columns or more to the table? Like set theory in music composition, with a bit of imagination and the will to structure it, the variability blooms exponentially. It is the hope of this author that deliberate structured practice continues to be the result.

Further research into the Permutation Practice system could include longitudinal studies of practicers based on the application of meta-techniques. For example, it would be valuable to see a study comparing 5 years of practice and the results for practicers who employ: no practice structuring method, some practice structuring method, or the Permutation Practice system. Also, related to the practice of freelance musicians, the literature would benefit from a descriptive study of the practice habits of successful freelancers, whether or not they double on multiple instruments or in a variety of genres.

The system is strong yet flexible. Any instrumentalist will be able to apply the system to practice in varied skills on multiple instruments, or in multiple genres. If applied creatively, the system is capable of unlimited variants and will be helpful to practicers seeking to grow multiple skill sets at equally high levels of performance.
Bibliography


Appendix 1. Copy of Josiah Williams’ Master’s Recital Program

BALL STATE UNIVERSITY
College of Fine Arts
School of Music

Master of Music Recital
Thursday, November 7, 2019
Suesa Performance Hall, 7:30 p.m.

JOSIAH WILLIAMS, trombone
with
Michael Seregow, piano

Luciano Berio
(1925–2003)
Sequenza V

Leopold Mozart
(1719–1787)
Concerto for Alto Trombone
I. Adagio
II. Menuetto and Trio
III. Allegro

Amy Riebs Mills
(b. 1955)
Red Dragonfly Sonata for Trombone
and Piano
I. Ardimente
II. Remembering
III. Gioioso

David M. Rodgers
(b. 1965)
Calypso
with Eric Rodriguez, trumpet

Dexter Gordon
(1923–1990)
Second Balcony Jump
with Sam Green, drums; Claire Everait, bass; Tommy Schilb, piano

Josiah Williams is a trombone student of Chris Van Hoof.
This recital is presented in partial fulfillment of the requirements
for the degree Master of Music in performance.
Appendix 2. Sample Handout for the Permutation Practice System

Permutation Practice is a deliberate practice system for structuring practice time that uses statistics to evenly distribute time between skill areas.

This handout will help you to:

- Plug in desired skills and practice conditions
- Plug in time intervals
- Assign rotations to practice sessions
- Practice with peace of mind that time will be distributed evenly among skill areas

Example 1.
Player A has three skills they want to practice evenly i.e. Lip Slurs, Multiple Tonguing, Melodic Minor Scales in Thirds. They want each practice session to cover all three skills with even time allotments. They don’t want each practice session to be exactly the same in the same lineup.

Use Permutations, Combinations, and their Rotations to structure your practice and add variety.

A permutation is an ordered subset (i.e. attention is paid to the order of selection or arrangement) of a particular set of objects.
\[ n!/(n-r)! \]

A combination is any subset of a particular set of objects, regardless of the order of selection.
\[ \frac{r!}{r!(n-r)!} \]

Order matters means that 1-2-3 is different from 3-2-1 and 2-3-1, etc.
So, Player A is picking three items from a set of three items: (Lip Slurs, Multiple Tonguing, Melodic Minor Scales in Thirds)

Combination: \(3!/(3-3)! = 1\)
Permutation: \(3! = 6\)

There are 6 ways of arranging a set of three items: Lip Slurs, Multiple Tonguing, Mel Min Scales; Slurs, Scales, Tonguing; Tonguing, Scales, Slurs; Tonguing, Slurs, Scales; Scales, Slurs, Tonguing; Scales, Tonguing, Slurs. Think of these 6 ways as rotations of the same set of items.
(This is also the definition of a factorial).

In practice, assign time values to each item and assign each rotation to a practice session. For example, if each item receives 20 minutes, then Player A’s practice session will take about an hour. If each rotation is assigned to a day of the week, then Player A will include one session on six days and either rest the seventh or begin again.
Example 2. Player A decides to take up doubling on bass trombone.

Now, consider practicing each three of those skills on a different instrument. The table below helps visualize the new set of items.

If we take the set of six now and look for a subset of three, we do NOT guarantee that tenor trombone and bass trombone will be practiced equally in every practice session. For example, the subset that contains 1, 3, 5, will only include tenor trombone and the session that contains 2, 4, 6, will only include bass trombone. Only at the end of practicing all the rotations will even practice time be distributed.

<table>
<thead>
<tr>
<th>Lip Slurs</th>
<th>Tenor Trombone</th>
<th>Bass Trombone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td>Multiple Tonguing</td>
<td>3.</td>
<td>4.</td>
</tr>
<tr>
<td>Melodic Minor Scales in Thirds</td>
<td>5.</td>
<td>6.</td>
</tr>
</tbody>
</table>

Does order matter?
Permutation: $6!/(6-3)! = 120$ permutations
(Experientially, practicing 1, 2, 3, feels differently from practicing 3, 2, 1. Fun for the far-sighted! See you in 120 practice sessions.)
Combination: $6!/3!(6-3)! = 20$ combinations
(Statistically, practicing 1, 2, 3, is the same as practicing 3, 2, 1, etc.

<table>
<thead>
<tr>
<th>1, 2, 3</th>
<th>1, 2, 4</th>
<th>1, 2, 5</th>
<th>1, 2, 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3, 4</td>
<td>1, 3, 5</td>
<td>1, 3, 6</td>
<td>1, 4, 5</td>
</tr>
<tr>
<td>1, 4, 6</td>
<td>1, 5, 6</td>
<td>2, 3, 4</td>
<td>2, 3, 5</td>
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<tr>
<td>2, 3, 6</td>
<td>2, 4, 5</td>
<td>2, 4, 6</td>
<td>2, 5, 6</td>
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<tr>
<td>3, 4, 5</td>
<td>3, 4, 6</td>
<td>3, 5, 6</td>
<td>4, 5, 6</td>
</tr>
</tbody>
</table>

*Every condition shows up exactly 10 times*
*In 20 practice sessions all three skills under two conditions will be practiced evenly*
Anything with a 1 or 2 contains a lip slur (16 sessions)
Anything with a 3 or 4 contains multiple tonguing (16 sessions)
Anything with a 5 or 6 contains melodic minor scale practice (16 sessions)
Anything with a 1, 3, or 5 contains tenor trombone practice (19 sessions)
Anything with a 2, 4, or 5 contains bass trombone practice (19 sessions)
Finally, assign practice times and rotations to practice sessions. If each skill received 30 minutes, then Player A's sessions will take about an hour and a half. If each rotation is assigned to a day, then Player A will have about three weeks to rotate through even practice between all skills and conditions.

Step 1. Determine your goals: skill areas, styles/genres, instrument doubling, etc.
  - What skills do you want to practice and under what conditions?
Step 2. Create a table and tabulate ordered associations if needed
Step 3. Calculate permutations or combinations
Step 4. Assign time values to items and rotations to practice sessions
  Step 5. Practice
  Bonus: Record yourself and listen back