Saxophone without mouthpiece

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Saxophone Without Mouthpiece

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This dissertation is submitted in partial fulfillment of the requirements for the doctoral degree program at the Academy of Creative and Performing Arts of Leiden University. The remaining requirement involves a demonstration of the research and its findings through an artistic presentation and the official defense of the thesis.

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Please note: This dissertation was originally produced as a website with embedded video demonstrations, audio and video performances, and audio examples. The links to those video demonstrations are marked with hyperlinks. The reader is encouraged to access the dissertation website at the following link:
https://www.saxowithoutmouthpiece.com

Acknowledgments - https://youtu.be/hWRDTLZkkDc

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Introduction

Background - https://youtu.be/Bm2xmkMVPV4

Hello, my name is Don-Paul Kahl, I am a saxophonist, educator, and researcher. Welcome to my PhD research on saxophone without mouthpiece.

Saxophone without mouthpiece (SWMP) is the practice of playing the saxophone without the object which produces the common practice sound of the instrument: the mouthpiece. Taking away this seemingly integral part of the saxophone, in fact, opens new sonic possibilities. Innumerable possibilities exist for the player who wishes to explore this arguably new instrument properly and thoroughly - I would like to be your tour guide on a journey into the sonic world of this instrument. As a starting point (and to focus this research topic) I will examine the most used techniques found in the repertoire, as well as some major problems concerning notation. I will focus on four techniques: air sounds, tongue rams, trumpet sounds, and saxo-flute hybridity.

I first encountered these techniques while studying in Paris in 2014. A composer, Juan Arroyo, was working at IRCAM and had a work performed there as part of a series of concerts led and curated by him and his colleagues. After the concert, I approached Arroyo to congratulate him and introduce myself. As one so often does after a concert, we grabbed a drink in a local pub and sat down to discuss our practices. He informed me that he already had several works for saxophone but that they were "different;" they were for SWMP, largely unperformed, and available for me to look at if I would like. Fascinated by the idea, I eagerly awaited the next day to discover his scores.

In my initial discovery phase, I was both enamored by the sounds but simultaneously confused how to approach the techniques that Arroyo employed, for example in his composition *Sikuri I* (2012) for tenor saxophone and live electronics. I scoured the internet looking for any information that could help me on these techniques. I found little to no solace there. I looked in my technique manuals and could not find all that much information or data on these techniques - only a small page or a short paragraph here and there. I asked my teacher at the time, Jean-Michel Goury, who could help to an extent. He gave me an overview of how to approach several of the techniques and to go about working on them and making them sound better - especially the trumpet and flute sounds. I worked for hours upon hours on this piece *Sikuri I*, until I felt that I was ready to play it for Arroyo.

After working with Arroyo, I realized that some of the practices that I had been told by my teacher might not be achieving the precise sounds which he demanded. I had to rework, rediscover, and invent methods to learn these techniques for myself. I ended up performing *Sikuri I* many times throughout Europe and the United States and was left with a palpable urge and desire to know more about playing SWMP.

From there, I went on to seek out other pieces, other saxophonists performing these techniques, and composers who were interested in them. And since these techniques, up until now, have not received the proper investigation, I set myself down a path towards an artistic research project which I deem necessary for contemporary saxophonists, modern pedagogues, composers of our time, and artistic researchers with similar interests in other instrumental fields. I sought out a means to perform this research in a structured and guided way; thus, I started my pursuit of a PhD in Artistic Research on SWMP techniques.

Abstract

Saxophone without mouthpiece (SWMP) techniques involve removing the mouthpiece from the saxophone's neck, adjusting the embouchure, and blowing air in specific ways to produce distinct sounds. This dissertation will focus on four such techniques: air pitch, tongue rams, trumpet sounds, and saxo-flute hybridity. Since the 1980s, composers have incorporated these techniques into their works. However, they have remained relatively under-researched, leading to many misconceptions among both performers and composers. Through my practice-led research, which includes experimentation, historical and aesthetic contextualization, sonic analyses, pedagogical insights, in-depth performances, collaboration with composers on new works, and addressing notational challenges with potential solutions, the intricate nature of these techniques can be more comprehensively understood by saxophonists, composers, and researchers.

The culmination of this research is an online dissertation featuring text and videos, which will examine three primary components:

1. **Contextualization of SWMP**: This component investigates SWMP techniques within an historical framework. It situates these techniques within various aesthetic movements and perspectives in music, providing a richer and deeper understanding. Additionally, it examines the techniques in the context of modern performance practices.
2. **Technical Information for Performers and Composers**: This section offers performers practical advice on successfully executing these techniques. It also provides composers with guidance on how to properly incorporate these techniques into their works.
3. **An Analysis of Notation**: This section looks at the role notation plays in the interpretation of SWMP pieces and techniques. The analysis examines the importance of some more or less standardized guidelines when composing with these techniques and highlights the critical relationship between composer and performer in both composition and performance.

The texts and videos are supplemented by a comprehensive collection of personal audio and video performances, a detailed pitch manual (including recordings of each individual

note possible), and other essential materials, such as a searchable database of repertoire that employs SWMP techniques. Furthermore, I personally conducted interviews with several composers and one performer, which are included as part of this supplemental material.

Research Questions - https://youtu.be/4Y8N9ZixesU

Any research should ideally set down clear and decisive goals, initially formulated in the form of research questions. These questions and goals serve to guide the examination and allow one to stay critical throughout the entire trajectory.

The overarching question that will guide my inquiry, and to which I will consistently return, is: What is SWMP? From this broad foundational question, several more specific inquiries emerged, further focusing my research. The first and logical follow-up question I pose concerns the technical craft of the practice: What is the artistic, technical, and sonic potential of SWMP techniques?

A thorough contextualization provides insight into how SWMP techniques have evolved, why composers have increasingly adopted these techniques, and how they contribute to a richer and more profound theoretical understanding. This process prompts several additional questions: What is the historical background and context of these techniques? And from where did they originate? The saxophone, an instrument ripe for investigation, invention, and discovery, serves as a venerable playground of sounds and possibilities. Furthermore, what are the potential relationships between the performer and their instrument? How do SWMP techniques fit into the performer-material-composer narrative? How can we understand the practice of SWMP through the lens of various aesthetic movements in music? By addressing these questions, we can better appreciate the unique aesthetic space these techniques occupy and their significance in contemporary musical practice.

Notation is a deeply personal and historically divisive topic. What notational trends have composers employed in recent decades when utilizing these techniques? Can a more standardized notational model be proposed for these techniques that allows for a basis of understanding upon which composers can potentially expand? Furthermore, regarding the broader role of the performer as a co-composer, in which contexts should a performer exercise artistic judgment when faced with notational discrepancies? How can the relationship between composer and performer be more closely aligned in the notation of SWMP techniques in works that are intended to be passed from one performer to another?

Presentation of Thesis

The presentation of this thesis takes the form of a bespoke website which includes videos, text, figures, manuals, and databases of works and recordings. Each chapter will explore a distinct aspect of the research, addressing the research questions and contributing to a comprehensive understanding of the field of study on SWMP techniques.

A purely written model was not chosen for this research. This is for two important reasons: firstly, to convey the knowledge based on my artistic practice, I must show how playing SWMP can and perhaps even should be performed and practiced. Secondly, it is my intention to disseminate the research to as many channels as possible. A comment forum section is added to the website to allow for future discussion and discourse from interested viewers from around the world.

The following chapters will be explored as part of this thesis: contextualization of SWMP techniques; SWMP techniques (air pitch, tongue ram, trumpet sounds, and saxo-flute hybridity); and notation for SWMP. These six body chapters are preceded by this Introduction and followed by a Conclusion.

Research Method

In this research project, I focus on the development of a performance practice with and through SWMP techniques; as such, I need to shed light on the specific possibilities and issues of this topic from an artistic perspective. Therefore, I have developed a methodology to meet the needs of my performance practice and research.

From the beginning of my inquiry into these techniques and sounds I have used a plurality of methods and approaches. Some of these include:

- Experimenting with the techniques through my practice.
- Investigating a historical narrative.
- Discovering repertoire, recordings, and composers writing for and performers using these techniques.
- Performing works using SWMP techniques and utilizing them in public improvisations.
- Working as a pedagogue to discover how to better practice, learn, and master these techniques and how to teach them to my colleagues.
- Working with composers on new works and using my specific knowledge of these techniques to commission, perform, and record new pieces.

The "State of Art" - https://youtu.be/SqZIUq8ibYk

The "State of Art" is a barometer by which the necessity of a research topic is measured. To whom is it directed? What impact will this research bring to those groups of people? It

examines why this research must be performed now and addresses what knowledge gaps it will fill.

SWMP techniques have been employed in contemporary composition since the 1980s. However, a fully realized, researched, centralized, open-source, and dedicated understanding or knowledge of these techniques is yet to exist. While several historically important figures such as Daniel Kientzy, Jean-Marie Londeix, Marie-Bernadette Charrier, Marcus Weiss, and Giorgio Netti have discussed them in published books, there remain significant gaps in the profound comprehension of these techniques.

For whom is this research meant? First, for performers who are puzzled by how to approach the techniques in their practice. In most pedagogical institutions a systematic approach to these techniques is still lacking today. Ultimately, the performer is left to wonder about creating consistency in how they function and how to produce them reliably. What is ultimately missing is a centralized hub where practical, technical, artistic, and aesthetic knowledge for performers and educators is collected and made accessible.

However, not only performers can benefit from this research project. All topics addressed here are also useful for composers. If performers are unintentional about how to produce SWMP techniques consistently and effectively then how are composers to write and use them in their works? Many composers are forced to do their own in-depth research into these techniques to understand even how to begin to work with them. Notation also poses historically and continuously contentious issues here. There is a lack of a better thought-through notation system for writing these techniques. While notation can be seen as a highly individualized and personal matter, a system that gives more structure could be in place so that saxophonists have the tools to recognize and easily adapt to the notation system chosen by a composer. A more standardized structure model would in this case be helpful; therefore, one will be presented should a composer wish to use it or purposefully deviate from it, depending on their personal thoughts and ideology on notation.

Going Forward

Given that air pitch, tongue rams, trumpet sounds, and saxo-flute hybridity are being used in an ever-growing number by composers of today and that modern saxophonists need a thorough understanding of them to be able to interpret these works, this research aims to contribute to the further development of these techniques. It also aims to show that they are not just a novelty but require a dedicated, practice-led system to execute and use them properly.

Through this research process, I provide a foundational contextualization of these techniques, enabling them to stand independently as extensions of the already rich and dynamic world of the saxophone. In doing so, I also offer transparent empirical and pedagogical data on the sonic possibilities of these techniques. The works employing

them constitute a significant portion of the discussion, and they are highlighted and critiqued to serve as a valuable resource for saxophonists and composers. Despite ongoing debates about notation, offering a historical understanding and a subsequent general framework for notating these techniques might promote their wider acceptance and ultimately enrich the future tapestry of notational possibilities. Finally, with the aim of offering the necessary foundation for these techniques to thrive, I present a narrative that situates them within the broader domain of saxophone performance practices, allowing them to assume their well-deserved place.

Chapter 1
Contextualization of Saxophone Without Mouthpiece

Saxophone without mouthpiece (SWMP), as a bespoke technique of playing used in notated, published music, can be traced back to the early 1980s with the work by Costin Miereanu[1] entitled *Do-Mi-Si-La-Do-Ré.*[2] This work was commissioned and premiered by the French saxophone virtuoso Daniel Kientzy.[3] Subsequently, Kientzy's massive efforts to expand the literature for contemporary saxophone resulted in many standard works in this genre, with a significant number employing SWMP techniques.

SWMP techniques have survived into the modern day in large part due to Kientzy's technical prowess, his immense desire to promote the contemporary saxophone, and his support network to commission and perform new works. The techniques have since evolved with the changing perspectives of musical ideology and aesthetics, the innovations and methods of other saxophonists, and the ever-expanding repertoire and sonic exploration developed by composers. They have seen a veritable renaissance in the last decade at least; however, they had more humble beginnings.

Providing a context is necessary due to a general lack of understanding of the practice and performance of these techniques. This chapter aims to offer various contexts within which SWMP can be positioned. I have selected some markers that have contributed to the genesis and development of SWMP. I will present a timeline of its evolution from the 1920s to the present day, delving into the influence of Vaudeville and dance band musicians. I will highlight significant saxophonists along with their methods and manuals, and examine the contribution of improvisers, composers, and performers to the ongoing history of SWMP. Furthermore, I will contextualize these techniques within the shifting ideological perspectives in music during the pre- and postwar eras. I will also provide an overview of what knowledge has been available already, discuss the various misconceptions or knowledge gaps that pervade in previous texts, and review the literature and practice of these techniques in general. The contributions by my predecessors have paved the way for younger generations of saxophonists, composers, and researchers to become more curious to understand SWMP techniques. This curiosity has also led to a desire to be more precise and to reexamine preconceived notions. This is where my research will add to the already existing body of knowledge: filling in missing or unclear gaps, providing accurate and transparent sonic results, presenting suggestions for notational practices where no convention exists, and examining the techniques through the lens of current aesthetic practices.

[1] Costin Miereanu is a French composer of Romanian birth. His primary composition teachers were Karl-Heinz Stockhausen, György Ligeti, and Erhard Karkoschka. Taking musical inspiration from many different sources, his compositions have been praised for exhibiting a mix of traditional Romanian music, elements of aleatoric music, music theater, and musique concrète. He was the recipient of many prestigious composition prizes including the *Prix Enescu* in 1974.
[2] *Do-Mi-Si-La-Do-Ré* is a work dating from 1980-1981. It is written for one saxophonist performing on multiple saxophones. In very true fashion to his virtuoso and complex works, the work is accompanied by electronics and a bespoke film. The work was first performed by Daniel Kientzy in October 1981 as part of the *Concerts Manifestes* of the G.E.R.M. in Paris.
[3] For more information, please see Daniel Kientzy's website: www.kientzy.pro

1.1 - 1920s-1930s Novelty Techniques

The act of removing the mouthpiece and performing techniques on the neckpiece or by the addition of a trumpet mouthpiece was employed much earlier than the 1980s. Vaudeville and dance band musicians of the 1920s and 1930s took advantage of such techniques in their performances. As outlined in Gail B. Levinsky's dissertation, "An Analysis and Comparison of Early Saxophone Methods Published Between 1846-1946," several method books from this time explain in broad terms how to perform "tricks" on the saxophone. One of these tricks includes the "bugle-effect," which is similar in scope to the modern "trumpet sounds technique."[4]

The pedagogy outlined in the methods of the time regarding these "tricks" or "stunts" emphasized the novelty of the techniques. One or two-sentence summaries are given, indicating that performers were intended to learn more on their own or by devising strategies based on listening to others. In Henri Weber's method *Sax Acrobatix* from 1926, he instructs the reader to have patience when working on these novelties and to do their best to imitate the sounds described.[5]

> Don't imagine that you or anyone else can acquire these tricks at the first or second, or even third trial. It takes patience and practice to finally 'get the knack.' But it CAN BE DONE and the effort IS WORTH WHILE [sic]. Bear in mind, when attempting to produce any of the tricks, that you must try to articulate the sound imitated, as nearly as it is possible to do so into the instrument, just as you would imitate [them] without the instrument. (Weber 1926: 4)

Imitation no doubt played a role in early explorations of these techniques. It is important not to overlook the natural influence from other instrumental practices when examining the historical context of these techniques and others like them. SWMP techniques can be seen as being directly inspired and derived from other wind player performance techniques. For example, when exploring the common or extended practice techniques of flute players, one immediately encounters tongue rams, air sounds, and, of course, typical flute sounds. Trumpet sounds are inspired by performance techniques of brass instruments. However, not all pedagogues were so eager to participate in such novel imitation.

It is well-documented by Levinsky that much of the saxophone and pedagogical community at this time was torn between the exploration of new sounds and techniques and the development of proper saxophone technique (Levinsky 1997: 184).[6] Many

[4] The bugle-effect was used with the addition of a trumpet mouthpiece inserted into the saxophone neckpiece. For more discussion on this topic, please see Chapter 4 on trumpet sounds.
[5] Henri Weber was a saxophonist and author of many early saxophone method books. Without too much generalization, he mostly focused on the publication of early jazz methods.
[6] I have been unsuccessful in finding the relevant method books that Levinsky lists in her dissertation that mention the "bugle-effect" technique. In speaking with her directly, she does not remember the exact technique but states that she would not have listed it had

authors point out that these new techniques were often dismissed as nothing more than raucous noise designed to distract diligent saxophonists from honing their craft.[7] Despite this, they persevered to some extent. While some of the novel "tricks" outlined in these early methods and performed by 1920-1930s saxophonists have since become standard saxophone techniques (i.e., glissandi, double tonguing, vibrato, etc.), many others have been forgotten to obscurity or have been absorbed into other similar techniques (the "meow" or the "sneeze," for example).[8] While it was likely the intention of Weber and similar authors to inform the practice of Vaudeville and dance band enthusiasts with their methods, it is conceivable to imagine that classically-trained saxophonists were also interested in such techniques.

As the music of dance bands and Vaudeville musicians started to fade out of popularity, so too did the novelty sounds and effects of this era. While there is little literature to support the existence of SWMP techniques between this waning popularity of the dance band eras and the innovations of Daniel Kientzy, we can only assume that saxophonists remained curious and explored these techniques in their own time; that is exactly what Daniel Kientzy did in his early career.

1.2 - A Turn to the Sonic

Situating the SWMP techniques and practices within broader musical trends provides a more expansive contextual framework in which they can thrive. This broader perspective not only deepens our comprehension of these techniques but also adds aesthetic and philosophical dimensions to the historical context. This section positions SWMP within a more encompassing context to illuminate and highlight the influence of these aesthetic and philosophical theories on the SWMP practice as it exists today. While there might not be a direct connection between the stated theories and theorists and the SWMP practice, there is the mutual understanding of exploring new possibilities during an ever-evolving history of Western art music.

Despite the inevitability of classically trained saxophonists taking interest in the novelty techniques of the 1920s and 1930s, there is no mention of saxophonists or composers using SWMP techniques until the 1980s.[9] However, music was evolving. SWMP techniques did not occur in just a vacuum. The rise and dominance of experimentation in music and the tools used to create music – instruments, computers, playing techniques, etc. – have been in constant renewal and evolution since the early 20th century. Marked by an

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the "bugle-effect" not been mentioned. Due to the extreme difficulty or absolute impossibility of purchasing or even perusing every single method that she discusses, I am taking the secondary source material as relevant to my research.

[7] For example, method authors such as Giuseppe Pettine, Rudy Wiedoeft, and J. Beach Cragun cautioned against the concentrated practice of special tricks and Vaudeville performance techniques without first developing proper saxophone technique and embouchure.

[8] See Weber (1926): 16-17. Both the "meow" or the "sneeze" can nowadays be considered a part of the standard practice of saxophone playing. Their appearance in written music has however waned since the 1920s and 1930s.

[9] Despite many attempts to find works that employ SWMP techniques in the 1950s, 60s, and 70s, I have been unable to identify any that use them. While the repertoire is vast and this formative period of saxophone repertoire and technique development could be the discussion of another research project, the focus of my study will start from the 1980s onward.

ubiquitous push against tradition and convention, contemporary composers, artists, and theorists have made distinct aesthetic movements, for example, the significant move towards understanding noise as a musical sound. Following Christoph Cox in "Beyond Representation and Signification: Toward a Sonic Materialism" (2011), Michael Eng in *The Sonic Turn and Theory's Affective Call* (2017), and the philosophy of Marcus Weiss, I call this "the sonic turn": The emphasis on melody, harmony, and rhythm shifted towards an increased attention for "sounds in themselves" (Cage 1961), timbre, frequencies, and noise, that is, sounds previously not considered as music. Furthermore, Eng and Cox relate music and sound to shifting paradigms in philosophy more broadly. Cox specifically introduces sound within a materialist framework: inspired by Nietzsche and Deleuze, he grounds sound in its material and dynamic qualities. He proposes a rigorous critique of visual culture, as well as the connected concepts of representation and signification, in favor of a new ontology of change, becoming, and temporality based on sound (Cox 2011: 157). He suggests that shifting focus from representation to material forces fundamentally alters how one perceives art. Cox states that instead of thinking in terms of representation and signification,

> we might begin to treat artistic productions not as complexes of signs or representations but complexes of forces materially inflected by other forces and force-complexes […] Thinking about sound in this way provokes us to conceive difference beyond the domain of 'culture', signification, and representation, and to see these as particular manifestations of a broader differential field: the field of nature and matter themselves. (Cox 2011: 157)

Cox and Eng posit that a turn towards sound and the sonic engages with the idea that sound, as a material phenomenon, can disrupt established concepts and categories, potentially offering a more direct and immediate form of engagement with reality. Eng argues that "sound is to be valued because it upends all existing epistemological paradigms" (Eng 2017: 317). The sonic turn thus reflects a desire to break free from representational thought, which often prioritizes visual and linguistic forms of understanding, in favor of appreciating the inherent materiality of sound and its impact on perception and knowledge.

In the early 20th century, Futurist artist Luigi Russolo pens his *The Art of Noises* (1913) where he argues that noises emerging with the advent of machinery in the 19th century, now would dominate human life, contrasting with the relative silence of the pre-industrial era. Russolo asserts that traditional music, bound by historical conventions and limited in its range of sounds, has become insufficient for modern sensibilities. He argues for an increased interest of composers and artists to use noise in their works.

> This revolution of music is paralleled by the increasing proliferation of machinery sharing in human labor. In the pounding atmosphere

> of great cities as well as in the formerly silent countryside, machines create today such a large number of varied noises that pure sound, with its monotony, now fails to arouse any emotion. (Russolo 1913: 5)

He traces the evolution of music from the sacred, pure sounds of antiquity through the Middle Ages and Renaissance, leading to the complex dissonances of contemporary music. This progression, he believes, prepares the ground for integrating noise into music. Modern life, filled with the sounds of machinery and urban environments, has attuned human ears to appreciate more varied and intense auditory experiences.

Music, according to Russolo, calls for "a greater variety of instrumental tones and coloring" from which the typical instrumental practitioner "vainly tries to create a new variety of tones" (Russolo 1913: 5-6). To create this richer variety, Russolo envisions a venerable mechanical noise orchestra that can "conquer the infinite variety of noise-sounds" – categorized into six groups including roars, claps, and whispers – produced by specially designed instruments (Russolo 1913: 6). This combination of built and found instruments would, Russolo argues, create richer and more dynamic sonic experiences than traditional orchestras. He goes on to describe how, in the hands of the right musician, "the art of noises will extract its main emotive power from the special acoustic pleasure that the inspired artist will obtain in combining noises" (Russolo 1913: 9-10). In doing so, Russolo calls for musicians to embrace noise, analyze its rhythms and pitches, and explore new ways to combine these sounds artistically. Inspired by the soundscape of modern life, he presented in his music a blend of industrial, natural, and musical sounds.

Despite the intention of Russolo to create this Futurist orchestra used to produce noises that more reflect daily city life, Russolo's six categories bear a surprising number of sounds that can be easily reflected through the saxophone and particularly through SWMP.

1	2
roars	whistles
claps	snores
noises of falling water	snorts
driving noises	
bellows	

3	4
whispers	shrill sounds
mutterings	cracks
rustlings	buzzings
grumbles	jingles
grunts	shuffles
gurgles	

5	6
percussive noises using	animal and human voices:
metal, wood, skin,	shouts, moans, screams,
stone, baked earth, etc.	laughter, rattlings, sobs

Luigi Russolo: *The Art of Noises* (1913)

Here are many sound categories that can easily be produced through the saxophone with or without mouthpiece. For example, one can easily relate Russolo's roars to the barrissement technique inherent in trumpet sounds technique (see also Chapter 4) or to many aggressive multiphonics of conventional saxophone with mouthpiece playing. The whistles that Russolo asks for in his second category can be heard easily through the implementation of saxo-flute hybridity. Whispers, mutterings, and rustlings can all be produced through the lens of the saxophone as a megaphone. To implement the types of percussive noises that Russolo imagines, modern tongue rams, slap tongues, key clicks, and various techniques that have the saxophonist hitting the instrument can all be imagined. This is not only true for the saxophone or the SWMP, but for any modern instrument. Already in 1913, Russolo imagined a world where "the variety of noises is infinite" where the public would "be able to distinguish among ten, twenty or thirty thousand different noises" (Russolo 1913: 12). Saxophone culture benefitted from this development and opened itself towards less conventional sounds and ways of playing. In his ire of the "weak" sounds gained from conventional orchestral instruments, and his call in building mechanical instruments to produce these various sounds, perhaps unintentionally, Russolo was prescient in realizing how contemporary art and music would respond in the following decades.

Not wholly unlike Russolo, French-American composer Edgard Varèse emphasized the importance of electronic instruments in achieving new sounds and timbres previously unattainable with traditional instruments. In his own manifesto, which compiles lectures given from 1936 to 1962, entitled *The Liberation of Sound* (1966), Varèse would dream of "instruments obedient to [his] thought" that can produce "a whole new world of unsuspected sounds" to meet the "exigencies of inner rhythm" (Varèse 1966: 11). He

acknowledges the revolutionary impact of electronic music on the state of sound, noting that "the electronic medium is also adding an unbelievable variety of new timbres to our musical store," and he celebrates its ability to free music from the tempered system, aesthetic codification, and rules which had previously limited musical evolution (Varèse 1966: 18). Despite this, and unlike Russolo, he maintains that traditional instruments will continue to have their place: "Our new liberating medium – the electronic – is not meant to replace the old musical instruments which composers, including myself, will continue to use. Electronics is an additive, not a destructive factor in the art and science of music" (Varèse 1966: 15). Varèse concludes his manifesto by stating that composers will create both good and bad music, just as they have done before with conventional instruments. He states that "the computing machine is a marvelous invention and seems almost superhuman. But, in reality, it is as limited as the mind of the individual who feeds it material" (Varèse 1966: 18). Varèse and Russolo both look to the future when technological means will be able to better facilitate and realize the complex ideas that composers can create: "Considering the fact that our electronic devices were never meant for making music [...] it is remarkable that what has already been achieved is musically valid. [Computers] are still somewhat unwieldy and time consuming and not entirely satisfactory as an art-medium" (Varèse 1966: 18). It is hardly difficult to imagine that Varèse would be a proponent of the incredibly diverse playgrounds in which his electronic medium exists today.

In the post-war period new musical perspectives and ideas were circulating, also affecting interest in new ways of performing and playing. This period is marked by a general turning to the sonic, referring to how music turned away from traditional forms and compositional techniques. Previous rules for compositional success were no longer strict guidelines for musical thought; instead, sound itself received more and more focus. Through the exploration of sound, performers sought new ways of engaging with their instruments, and composers, eager to exploit these new practices, began creating works using new playing techniques. This resulted in an outpouring of new compositions that featured extended techniques of playing. A continued boom in creativity spread across the Western world, also affecting music. The period between the end of WW II and the 1980s witnessed two major shifts in music: total serialism and experimental electronics (Ingham 1998: 161). Within this timeframe, composers and performers were continually turning their practices towards imagining new landscapes of sound disembodied from melody, traditional Western understandings of pitch, functional harmonies, and classical structures. This combined interest led to many budding and close composer-performer relationships. No longer were their practices divorced from each other; instead, they became partnerships that fostered countless practice-led innovations, for example, John Cage and the pianist David Tudor, Luciano Berio and the singer Cathy Berberian, Milton Babbitt and singer Bethany Beardslee, or Costin Miereanu and Daniel Kientzy. In many cases, these relationships resulted in compositions that reflect the personality and identity of the performer for whom they were written (Ingham 1998: 162). For example, the *Sequenza III* (1965) by Luciano Berio for soprano vocalist featured exigent vocal

techniques that Cathy Berberian was prominently displaying at the time. Similarly, Miereanu would implement techniques in his works (*Do-Mi-Si-La-Do-Ré* (1980/1981), *Aksax* (1984), or *Concerto pour saxophone et orchestre* (2006)) that were advocated by Daniel Kientzy. These relationships would become important and lead to new and challenging works allowing for the continued development of pedagogy on and performance of works utilizing extended techniques. Daniel Kientzy, in his pursuit to advocate for a modern and progressive saxophone, was one of many who became interested in novelties co-developed with composers.

Saxophonists and pedagogues, Claude Delangle and Jean-Denis Michat remark on the dissonance between the saxophone's origin story and its current grounding in modern music:

> As it frees itself from jazz and popular influences, and asserts its independence, the modern saxophone, far from disowning its roots, will increasingly exploit its unique duality: aggressive or tender, refined or vulgar. Ever since composers learned how to quantify and exploit the uncertainties of 'real-time' creation, the modern classical saxophone school has produced artists able to master even the most transcendent of works. (Ingham 1998: 169)

The dual nature of the saxophone as "aggressive or tender, refined or vulgar" serves as both a creative force and a compelling attraction for performers and composers. At the intersection of melding distinctive styles into one, the entire saxophone community discovers the development and prominence of new techniques and their ambassadors. Many of the aforementioned novel techniques have since the mid-20th century become commonplace for any classical saxophonist to thoughtfully develop, train, and flawlessly execute. For instance, multiphonics, slap tongue, key clicks, and microtonal playing are now standard techniques in classical saxophone curriculums worldwide. The ongoing process of exploration and growth is such that the saxophone and composer communities can also consider these techniques, along with numerous others, as integral components of an entirely different concept, being that of *musique concrète instrumentale*.

SWMP techniques are philosophically and aesthetically aligned with the principles of *musique concrète instrumentale*, a term coined by Helmut Lachenmann that blends elements of musique concrète with traditional instrumental music. *Musique concrète*, pioneered by composers such as Pierre Schaeffer and Pierre Henry in the mid-20th century, involves the manipulation of recorded sounds – often drawn from everyday or environmental sources – to create new and abstract auditory experiences. Lachenmann's *musique concrète instrumentale* extends this concept by incorporating traditional musical instruments, often utilizing novel playing techniques. Describing his own music, Lachenmann explains that *musique concrète instrumentale* is "sound as a message conveyed from its own mechanical origin, and so sound as experience of energy" (Lachenmann as quoted in Ryan and Lachenmann 1999: 20-21). He goes on to say that it

> signifies an extensive defamiliarization of instrumental technique: the musical sound may be bowed, pressed, beaten, torn, maybe choked, rubbed, perforated and so on. At the same time the new sound must satisfy the requirements of the old familiar concert-hall sound which, in this context, loses any familiarity and becomes (once again) freshly illuminated, even 'unknown'. Such a perspective demands changes in compositional technique so that the classical base-parameters, such as pitch, duration, timbre, volume, and their derivatives retain their significance only as subordinate aspects of the compositional category which deals with the manifestation of energy. (Lachenmann as quoted in Ryan and Lachenmann 1999: 21)

And using the words of artistic researcher Paulo de Assis, Lachenmann's work can be described as follows:

> [T]he sound events are chosen and organized so that the manner in which they are generated is at least as important as the resultant acoustic qualities themselves. In such a music those qualities, such as timbre, volume, dynamics or duration, do not produce sounds for their own sake, but describe or denote the concrete situation: listening, you hear the conditions under which a sound- or noise-action is carried out, you hear what materials and energies are involved and what resistance is encountered. (Assis 2011: 68)

The philosophy underlying this musical language emphasizes that the physical action of sound production is as important, if not more so, than the resulting sonic outcome. This basic principle is relevant to the contextualization of SWMP as well. For example, saxo-flute hybridity requires the saxophonist to find the precise angle for air projection, with the outcome sometimes differing from what is expected. These unpredictable results can lead to surprising and artistically valuable moments in performance, where the attempt at creating the sound itself becomes an integral part of the musical experience.

In *musique concrète instrumentale*, physicality often plays a crucial role in shaping the sonic outcome. Scores may demand multiple layers of techniques from a performer simultaneously. Often, it is physically impossible to execute all these demands perfectly; however, the endeavor to do so creates a valuable artistic situation. The process is considered more important than strict adherence to the score. In SWMP, this might occur when transitioning from trumpet sounds to tongue rams to air pitches in rapid succession. At such a demanding tempo, the precision of these techniques may begin to falter, yet the performer still honors the composer's intention by maintaining the action-based sound creating a texture that could almost never be reproduced in another performance situation. In a way, this resembles the aesthetic of *musique concrète instrumentale*, where the performative action and the resulting sound exploration from those actions are both vital to the overall artistic expression demanded.

Through the ideas developed by Russolo, Varèse, Lachenmann and many others, SWMP could establish its own aesthetic space within the broader musical landscape from the early 1900s to the present day. By contextualizing SWMP techniques in such a manner, we gain a richer and more comprehensive understanding of its basic structures, as well as its cultural and theoretical backgrounds. SWMP can thus be understood to be part of a general, organic, and ever-evolving continuum of sonic expansion and discoveries.

The following section will examine some of the leading figures in modern saxophone practice and their contributions to the development of SWMP.

1.3 - Daniel Kientzy and his *Saxologie*

During the experimentally fertile period of the 1980s, many sonic experimentations, commissions, and developments were initiated by Daniel Kientzy. The impact of Kientzy on the modern saxophone and the evolution of new playing techniques cannot be overstated, particularly in the context of SWMP techniques. In an endeavor to highlight the versatile and artistically powerful nature of the saxophone, he commissioned, premiered, and promoted numerous new pieces. This resulted in the creation of many new works using SWMP techniques.[10]

His dedication to new techniques of playing led him to write and publish a saxophone treatise entitled *Saxologie* (2007 [1990]). Written in the early 1990s, but only published much later, in this work, Kientzy details over 100 different saxophone playing techniques. Within this number, he designates 30 techniques as "special effect" modes of playing (Kientzy 2007: 4). Each technique is accompanied by a short text explaining how to produce it, along with the pitched sonic realization of each note for saxophones, ranging from sopranino to bass instruments. Included in *Saxologie* are also several pages dedicated to different SWMP techniques.

However, upon closer inspection, I found some discrepancies between my experience with and observations of these techniques and what Kientzy writes about them. Two distinctions must be considered when discussing these discrepancies. First, from what Kientzy writes, it is unclear what formal sonic analyses, if any, he used to come up with the sonic outcomes for the various techniques. The only hints that are given, is a short paragraph explaining that errors in research happen and are possible due to the

> ruthless yet ultimately respectful exploration of dormant 'genetic faculties' [of the saxophone]. [This research] broadens the field of means of expression by acquiring the resources and perfecting traditional techniques. We must not, however, measure the interest of a playing mode by the dimensions of its sound sample, its definition or its applications. (Kientzy 2007: 7)

[10] According to his website, Kientzy is responsible for over 700 new works for saxophones.

When examining another important resource by Daniel Kientzy, *Les sons multiples aux saxophones* (1982), there is a similar lack of transparency concerning the analyses used in his methodology. Even though these two major resources (*Saxologie* and *Les sons multiples aux saxophones*) have become a "must" in saxophonist's libraries, a general trend has emerged of experimenting with the fingerings used and taking Kientzy's sonic outcomes "with a grain of salt" so to speak.

Second, two major developments have occurred since Kientzy wrote his *Saxologie*: technology and instrumental-performer evolution. Technological advances in audio analysis have come quite a long way since the 1980s and 1990s. Powerful software such as Sonic Visualizer or OpenMusic, which allow composers and performers to analyze sound in extraordinary detail, were only conceptual ideas in the minds of audio engineers at the time.[11] Software, such as the aforementioned, allow the user to input audio files and receive sound data compiled in hertz and in spectrograms. The user can then analyze this data against their aural perception to come to a final sonic analysis of the initial audio file. For example, for this research project I have used Sonic Visualizer to examine recorded material and to provide me with data on each individual note and on all techniques. I then took this data and compared it to what I experience aurally (see Chapters 2 through 5 and the Pitch Manual). The implications of these powerful new technologies are that all past sonic analyses must be called into question and scrutinized. This reexamining of sonic results has led to newer manuals of techniques with more accuracy than their predecessors. Additionally, the modern saxophonist and the saxophone itself are continually evolving. With each new generation of performers being taught and encouraged to master new skills, what once was considered a major innovation now has becomes a standard practice. While Kientzy's contributions to saxophone practice have been integral to its evolution, there remains room for further research and development in this area.

1.4 - Jean-Marie Londeix's *Hello! Mr. Sax*, Marcus Weiss and Giorgio Netti's *The Techniques of Saxophone Playing*, and Others

Kientzy was not alone in his pursuit to understand and codify saxophone techniques. Many other voices entered into the discussion, and among them certain authors are of particular interest for the purposes of this thesis. Notable contributors include Jean-Marie Londeix, Marie-Bernadette Charrier, Marcus Weiss, Giorgio Netti, Claude Delangle, and Jean-Denis Michat. Like many others, these authors have conducted in-depth research and added their own manuals on saxophone techniques. Two major textual resources stand out when discussing extended techniques of saxophone playing. The first is *Hello! Mr. Sax* (1989) by Jean-Marie Londeix, with chapters contributed and written by Marie-

[11] "The Spectral School" of composition was already performing their own sonic analyses using technology of the time. These types of advancements were already in motion in the late 1970s. For example, the work *Partiels* (1975) by Gérard Grisey was composed using technology from this period. My remarks about "conceptual ideas" refer to the power with which modern software can analyze sonic material in fine detail – much more so than in previous decades.

Bernadette Charrier. The other is *The Techniques of Saxophone Playing* by Marcus Weiss and Giorgio Netti.

In *Hello! Mr. Sax*, Londeix details his viewpoint on the parameters of saxophone playing, similar to Kientzy's approach in *Saxologie*.[12] This book includes references and pedagogical methodologies to develop one's understanding of saxophone pitch, timbre, articulations, dynamics, and attacks. Contemporary techniques of playing are also covered, with a specific chapter dedicated to trumpet sounds falling under the timbre category. The information on sonic results, performance tips, suggested notational practice, and methodology on trumpet sounds spans several pages and was written by Charrier.[13]

Among the texts examined in this research that include trumpet sounds, *Hello! Mr. Sax* provides the most succinct and pedagogically helpful information; however, the content is dated (1989) and misses, for example, parameters for the soprano saxophone. Additionally, while *Hello! Mr. Sax* is an invaluable resource for a basic understanding of standard and contemporary saxophone techniques in general, it does not explore air pitch, tongue rams, or saxo-flute hybridity.

The book by Marcus Weiss[14] and Giorgio Netti[15], *The Techniques of Saxophone Playing* (2010), functions similarly to the aforementioned books with the authors providing practical, technical, and artistic knowledge on the performance and composition of extended techniques. Several pages are dedicated to SWMP practice and techniques, covering short synoptic information on air pitch, tongue rams, and trumpet sounds. Although the authors extensively studied and analyzed multiphonics and eighth-tones, the chapters mentioning SWMP are somewhat neglected in this regard. During my discussion with Weiss about this choice, it became evident that there was a deliberate emphasis on providing a comprehensive understanding of saxophone multiphonics; more thorough exploration of the derivations of extended techniques was envisioned for future examination by other authors and researchers. Nevertheless, the text has become a standard reference within the saxophone and composer communities who aim to adeptly execute and compose using contemporary techniques, particularly in the realm of multiphonic and microtonal playing.

[12] Jean-Marie Londeix is a French saxophonist and an early student of Marcel Mule. He has contributed a breadth of knowledge on saxophone repertoire, pedagogy, methodology, and playing techniques that has inspired over a generation of saxophonists. As the former saxophone professor at the Conservatoire de Bordeaux, he taught many students from all over the world. Londeix is known to be a champion of the contemporary saxophone repertoire. Many standard works have been composed for him, for example, *Sonate* by Edison Denisov and *Neuf Études* by Christian Lauba, among countless others.
[13] For further information about Marie-Bernadette Charrier please refer to her dedicated website: https://proximacentauri.fr/presentation/ensemble/marie-bernadette-charrier/.
[14] For more information on Marcus Weiss, please visit his website at https://marcusweiss.net.
[15] For more information on Giorgio Netti, please refer to his website at https://www.giorgionetti.com/.

Another noteworthy text has been provided by saxophonists Claude Delangle[16] and Jean-Denis Michat.[17] In their chapter on the contemporary saxophone, part of the larger *The Cambridge Companion to the Saxophone* (1998), Delangle and Michat present a historical overview for the contemporary saxophonist and explain diverse playing techniques. They specifically discuss two SWMP techniques, trumpet sounds and tongue rams. However, they did not aim for exhaustiveness in detailing other contemporary techniques; instead, they provide an overview of possibilities and describe a few works that employ such techniques. Although their relevance for my research is rather limited, it holds value by adding artistic weight to these techniques. This is largely attributed to the audience for whom the book was written. As a contribution to the Cambridge Companion series, which delves into the historical backgrounds of various instruments, the book caters to a broad audience. It provides insights into the historical significance, key performers, general parameters, technological advances, etc. of the saxophone since its inception.

Many other saxophonists have authored texts, manuals, treatises, and videos covering an ever-growing number of saxophone techniques, contributing their voices to discourse, pedagogy, practice, and understanding. Despite this, few if any other resources cover SWMP techniques. Kientzy, Londeix/Charrier, Weiss/Netti, and Delangle/Michat, have, in their own way, given prominence to SWMP techniques. Regardless of giving SWMP techniques historical significance by including them in their manuals and texts, the knowledge to hone and establish these techniques has yet to be given more thorough analysis and examination.

1.5 - An Historical Outlier: Saxo-Flute Hybridity

In the contextualization of SWMP techniques, saxo-flute hybridity stands out as the most novel, with limited resources available from other authors. This particular technique is almost entirely absent from the historical repertoire overview; however, it has gained legitimacy through the advocacy of both performers and composers. While it has a brief mention in *Saxologie*, it does not appear elsewhere in the literature. Nonetheless, it has found its way into newer works and improvisatory performance by several notable saxophonists, primarily Philippe Geiss[18], Rolf Erik-Nystrøm[19], and Ola Asdahl Rokkones.[20]

I first witnessed and heard this technique at the 2012 World Saxophone Congress in St. Andrews, Scotland, where Geiss performed one of his compositions featuring an improvised saxo-flute hybridity solo. Geiss is now recognized for incorporating this technique into his works as freely improvised solos over pre-composed material. While

[16] For more information on Claude Delangle, please visit his website at https://www.sax-delangle.com/.
[17] For more information on the work of Jean-Denis Michat, please refer to his website at https://www.jdmichat.com/.
[18] For more information on Philippe Geiss, please see his website at https://philippegeiss.com/.
[19] Rolf-Erik Nystrøm is a Norwegian saxophonist and composer specialized in the field of contemporary music. To hear an example of an improvisation by Nystrøm where he is exploiting saxo-flute hybridity please see the following link: https://youtu.be/eaHIMY_ZiwQ?si=pjCm7jnc8qX8hdHZ&t=173.
[20] Ola Asdahl Rokkones is a Norwegian saxophonist who actively bridges his artistic career between classical and jazz idioms. For more information, please visit Ola's personal website at https://www.olarokkones.no.

this technique echoes the parlor trick virtuoso stunts from the 1920s, this time by imitating a flute, several composers in recent years have now used it in their works. Examples include Stratis Minakakis' *For Felipe M.* (2021) and Eleni Ralli's *Go Within* (2020), among others.

1.6 - Innovation through Improvisation

Jazz and free improvising musicians have significantly contributed to the development of new techniques and sounds on the saxophone. Often, improvisers pioneer new techniques or playing styles that only become known and adopted by composers and classical saxophonists later on.[21] Weiss and Netti acknowledge improvisation as one of the two main contributions to the development of sound for modern saxophonists, with the other being the postwar avant-garde: "The desire on the part of the composer as well as the interpreter to expand the sound of the instrument can be […] found in free jazz [in the] revival of sonic experimentation as an integral component of performance" (Weiss and Netti 2010: 152).

SWMP techniques have also been present in the world of free improvisation for decades. It is here that highly differentiated, complex, and mixed techniques and many different forms of playing intersect. In other words, in free improvised music contemporary techniques are not used in complete separation. What makes this music so compelling is the level to which sonic and physical actions intersect and show the connections and condensed mixture between air pitch, tongue ram, saxo-flute hybridity, and trumpet sounds, next to other (extended) techniques.

Several well-known improvisers use SWMP in their performances; notable figures include Philippe Geiss, Marc Vilanova[22], Christine Abdelnour[23], Rolf Erik-Nystrøm, Joan Jordi Oliver[24], PedroSaxo[25], and Ben Eidson.[26] All of them, with the distinct exception of Abdelnour, have educational foundations in both classical and jazz saxophone playing. Through cross-disciplinary interest, these artists have embraced various SWMP techniques in their performance practice. Each of them integrates these techniques with common practice saxophone playing. PedroSaxo, known for his rhythmic driving improvisations, effectively utilizes trumpet sounds and air pitch. Geiss thoughtfully explores saxo-flute hybridity. Erik-Nystrøm most commonly exploits saxo-flute hybridity and trumpet sounds integrated in his solo and collaborative improvisations. Marc

[21] While I have been trained in experimental free improvisation, it is not my field of direct expertise. Instead, I have much more experience working with composers on interpreting their fixed works and notational signs. Therefore, this thesis explores the more conventional relationships between composers and performers as well as notated music. To do a complete and broad analysis of the advancements that have been made by my colleagues in the world of (free) improvisation would turn out to be a dissertation on its own.
[22] Discover more about Marc Vilanova and his use of SWMP at the following website: https://marcvilanova.com/Saxophone-Miniatures.
[23] Further information about Christine Abdelnour can be found at her website: https://christineabdelnoursehnaoui.com.
[24] For more information on Joan Jordi please visit his website at https://joanjordioliver.com/.
[25] PedroSaxo is a classically trained saxophonist who, after becoming a finalist in Spain's Got Talent, became an internet sensation. However, due to financial difficulty he has since retired from public performance. To hear some of his improvisations using SWMP, please refer to his YouTube channel. For example: https://youtu.be/8BxD_GMKLqY?si=bx5plliw8Iz2Hcer&t=20.
[26] To hear more of Ben Eidson's improvisations please visit his Linktree: https://linktr.ee/beneidson.

Vilanova and Joan Jordi Oliver tend to utilize air pitch and tongue ram techniques. Christine Abdelnour, coming from a more exploratory generative improvisational music culture, investigates air sounds, trumpet sounds, and saxo-flute hybridity usually with the addition of electronics or distortion patches. Composer and improviser, Ben Eidson, the youngest of these artists, uses air pitch, tongue rams, and trumpet sounds often in tandem with MaxMSP patches that he himself creates to distort and augment the listening experience for audiences.

Vilanova's *Saxophone Miniature II* (2015)[27] is a visually striking work presented with a closely microphoned soprano saxophone, lighting placed inside of the instrument, and a combination of key clicks and air pitch technique. The left stack of keys is completely closed by the left hand. The viewer can only see the right stack. The work begins with a quick key click opening the saxophone completely, followed immediately by a loud air sound. Each time Vilanova opens or closes the keys a different light source is seen accompanied by a different air pitch sound. This continually speeds up until Vilanova uses double tonguing and increases the pressure with which he is producing the air pitch sounds. This work evokes a distinct sense of distance from what is traditional thought of as the saxophone.

The intersection of my practice with that of Christine Abdelnour is rather close despite coming from different musical backgrounds. This is especially true in the innovative way we approach the instrument—as a tool for expressive sound potential. The similarity is most evident in how we both explore saxo-flute hybridity: a technique far removed from typical saxophone pedagogy, challenging to produce, and requiring immense effort to master. Abdelnour, especially in some of her solo improvisations, explores the evolution of sound through the gradual transformation of a specific SWMP technique. In her solo set recorded live in Paris in March 2023[28], she begins by using two different air pitch transformations. The neck position where she focuses her air creates a dramatic result especially when amplified. This is explored for two minutes before she starts to integrate flutter tongue with air pitch and trumpet sounds techniques. Around 4'11", she overblows the air pitches heard at the beginning of the improvisation creating saxo-flute hybridity sounds in a very high octave which are therefore difficult to control. While her embouchure position does not necessarily yield the best results when trying to create controlled pitches, it is interesting to try and reproduce. However, exploring the more pitched realm of SWMP allows her to transition to playing with the mouthpiece.

In Ben Eidson's *Solo Saxophone I* (2022)[29] both saxophone and SWMP are used to create a 57 minute improvisation. Starting around 4'45", Eidson takes off the mouthpiece and uses a series of air pitch, trumpet sounds, and vocal sounds to create a tapestry of

[27] Please click the following link to listen to Marc Vilanova's *Saxophone Miniature II* (2015): https://vimeo.com/142648120.
[28] Please click the following link to listen to Christine Abdelnour's solo set from 2023: https://youtu.be/zwxXfRkxiGE?si=vxkDi5jQMKqyQOP3.
[29] Please click the following link to listen to Ben Eidson's *Solo Saxophone I* (2022): https://on.soundcloud.com/iHNuXVRuWwUipNc69.

interweaved sonic complexity. Of particular interest is his use of harmonic sweeps with trumpet sounds, sometimes incorporating the barrissement technique and at other times allowing the trumpet sound to resonate with a full-bodied quality. Many times, the exhaling air pitch becomes a pseudo-trumpet sound by the position of Eidson's mouth being in the right place for a "shadowed" sound to escape. Eidson is also incorporating kissing sounds into the saxophone neck. Despite his use of SWMP for only about two minutes, his exploration of the techniques is incredibly rich.

1.7 - Composers and their Contributions

Throughout my research, I have identified over one-hundred pieces that incorporate SWMP techniques, and new works with these techniques are being composed continually. Some notable composers in this realm include Costin Miereanu, Robin Hoffmann, Helga Arias, Jean-Claude Risset, Vitor Rua, Ramon Lazkano, Robert Lemay, and Juan Arroyo. In my own research, commission, and performance endeavors, I have had the pleasure of working with Stratis Minakakis, Chaya Czernowin, Max Grafe, María Eugenia Luc, Nicolas Tzortzis, and Eleni Ralli, among others, on new works that incorporate these techniques. The fact that numerous composers wish to use them can count as proof that they enrich the musical world, have their legitimate place in contemporary music, and their importance in the saxophone world. While my survey may always be incomplete due to unknown or newly emerging works, the discovery of this many works utilizing these techniques stands as a testament to composers' curiosity in exploring new sonic landscapes.[30]

For a complete list of repertoire, please see the appendix entitled Repertoire.

1.8 - Performers and their Contributions

If composers and improvisers have contributed to the development and history of these techniques, so too have the many performers that take on these techniques. Besides the foundational figures in contemporary saxophone music (i.e. Kientzy, Londeix, Charrier, Jean-Michel Goury, Weiss, XASAX Quartet, etc.), there are other important saxophonists who commission and present new music using SWMP.

The first set of performers who have been prolific with their commissioning of new music is the Sigma Project Saxophone Quartet (Andrés Gomis, Josetxo Silguero, Ángel Soria, and Alberto Chaves). Sigma Project have taken a very keen interest in the development of repertoire from Spanish contemporary composers. Often the works that they commission and perform have integrated SWMP techniques in them. Uniquely, many of the commissions are high profile with financial backing from the Spanish Ministry of Culture, Ernst Von Siemens Music Foundation, and BBVA Foundation, among others.

[30] Whereas some composers use contemporary playing techniques like SWMP in a "shopping-list-like approach" where the artistic work is little more than the sum of the disparate techniques, I find it a part of my personal mission to see through any temptation to program or perform such works.

Other performers that should be mentioned and acknowledged for their contribution to SWMP techniques and development of the repertoire is the Canadian quartet, Quasar (Marie-Chantal Leclair, Matthieu Leclair, André Leroux, and Jean-Marc Bouchard), Philippe Geiss, Patrick Stadler, Claude Delangle, Kyle Hutchins, Ola Asdahl Rokkones, and Noa Even. Among a plethora of influences and cultural-historical backgrounds, it is their openness to try new things, the perseverance to never say no to a composer, or the eagerness to explore the boundaries of sound that have led these musicians to use SWMP techniques in their practice.

1.9 - Analyses of Two Major Works using Saxophone Without Mouthpiece

This section will focus on the analyses of key structural elements and motives of two works written for me using SWMP. I like to underscore the significance of such compositional elements in understanding and crafting the SWMP techniques. Furthermore, I provide concrete examples of the artistic application of these techniques, thereby offering a more relatable context for saxophonists and composers. While it is valuable to discuss these techniques within historical and theoretical contexts, it is equally crucial to understand them through a primarily musical and practical lens.

First, I will analyze the works and the SWMP techniques employed within them, highlighting their overall artistic depth. This will be achieved by integrating theoretical concepts discussed in previous sections and drawing parallels between these works and the ideas presented before. Secondly, from a more pragmatic perspective, I will demonstrate how the techniques function within these works and how they are intended to be interpreted by saxophonists. This part of the analysis will focus on exploring the use of notation. Finally, I will critically evaluate each composer's utilization of SWMP techniques, assessing what aspects were successful and identifying areas for potential improvement. Within each of the two analyses, I have provided examples from the score to further elaborate my points. Within the caption text of these excerpts, one will also find timestamps which refer to exactly when these specific moments can be heard. The videos that should be referenced for these excerpts can be found at the following links:

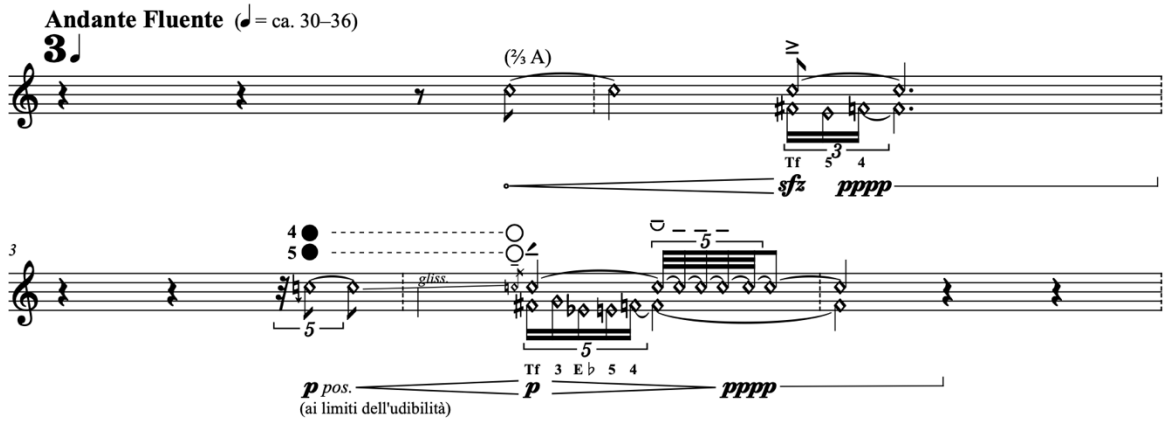
- *For Felipe M.* (2021) – Stratis Minakakis: https://youtu.be/LFlH1_ay-Ds
- *Go Within* (2020) – Eleni Ralli: https://youtu.be/GwaisJoHlbo

1.9.1 - *For Felipe M.* (2021) – Stratis Minakakis

For Felipe M. by Stratis Minakakis is a virtuosic and physically demanding composition for solo baritone saxophone. The complex and intricately notated piece is sectioned into nine movements, comprised of seven short verses and two longer stanzas, all of which flow uninterrupted from one movement to the next. The piece is written for both saxophone with and without mouthpiece; SWMP techniques only make their appearance in the final movement of this work. Minakakis is acutely aware of the dramatic and theatrical

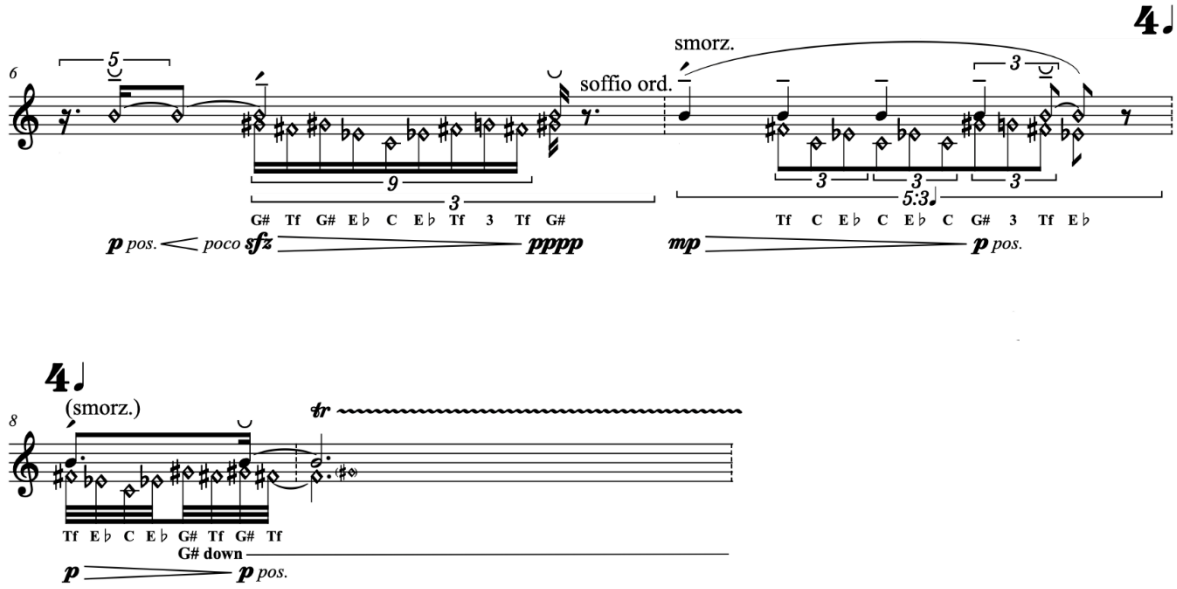
significance of removing the mouthpiece. Consequently, he incorporates this crucial moment as a pivotal element marking the culmination of the first stanza, the climax of the piece, and the transition to the second stanza. Before conducting a microscopic examination of the SWMP techniques employed, it is essential to first discuss the underlying musical content that Minakakis draws upon for the entirety of the work.

The backbone of *For Felipe M.*'s musical content is based around Minakakis' metaphorical formulation of four disparate sound gestures: "islands," "disappearing signals," "strings," and "negative space." These four terms serve to provide a striking mental image in which an audience is able to picture the sound world he is trying to convey. These four gestures constitute the core of the compositional world in which this piece resides. They are stated simply at the beginning of the work, each having their own space to be (subconsciously) remembered and evolving over the course of the nineteen-minute piece. Sometimes they collide and interact, evolve and influence each other. The work opens in silence offering the listener a moment to enter the listening space. Then the first gesture – "islands" – emerges from an "ocean of silence and end[s] in mist" (Minakakis 2021: 1).



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 1, 0:32-0:59

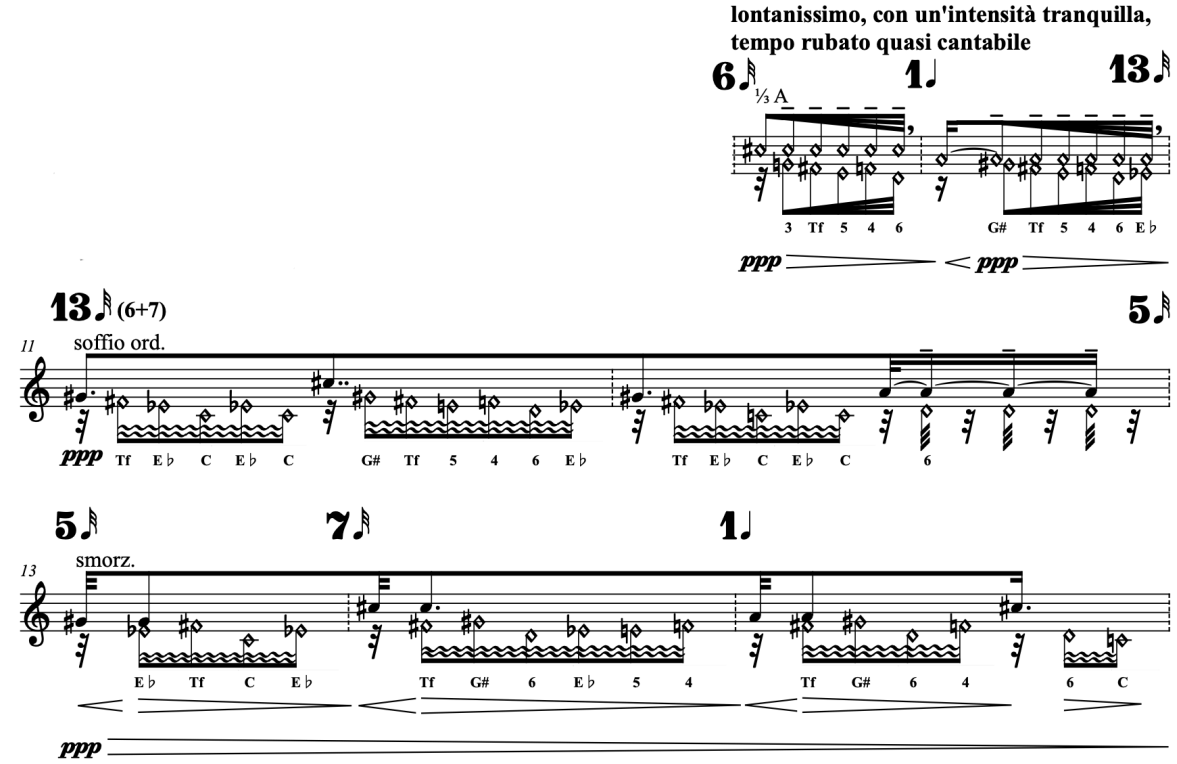
Remarkable here are the demand of specific air sounds to be mixed and presented with the body of conventional sounds as well as the nano-microtonal variations in pitch that serve as granular murmurs. The "disappearing signals" gesture propels itself out of the third silence of "islands" erupting as "signals that fade, like memories of beloved people, events, or places as time advances" (Minakakis 2021: 1).



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 1, 0:59-1:14

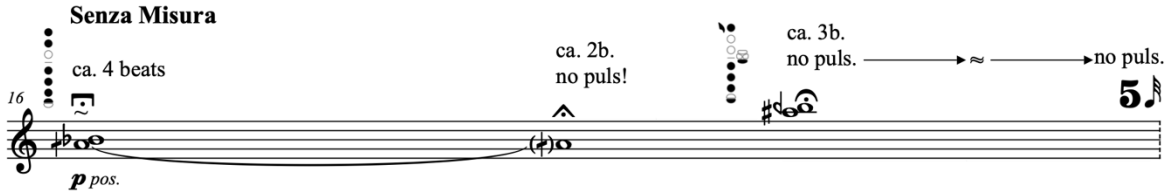
Three iterations of this signal are asked, each one becoming weaker and weaker. The first marked with the *sfz*, the second, with a stark contrast to *mp*, and the third to *p* as if they should be heard as moving figures passing in front of the listener but quickly erased from their ear.

The third gesture, "strings" introduces "a hidden melody behind a string of nano-microtonal oscillations" (Minakakis 2021:1) They are "fragile and unstable, as if sung under-breath" (Minakakis 2021: 1).



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 1, 1:15-1:30

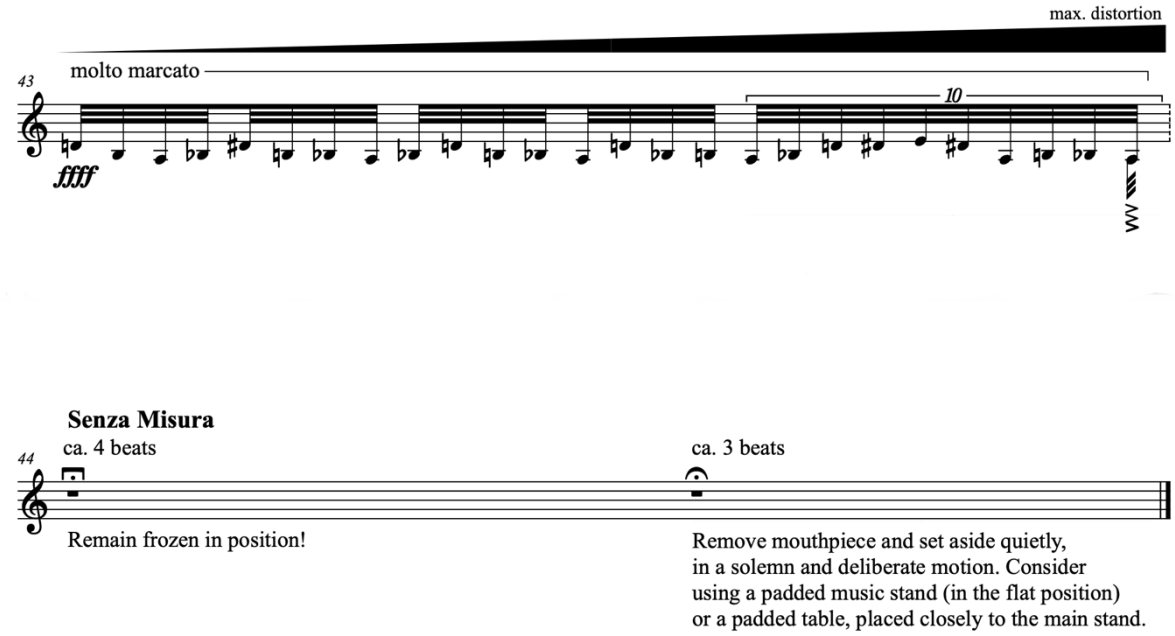
This gesture is deliberately imperfect, resembling tunes sung by an untrained individual, perhaps muttered softly while engaged in fieldwork. Despite their melodic simplicity—comprising a basic sequence of notes, C#-A/G#-C#-G#-A/G#-C#-A-C#—the required nano-microtonal fingerings infuse the music with an energetic pulse and a sense of unease, as the pitch center is in a state of near-constant flux. "Strings," repeated thrice, leads to the final gesture, "negative space." Minakakis describes this fourth gesture as "like a 'colored silence;' a place of stasis to create enough space for memory to be evoked" (Minakakis 2021: 2).



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 2, 1:31-1:55

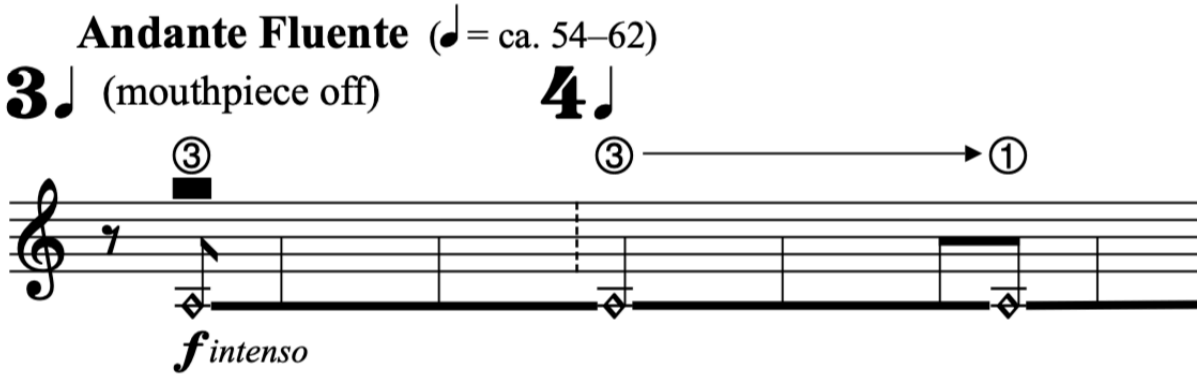
The richly harmonic sounds of the multiphonics that occupy the fourth gesture create a sonic texture which provide an almost ancillary world as compared to the three preceding gestures. In these multiphonics disparate breath oscillations provide a sense, or lack thereof, of movement.

Having established the formal structural components of *For Felipe M.*, the final movement, Stanza II, can be understood through the lens of these four gestures. It is a shadow world of the music that had come before it, and comments on and fleshes out the musical discourse that was set by Minakakis in the preceding eight movements. Whereas the first stanza ends with a moment of intense drama – with the final thunderous roar of the baritone saxophone performing in its lowest range and asked to shade the sound with "max distortion" by overblowing with the addition of growl (Minakakis 2021: 12) – the second stanza exists in a wholly different yet entirely dramatic sound universe.



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 12-13, 13:50-14:20

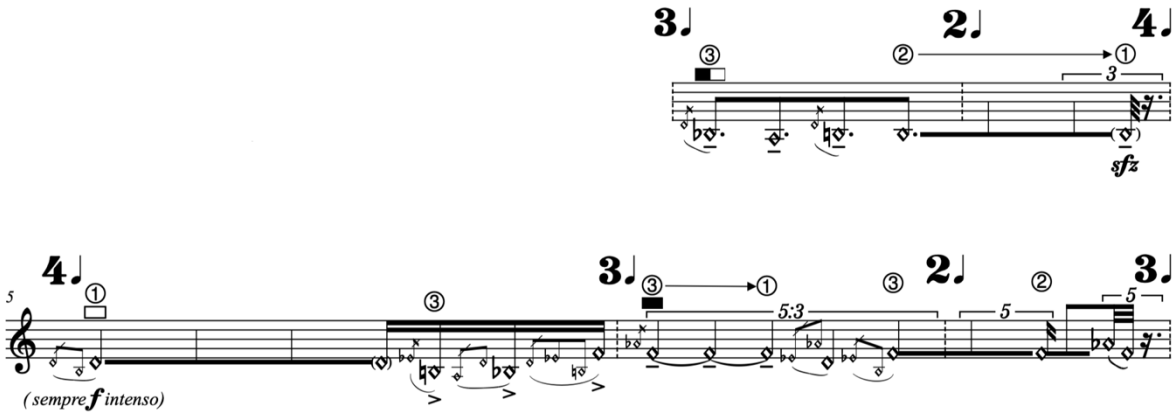
Immediately after the end of Stanza I, Minakakis has composed a silence of around four beats where he demands the performer to "remain frozen in position" (Minakakis 2021: 13). The treatment of this silence should act as an integral element of the dramaturgy of the work. This silence is broken by the sudden movement of the removal of the mouthpiece. Minakakis writes in his score: "Remove mouthpiece and set aside quietly, in a solemn and deliberate motion" (Minakakis 2021: 13). This moment is vital as the silence in the hall will be deafening after the wash of sound that came before, all eyes are on the saxophonist as they do something rather strange. In performances that I have given, many audience members comment that it is as if they experience a strange but alluring ritual. With the mouthpiece set aside, the final stanza opens and cuts the deafening silence with an explosive air pitch, marked *f intenso*.



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 13, 14:20-14:25

The first air pitch is characteristic of the "negative space" gesture. It is stagnant and intense, a shadow of the harmonically rich multiphonics that characterized this gesture in the earlier movements. It eventually oscillates through the change in distance from the

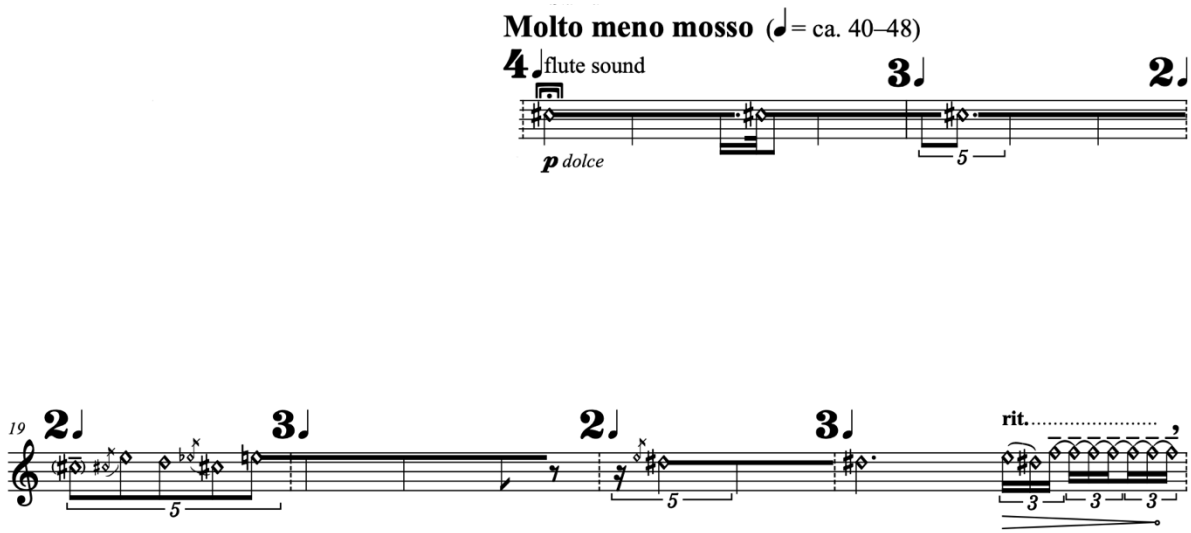
neckpiece. The memory of the subtle energy created by this texture shift is reminiscent of the fourth gesture. Almost by an energetic propulsion the next gesture is introduced in the shadow world of this stanza, the third gesture – "strings" – exists in the melodic air pitch sounds starting from the third measure.



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 13, 14:26-14:38

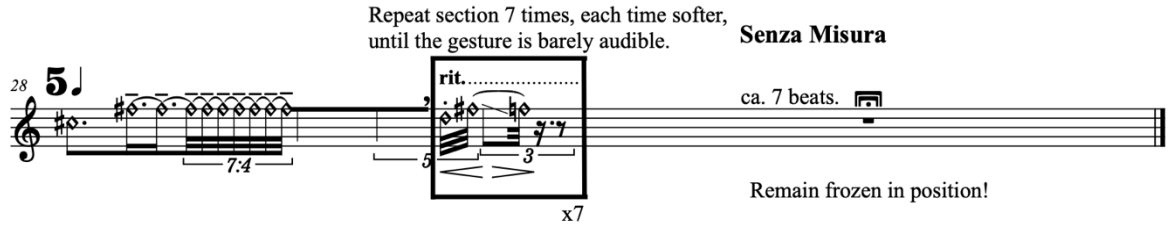
While Minakakis does ask the saxophonist to change the density of the sound, indicated by the shaded rectangles in the score, producing some interesting sonic effects, the "strings" gesture exists in the melody. The need for nano-microtonal fingerings has diminished, as the air pitch technique produces a muffled, subdued sound compared to conventional playing. These two gestures – "strings" and "negative space" – weave themselves into the interplay that make up the entire first part of Stanza II.

The second part of Stanza II introduces itself with a new sonic world made up of saxo-flute hybridity. The air pitches of the first part of the movement have now become fully-fledged. They have replaced the texture of density and shading by way of a distance to the neckpiece with a more conventional sound. The flute sounds reiterate the fourth and third gesture, "negative space" and "strings," respectively, in the first phrase. Only at the end of this first phrase is the second gesture, "disappearing signals," reiterated through the SWMP portion of the work. The "disappearing signals" can be heard in the repeated notes marked with tenuti over the top of them.



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 14, 15:09-15:38

Minakakis does not need the nano-microtonal variations in the shadow version due to the otherness of the sound achieved through SWMP techniques. Each of the three phrases end with the "disappearing signals" gesture leading to the final coda. This coda reiterates the first gesture, "islands."



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 14, 16:07-17:07

Minakakis asks the saxophonist to repeat this "section 7 times, each time softer, until the gesture is barely audible" (Minakakis 2021: 14). After the seventh repetition, the saxophonist is instructed to again freeze in place and reimagine the silence that opened the work.

Minakakis' use of SWMP techniques is intuitive and serious. Without these techniques the work would lose a crucial dramatic element. Often these techniques can take on an aesthetic position of being a gimmick or a fun trick incorporated into a much more interesting fabric of conventional techniques. However, in Minakakis' work, SWMP techniques are given artistically serious consideration and function to mirror the compositional and structural elements heard in the piece just before. In working with Minakakis on techniques for an earlier collaboration resulting in the work, *Thalassografia A* (2019), written for my saxophone quartet, he was already keen on exploiting the artistic nuances achievable through SWMP techniques. Using the collaboration we initiated through this first work, Minakakis expanded his sonic ideas in the solo piece composed a few years later. I worked closely with him, sending him recordings of what was possible

and expanding on the limits of the techniques at the time. Minakakis was particularly eager to use the saxo-flute hybridity and integrate it in an altogether surprising way in the piece. At the time, I was only beginning to understand the full possibilities of the saxo-flute hybridity technique on baritone saxophone. This is why the range Minakakis took advantage of is so limited. Back then, I was only able to produce the primary octave with this technique.

In terms of the notation practices utilized, Minakakis is consistent and relatively clear throughout the work. He uses similar signs and symbols to express air sounds regardless of whether the mouthpiece is attached. This consistency between similar sound groups makes learning the score easier. However, the noteheads that Minakakis uses for the three SWMP techniques in this work could be better distinguished from one another, especially when comparing air pitch and saxo-flute hybridity. I will elaborate on notation of SWMP techniques in Chapter 6.

1.9.2 - *Go Within* (2020) – Eleni Ralli

The next work that I will examine is by Greek-born and Swiss-based composer, Eleni Ralli. Ralli's recent compositional and research work explores the idea of embedded, yet removable, hardware within instruments. *Go Within* is a work that was written on my request and explores several themes that surround the work of poet Rainer Maria Rilke. Taking the concept and text of his *Letters to a Young Poet* (1929)[31], Ralli composed a work that acts as a duo within a solo piece. Composed for tenor SWMP and embedded speaker, the score demands the saxophonist first to record the saxophone with mouthpiece part. The speaker itself is placed in the bell of the saxophone.

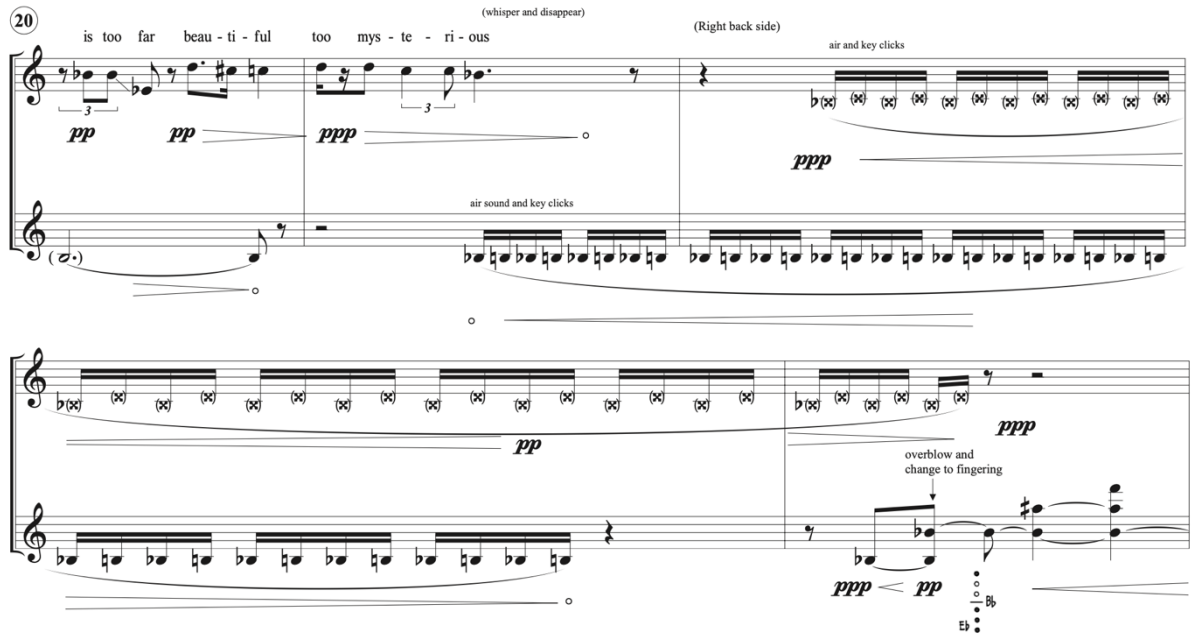
> A portable, removable loudspeaker should be securely embedded in the bell of the saxophone. It should not be noticeably visible to the audience to create the illusion that the pre-recorded sounds are coming from the live saxophone. It should be easy enough to remove so that a dramaturgy is create with its removal at the final section of the work. (Ralli 2020: 1)

The pre-recorded part mirrors the live part, creating the illusion that the saxophonist is performing with themselves on stage. The live part is composed of only SWMP techniques. Innovative in their usage and very demanding of the player, Ralli exploits all SWMP techniques and even aims at exploring some auxiliary techniques such as megaphone properties when demanding the saxophonist speak or intone through the instrument.[32]

[31] The original was published in 1929 under its original German title *Briefe an einen jungen Dichter*. The translation that Ralli used was made by Joan M. Burnham. This translation was published in 2000.
[32] The audience may find themselves questioning the source of the sound and how the saxophonist executes such techniques, as they hear both the pre-recorded common practice saxophone sound and the live performance. This contrast creates an opportunity for the saxophonist to engage directly with the audience on the fundamental concept of the work.

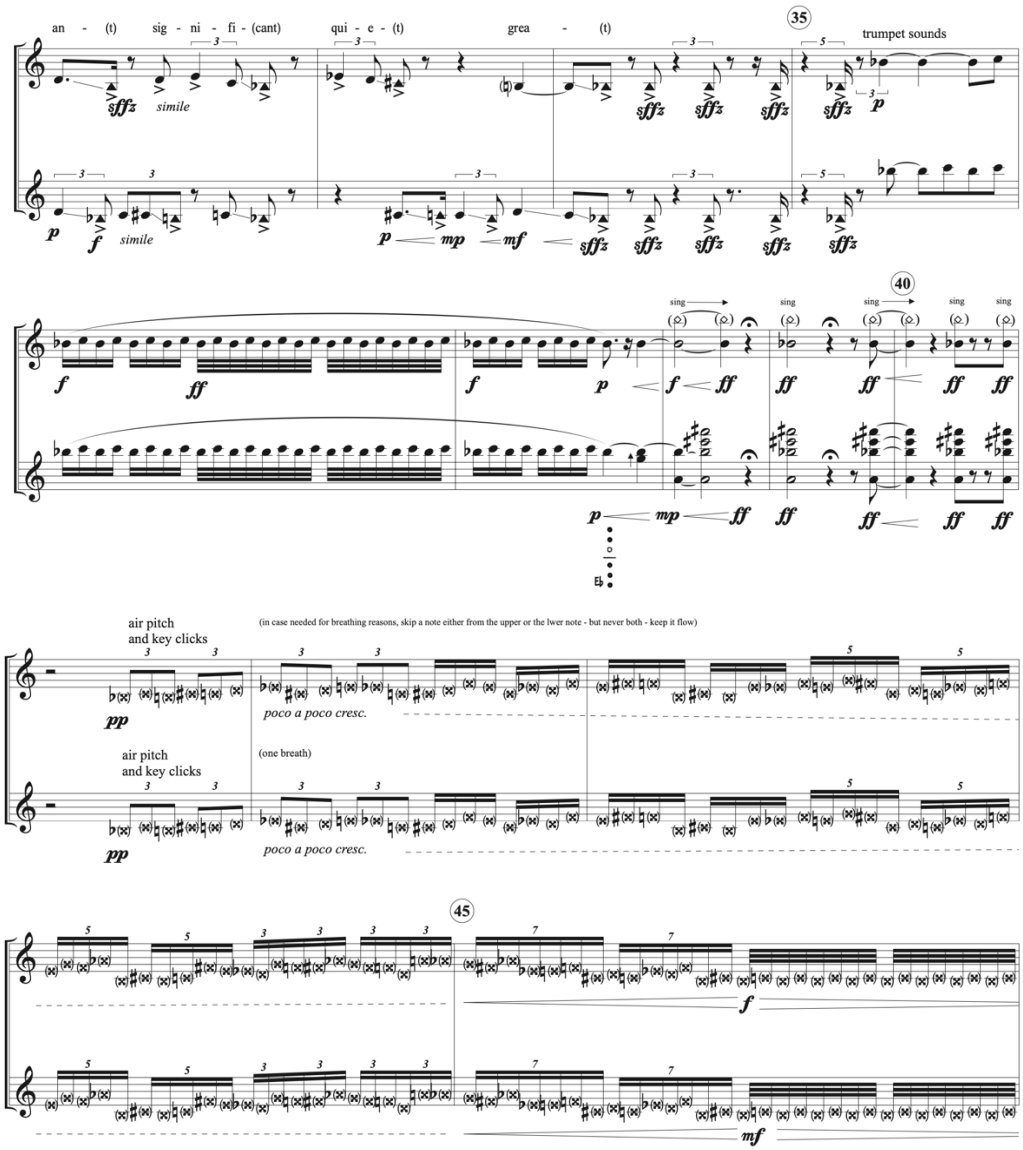
Each of the four sections of *Go Within* starts with a sounding low long tone on the pre-recorded saxophone line with the B♭ pitch (fingered, not sounding). In the beginning, the saxophonist is off stage, starting the pre-recorded track and waiting for this low B♭ to sound; then, they slowly walk to the center of the stage with the saxophone in their mouth, although not yet creating live sounds. The live performer then introduces various techniques which will develop further throughout the work: key clicks, megaphone properties (speaking through the instrument in a pseudo-vocal fashion), air pitch mixed with deliberate key clicks, tongue rams, and actual singing without the instrument.

In the second and third section, Ralli adds more and more unison figures between the recorded and the live parts, creating a sense of mimicry between the two voices. For example, in the second section, measures 21 to 23 (see below), if performed correctly, the audience should not know which voice is which.



Eleni Ralli's *Go Within* for saxophone (2020), p. 3-4, 1:38-1:58

Similarly, in the third section, measures 34 to 46 (see below), the almost complete rhythmic unison (with one disparity on the second beat of measure 35) should give the audience the sense that there is only one person/entity creating these sounds.



Eleni Ralli's *Go Within* for saxophone (2020), p. 6-7, 2:29-3:28

The second section ends with the introduction of trumpet sounds which creates a bridge to the third section. Ralli introduces a quasi-cadenza (which must be timed perfectly with the pre-recorded part) to start the third section. The jagged and precise articulations of the trumpet sounds demanded here contrast with the almost lyrical melodies Ralli created in the first two sections.

In the final section the saxophonist must remove the loudspeaker, disillusioning the audience to the shadow voice that has been performing with them throughout the first three sections. This section begins with the succession of four different statements played on the SWMP. The first starts with megaphone properties connected with tongue rams; then air pitches; the next features trumpet sounds; and, finally, the saxo-flute hybridity technique. This final statement is extremely difficult to perform but also hauntingly effective. The connection between the two voices, sometimes at odds and sometimes in perfect unison, has now evolved into melodic figures without the purposefully garbled

sounds of the megaphone properties, the airy and ghostly sound of the air pitch, or the rough and coarse sound of trumpet sounds. The saxo-flute hybridity sounds continue for a long while in a quasi-cadenza and marked molto rubato section. Metaphorically, it could be stated that the saxophonist no longer needs the aid of the common practice saxophone and has fully accepted the SWMP techniques. The work ends as the saxophonist walks off the stage performing three last and final tongue rams.

Ralli is very clear concerning notation. Slight confusion can be possible between the key click and air pitch parts since they are similar; however, Ralli wanted to show that while the saxophonist is performing the air pitch techniques, they need to press harder on the keys to create audible key clicks as well. For this reason, she chose similar markings. For trumpet sounds and saxo-flute hybridity, Ralli decided to notate these normally but advises the saxophonist to the technique in text above the notes. This notational choice would be clear to any performer.

1.10 - Summary

SWMP practice and techniques can be connected to various contexts. Historically, numerous indicators suggest the emergence of extended techniques to enhance the sonic capabilities of the saxophone. Vaudeville and dance band musicians significantly contributed to pioneering innovations that are now integral to contemporary repertoires. Examining SWMP within aesthetic contexts and movements, such as those presented by Russolo and Varèse, elucidates the origins of musical and instrumental advancements. These movements ultimately laid the groundwork for virtuosic performers to continually push the boundaries, as evidenced by the development of technique guides for extended practices on the saxophone.

Expanding the aesthetic framework further, the physicality of SWMP can be related to *musique concrète instrumentale*, where the process of creating an action is paramount to the sounding results. The innovations from composers who strive to explore new sonic territories and challenge the limitations of performers are crucial in this context. Performers and improvisers, motivated by a desire to deepen their understanding of the saxophone's potential, also advocate for these novel sounds and techniques. In short, a dynamic interaction between composer and performer proved essential for the evolution and future of these techniques.

The subsequent chapters will scrutinize the four SWMP techniques in detail. A comprehensive review of the literature on each technique will be provided, along with thorough explanations of their performance methods. By analyzing recordings of each possible note, these chapters will offer a fresh and detailed perspective on SWMP techniques and their sonic outcomes.

Chapter 2
Air Pitch

2.1 - Description of Technique - https://youtu.be/Ll2O2s8LrSU

Air Pitch is a technique where air is blown through the neckpiece of the saxophone and resultant pitches are produced. [Performs an improvisation using the air pitch technique]. Pitch is affected by the fingerings. Timbre and sound quality are affected by the position of the mouth and the pressure of the air. Since the air is inherent in the timbre of the sound, a purely pitch-based result is impossible; in other words, there will always be an airy timbre to the sound. However, by changing positions of the mouth – for example blowing from the right or left, from above, from below, straight on, or enclosing the neckpiece around the lips, etc. [demonstrates all sounds] – a resultant timbral shift can become apparent. Air pressure affects the balance between air and pitched sound.

2.2 - Technical Parameters - https://youtu.be/FT2w-ZGOdPs

Transposition:
As with all SWMP techniques, a standard and all-encompassing transposition is impossible to deduce for each saxophone. However, below this main video you will find a transposition chart for each saxophone – soprano, alto, tenor, and baritone.

Range:
The use of the octave key has no bearing on the sound of the air pitch; therefore this technique has a rather limited range. Mainly speaking, the range starts from B♭3 (or A3 on baritone) and chromatically extends to C#5. [Demonstrates range]. Then by bypassing the normal fingerings from D5 to F#5 (G5 on soprano) and instead using the C1-C5 (or C6) side keys, we can further extend the range by five half steps (six on soprano) [Demonstrates range]. So then the full range would be: [plays full range].

Discussion:
Air pitch has been described by Daniel Kientzy (2007) as *Flûtage* due to the windy temperament of the sound. In describing the air pitch technique, he says that it is "the most efficient [means] in which it is possible to produce a melodic 'air' sound on the saxophone" (Kientzy 2007: 453).[33] He goes on to argue that although the technique is suited for melodic situations, it produces a rather weak sound result (Kientzy 2007: 453-4). The reason he explains that air pitch produces a weak sound is because of the balance between air and pitch that is produced by the aforementioned pressure of air. Saxophonists and composers should be wary of this balance issue.

The air pitch technique is effective on all saxophones. Kientzy mistakenly makes the assessment that the acoustic rendering is relatively weak for the tenor, baritone, and bass saxophones (Kientzy 2007: 453). While the larger bodies of these saxophones make it difficult, in any case, to blow through the instrument, the effective acoustic rendering of

[33] Translations from French by Don-Paul Kahl.

pitch is not weak. In fact, with a proper balance of air pressure, the sound is more present than with the smaller saxophones.

2.3 - Performance and Practice - https://youtu.be/4ocuBggJFgg

The mouth and lips should remain in a relaxed and natural position depending on the vowel or consonant shape that is asked. Kientzy describes the lip shape as if one were blowing out a flame (Kientzy 2007: 453). This is an excellent way to think about the air pitch technique; however, one should not be limited to the pressure that this imagery represents. The lips and subsequent air pressure variations can function as a sound distorter as well as a pitch creator. By subtly changing the pressure of the air, the balance of airy sound versus the amount of pitch can change drastically. Developing the technique even further, one must develop flexibility in the lips in order to be able to create disparate sounds and timbres.

Changing Vowel and Consonant Colors:
It is important to become fluent in changing the shape of the mouth in various vowel or consonant colors while performing the air pitch technique. While a "pure" air pitch sound – meaning one without any specified vowel or consonant shape – is often asked, other times a specific mouth shape is demanded. For a pure air pitch technique, the performer should keep a relaxed yet consistent vowel shape to the lips, adjusting the pressure according to the dynamic. With textural changes such as morphing the vowel shape from "ahhh" to "ohhh" to the consonant "ffff," for example, one should exaggerate the evolution between these various vowel and consonant shapes to best produce a distinguishable listening experience while also respecting the dynamic contour and rhythm demanded by the composer. I will slowly demonstrate this change for you. [Demonstrates]. I will demonstrate that change a little bit faster now. [Demonstrates].

Exhalations vs. Inhalation:
While most manuals on saxophone technique discuss the difference between inhaling and exhaling air sounds, without the mouthpiece the distinction is not as evident. Mostly all air pitch sounds are produced with exhalation. Only when the lips are enclosed around the neckpiece can a proper inhalation sound occur. The sonic result is, however, close to the sound when exhaling. What changes, especially when a lot of pressure is used, is the timbral result. [Demonstrates].

Dynamic Range:
The balance between the airy sound and resultant pitch is crucial for effectively producing air pitch techniques. A relatively large dynamic range is possible. Without any amplification, the technique can be performed from *niente* attacks to *f*, *ff* or even louder. However, this dynamic scaling is relative to the technique and should not be considered equivalent to common practice saxophone playing.

Articulation:
Single Tongue:
Articulation variance is also possible. Tonguing must be adapted from traditional forms of playing. However, the tongue should avoid touching the neckpiece itself - this will create a pseudo tongue ram. The tongue should approach the articulation in much the same way that one produces the consonant shapes and attacks without the saxophone, for example "Too Too Too Too," or "P P P P," "F F F F," or "Kah Kah Kah Kah." [Demonstrates sounds].

Double Tonguing:
Double tonguing is also possible and easily achieved in comparison to traditional playing techniques since there is an absence of resistance created by the mouthpiece. Here again, a composer can demand many different consonant variations. Here I will demonstrate the "Too Koo Too Koo" and "Duh Guh Duh Guh" attacks. [Demonstrates].

Flutter Tongue:
As an additional articulation structure, the flutter tongue technique is effective here as well, and does not pose problems either for the front rolling or back rolling "r" sounds. The intensity of the flutter tongue will also affect the air pressure balance. For this reason, for softer sections in which pitch must be present, it is best to employ the back rolling "r" instead of the front rolling one. The back rolling "r" possesses a less effective sound. I will demonstrate both of these now. [Demonstrates].

2.4 - Personal Development - https://youtu.be/qqtOB-CyqNI

A saxophonist might find it easiest to start their learning process of the air pitch technique by exploring each pitch of the saxophone as a long tone. This will also allow for adjustments to the limited resistance without the mouthpiece. I would personally start by using a neutral vowel and playing four long tones on the lowest note and working my way upward, chromatically exploring the sound and gaining familiarity with the "newness." Here I will demonstrate this for you. [Demonstrates].
Afterwards, start to integrate more rapid passages, again starting on neutral vowels. [Demonstrates].
From here, it is good to start becoming familiar with different articulations. Start with "K K K K" transforming to "Kuh Kuh Kuh Kuh" transforming to "Koo Koo Koo Koo," for example. [Demonstrates].
It would then be quite natural to integrate double tongue as well. First start on one pitch and then integrate more rapid passages. [Demonstrates].

Some of my best and most illuminating practice sessions on this technique, and SWMP in general, have an element of self-discovery. Additionally, working with composers have also led to enlightening discoveries. For example, when working with Stratis Minakakis on his *For Felipe M.* (2021), he wanted the air pitch to have more texture and density in the sound quality in addition to the dynamic volume demanded. I began exploring and

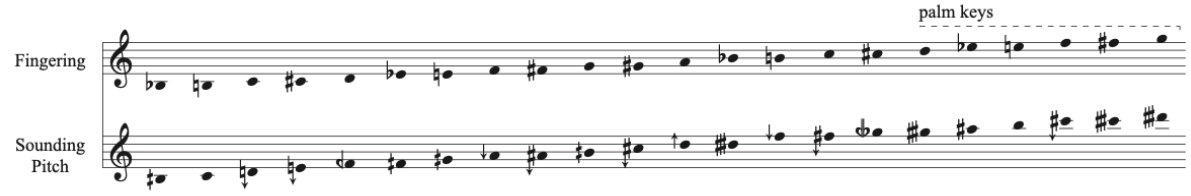
demonstrating for him new consonant and vowel combinations until we found, together, the texture that we were both happy with. The following is a video excerpt from a live performance of this section of Minakakis' work. [Video excerpt plays]. In any case, develop your own method for yourself or your students depending upon your or their needs.

2.5 - Pedagogy - https://youtu.be/KbysMNsZ0Wg

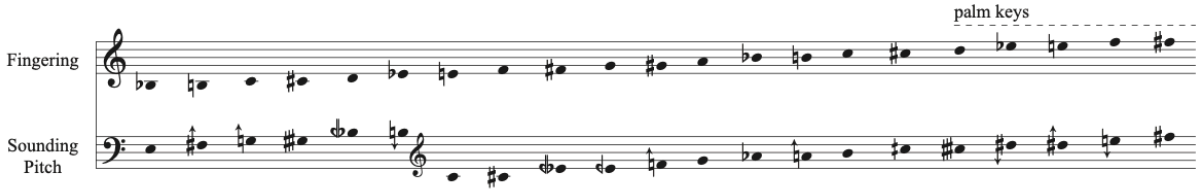
If necessary, adjust the neckstrap to the proper height so that the neckpiece is aligned with the mouth. [Demonstrates]. Prepare the desired fingering. [Demonstrates]. Prepare the desired distance from the neckpiece. [Demonstrates]. Breathe in. [Demonstrates]. Upon exhale, form the vowel or consonant shape desired with the mouth and then exhale into the saxophone producing the air pitch technique. [Demonstrates].

2.6 - Transposition Charts

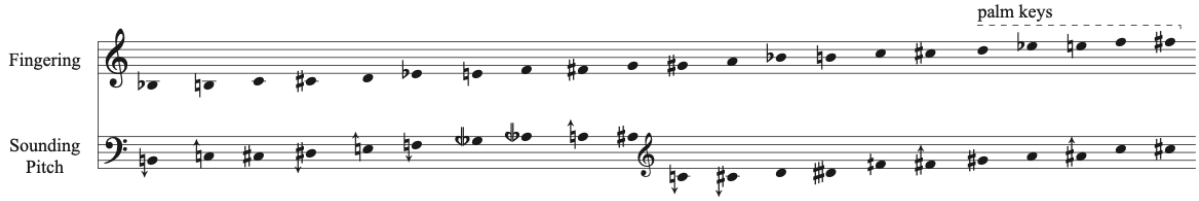
Soprano Saxophone



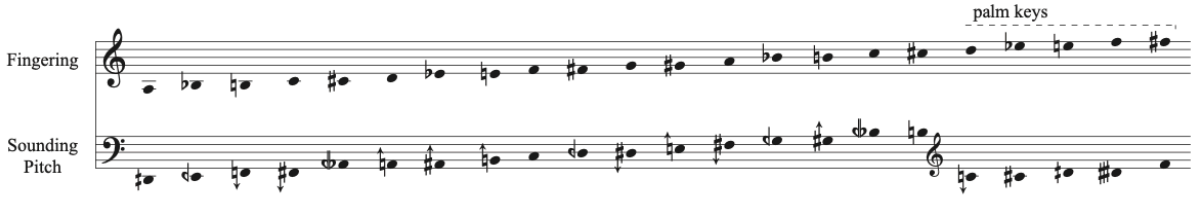
Alto Saxophone



Tenor Saxophone



Baritone Saxophone



2.7 - Demonstration Videos for Air Pitch

Below, I will demonstrate the air pitch technique on all four main saxophones, show various transitions with the other SWMP techniques, and perform combinations with singing and common practicing saxophone playing. Each video is accompanied by a brief text for further elaboration.

Chromatic Scale Played on Soprano, Alto, Tenor, and Baritone Saxophones:
https://youtu.be/a6LKQjOwlPk
Here I demonstrate the air pitch technique on all four main saxophones using a neutral vowel with a basic and simple articulation. Please notice a rather even balance between pitch and the air sound.

Vowel and Consonant Color Combinations:
https://youtu.be/fPqwClWW6zQ
Many vowel and consonant combinations can be imagined resulting in various colors and textures. The saxophonist takes on the role of an actor or a singer by being asked to produce different textual elements through the saxophone. Proper pronunciation should be practiced away from the saxophone and then slowly integrated into practice with the instrument. Proper pronunciation and diction can be learned from and referenced by the International Phonetic Alphabet (IPA) to avoid confusion.[34] The speed of transitions between various vowel and consonant combinations is beholden to how fast a saxophonist can produce them.

Playing Positions:
https://youtu.be/CiPOSM2w7So
Altering the playing position to which one is asked to blow through the saxophone can result in different color and dynamic shadings that cannot be achieved otherwise. Changing the position of the instrument from one point to another (from the left to the right, for example) allows for an evolution of the sound through movement - effective in the sounding result and as a means of musical theater. However, unless otherwise noted, one should assume a normal “straight on” approach when performing the air pitch technique. The speed at which a transition occurs can be quite fast. Saxophonists should take caution in avoiding hitting their mouth, lips, or teeth when transitioning between playing positions.

The air pitch playing position should be considered when switching between or in combination with other techniques.

[34] A future elaboration of this research could involve the recording and cataloguing of different IPA pronunciations in order to hear and analyze the timbral shifts present from one phonetic pronunciation to the next. I was unable to explore this properly during this research project due to time constraints in the recording studio, but it is a gap that should be filled in the future.

Articulations:
https://youtu.be/WkHXFi4w5fE
Articulation variance is an important facet of the complex sound world that can be created with air pitch. While many combinations are possible, three basic approaches are presented in the video: single tonguing, double tonguing, and flutter tonguing. All approaches can be used in combination with each other. Many times, the tempo, rhythm, and vowel and consonant shapes demanded by a composer will force a saxophonist to use single or double tonguing. Speed of articulation is dependent on the technique of the saxophonist and the precise fingering combinations that are asked.

Flutter tonguing might pose a problem for some saxophonists depending on if they are physically able to perform the alveolar trill, more commonly known as a rolling "R."[35] There are two main areas in which the flutter tongue takes place: either in the back or the front of the oral cavity. The front "R" is commonly referred to as the "Spanish R" and is a harder, more pronounced attack. It is my preferred way to produce the flutter tongue ability with air pitch. The back "R" is commonly referred to as the "French R" and produces a softer sound with a rather weak sounding result. It is suited for more delicate passages or where amplification is present.

Air Pitch in Combination with other SWMP Techniques:
Air Pitch to Saxo-Flute Hybridity:
https://youtu.be/AVEZi7Yk8k4
Combining air pitch with saxo-flute hybridity is quite logical. One can interpret the air pitch technique as a precursor to saxo-flute hybridity. The pitched sound from air pitch is a "shadow" of the resultant fully-fledged sound present in saxo-flute hybridity. Here it is best to use an air pitch from a playing position that favors the saxo-flute hybridity technique depending on how fast the transition must be made.

Air Pitch to Tongue Rams:
https://youtu.be/fI4G1KKoTrk
Tongue rams are easily combined with the air pitch technique. Composers should note the pitch difference between an identical fingering using tongue ram and air pitch techniques. Transition speed between these techniques can be quite fast; however, the tongue ram will momentarily stop the flow of air. This means that a slight pause will occur after the tongue ram to allow the tongue to retract back from the neckpiece before other musical material can be performed.

Air Pitch to Trumpet Sounds:
https://youtu.be/7fcl2KDud0E
Trumpet sounds are rather easily combined with air pitch. Although a similar fingering can be used, the resultant pitches between the two techniques will vary. Composers

[35] For more information on developing an alveolar trill and the physical technique that should take place to make one, see Cheryl Lu (2019).

should indicate the saxophonist to perform the air pitch technique with a “straight on” playing position when they wish to combine it with trumpet sounds. There is an inherent dynamic inconsistency between these two techniques that must either be overcome by the saxophonist with dynamic scaling or taken advantage of by a composer. The speed of transition can be quite fast depending on the distance between the neckpiece and the saxophonist's mouth while performing the air pitch technique. In this way, the two techniques can be performed with a seamless transition.

In combination with other techniques:
Air Pitch and Singing:
https://youtu.be/TALjVDslbtk
Performing air pitch techniques while singing is possible and can be used to produce harmonies through the instrument, air pitch having one role and singing another. The two voices can be performed independently from each other in two-part counterpoint. The singing is produced from the back of the throat, much in the same way that one produces a growl on the instrument. The dynamic balance is something to take into consideration. The air pitch will naturally have a weaker dynamic than the voice. The speed of transition between the two can occur seamlessly. Composers should take note of the voice type of the performer and allow for the singing to be produced in a different octave depending on their individual comfort and tessitura.

Air Pitch to Normal Playing:
https://youtu.be/UBhJuvCIMFQ
Combining any of the SWMP techniques with common practice playing with the mouthpiece attached is possible. However, there are a few important factors that should be noted. The first is the transition time required to put the mouthpiece back on the saxophone. Allow the saxophonist around 5-10 seconds to pick up their mouthpiece, properly place it on the saxophone, potentially adjust the neckstrap, and finally prepare to play with the mouthpiece again. This delay can be used to create a sense of musical drama through silence or a theatrical gesture by taking off or placing back the mouthpiece. Alternatively, a composer can use a transition based on different musical materials and techniques. For example, while the saxophonist replaces or removes the mouthpiece, they could be instructed to sing, speak text, create different air sounds, or create key clicks with the saxophone.

The second factor is the possibility that the mouthpiece will make a sound as it rubs against the cork of the neckpiece. If this is a problem, it may be solved with the use of cork grease before performing the piece, although this is not a foolproof solution. However, it could also be a moment where a composer uses that sound as part of the work.

A third potential factor is the tuning of the instrument after placing the mouthpiece back on. This is typically not a major problem, as a practicing saxophonist will intuitively know where to place their mouthpiece to play in tune. If it is necessary to have the saxophonist

play perfectly in tune, composers should make sure to insert a bespoke moment in the piece where the performer can retune.

2.8 - Pitch Manual for Air Pitch

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**Std Dev (Hz)**	**Musical Notation**
A#3 / B♭3	255.95	254.347	256.79	254.45	**255.38425**	1.19	**C4 minus 42 cents**
B3	263.9	266.47	261.6	259.22	**262.7975**	3.11	**C4 plus 8 cents**
C4	288.4	287.84	296.86	288.21	**290.3275**	4.36	**D4 minus 20 cents**
C#4 / D♭4	323.32	326.76	326.9	326.14	**325.78**	1.67	**E4 minus 20 cents**
D4	348	338.22	330.04	345.31	**340.3925**	8.04	**F4 minus 44 cents**
D#4 / E♭4	355.59	358.52	357.04	357.95	**357.275**	1.28	**F4 plus 39 cents**
E4	388.46	401.98	404.39	400.44	**398.8175**	7.09	**G4 plus 30 cents**
F4	432.61	433.08	432.07	433.47	**432.8075**	0.60	**A4 minus 29 cents**
F#4 / G♭4	458.41	457.42	458.64	461.97	**459.11**	1.98	**A#4 minus 26 cents**
G4	501.38	503.65	508.82	503.67	**504.38**	3.15	**B4 plus 36 cents**
G#4 / A♭4	555.67	547.41	534.45	543.24	**545.1925**	8.83	**C#5 minus 29 cents**
A4	583.11	593.51	597.32	601.65	**593.8975**	7.92	**D5 plus 19 cents**
A#4 / B♭4	641.94	640.94	635.21	640.46	**639.6375**	3.02	**D#5 plus 48 cents**
B4	684.08	693.18	683.77	685.49	**686.63**	4.43	**F5 minus 30 cents**
C5	738.45	727.86	746.1	700.19	**728.15**	20.08	**F#5 minus 28 cents**
C#5 / D♭5	811.58	817.63	813.01	815.47	**814.4225**	2.67	**G#5 minus 34 cents**
D5 (with palm keys)	846.19	844.32	846.53	850.27	**846.8275**	2.49	**G#5 plus 33 cents**
D#5 / E♭5 (with palm keys)	932.5	936.31	937.87	939.72	**936.6**	3.07	**A#5 plus 8 cents**
E5 (with palm keys)	992.2	973.01	934.33	1054.45	**988.4975**	50.12	**B5 plus 1 cent**
F5 (with palm keys)	1064.39	1094.39	1118.2	1099	**1093.995**	22.27	**C#6 minus 23 cents**
F#5 / G♭5 (with palm keys)	1127.5	1119.84	1108.34	1160.52	**1129.05**	22.41	**C#6 plus 31 cents**
G5 (with palm keys)	1224.49	1316.4	1338.24	1234.2	**1278.3325**	57.40	**D#6 plus 46 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	164.4	165.11	164.93	164.02	**164.615**	0.50	**E3 minus 2 cents**
B3	186.94	187.82	191.03	182.47	**187.065**	3.53	**F#3 plus 19 cents**
C4	197.64	201.5	199.12	193.69	**197.9875**	3.28	**G3 plus 17 cents**
C#4 / D♭4	210.37	211.82	209.11	212.71	**211.0025**	1.59	**G#3 plus 28 cents**
D4	220.55	232	229.54	228.76	**227.7125**	4.97	**A#3 minus 40 cents**
D#4 / E♭4	231.01	246.72	247.71	248.57	**243.5025**	8.36	**B3 minus 24 cents**
E4	262.41	262.81	263.33	259.28	**261.9575**	1.82	**C4 plus 2 cents**
F4	272.82	280.57	274.89	282.06	**277.585**	4.43	**C#4 plus 3 cents**
F#4 / G♭4	309.58	287.88	309.17	309.53	**304.04**	10.77	**D#4 minus 40 cents**
G4	318.18	320.3	320.8	323.98	**320.815**	2.40	**E4 minus 47 cents**
G#4 / A♭4	356.49	351.32	353.45	353.67	**353.7325**	2.12	**F4 plus 22 cents**
A4	392.93	392.42	388.25	391.68	**391.32**	2.11	**G4 minus 3 cents**
A#4 / B♭4	416.14	419.22	417.37	415.3	**417.0075**	1.70	**G#4 plus 7 cents**
B4	443.64	442.04	443.25	444.16	**443.2725**	0.90	**A4 plus 13 cents**
C5	496.71	493.31	497.46	496.74	**496.055**	1.86	**B4 plus 8 cents**
C#5 / D♭5	539.72	532.75	534.05	535.93	**535.6125**	3.03	**C5 plus 40 cents**
D5 (with palm keys)	559.09	571.61	578.76	562.34	**567.95**	8.95	**C#5 plus 42 cents**
D#5 / E♭5 (with palm keys)	613.47	613.3	614.02	613.78	**613.6425**	0.32	**D#5 minus 24 cents**
E5 (with palm keys)	630.95	628.68	630	630.54	**630.0425**	0.99	**D#5 plus 22 cents**
F5 (with palm keys)	690.89	684.48	692.9	692.21	**690.12**	3.85	**F5 minus 21 cents**
F#5 / G♭5 (with palm keys)	746.54	742.82	742.61	743.17	**743.785**	1.85	**F#5 plus 9 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	121.73	123.03	122.16	122.31	**122.3075**	0.54	**B2 minus 16 cents**
B3	131.12	131.92	133.37	131.13	**131.885**	1.06	**C3 plus 14 cents**
C4	137.78	137.82	136.83	139.36	**137.9475**	1.05	**C#3 minus 8 cents**
C#4 / D♭4	154.12	152.07	153.09	153.04	**153.08**	0.84	**D#3 minus 28 cents**
D4	166.55	167.75	166.27	164.3	**166.2175**	1.43	**E3 plus 15 cents**
D#4 / E♭4	172.59	172.64	172.45	173.42	**172.775**	0.44	**F3 minus 18 cents**
E4	180.21	181.53	181.11	180.44	**180.8225**	0.61	**F#3 minus 40 cents**
F4	205.14	204.98	203.59	202.6	**204.0775**	1.21	**G#3 minus 30 cents**
F#4 / G♭4	220.28	224.18	224.66	223.26	**223.095**	1.96	**A3 plus 24 cents**
G4	232.58	232.51	233.33	231.98	**232.6**	0.56	**A#3 minus 4 cents**
G#4 / A♭4	255	254.13	254.08	254.12	**254.3325**	0.45	**C4 minus 49 cents**
A4	273.65	273.75	273.39	272.79	**273.395**	0.43	**C#4 minus 24 cents**
A#4 / B♭4	295.75	295.63	294.6	295.09	**295.2675**	0.53	**D4 plus 9 cents**
B4	317.25	316.38	317.78	318.24	**317.4125**	0.80	**D#4 plus 35 cents**
C5	358.56	355.99	357.17	360.98	**358.175**	2.14	**F4 plus 44 cents**
C#5 / D♭5	375.12	375.12	374.81	375.45	**375.125**	0.26	**F#4 plus 24 cents**
D5 (with palm keys)	414.23	414.99	414.33	414.31	**414.465**	0.35	**G#4 minus 4 cents**
D#5 / E♭5 (with palm keys)	439.87	440.55	440.73	441.13	**440.57**	0.53	**A4 plus 2 cents**
E5 (with palm keys)	473.93	474.85	475.28	473.53	**474.3975**	0.81	**A#4 plus 30 cents**
F5 (with palm keys)	523.59	523.66	523.28	524.01	**523.635**	0.30	**C5 plus 1 cent**
F#5 / G♭5 (with palm keys)	557.53	558.3	554.72	554.86	**556.3525**	1.83	**C#5 plus 6 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3	74.6	74.95	74.7	74.87	**74.78**	0.16	**D2 plus 32 cents**
A#3 / B♭3	82.47	80.09	80.5	80.55	**80.9025**	1.07	**E2 minus 32 cents**
B3	85.9	86.14	86.03	86.24	**86.0775**	0.15	**F2 minus 25 cents**
C4	91.61	90.93	91.35	92.68	**91.6425**	0.75	**F#2 minus 16 cents**
C#4 / D♭4	101.36	101.83	101.97	100.74	**101.475**	0.56	**G#2 minus 40 cents**
D4	111.22	112.29	111.37	111.46	**111.585**	0.48	**A2 plus 25 cents**
D#4 / E♭4	117.89	117.12	117.68	116.58	**117.3175**	0.59	**A#2 plus 11 cents**
E4	124.41	127.2	123.37	122.33	**124.3275**	2.09	**B2 plus 12 cents**
F4	131.75	130.16	130.81	130.57	**130.8225**	0.67	**C3 plus 0 cents**
F#4 / G♭4	143.71	143.91	144.86	143.65	**144.0325**	0.56	**D3 minus 33 cents**
G4	153.72	155.02	153.6	153.52	**153.965**	0.71	**D#3 minus 18 cents**
G#4 / A♭4	165.06	166.12	165.06	167.37	**165.9025**	1.10	**E3 plus 11 cents**
A4	183.54	181.89	183.36	183.49	**183.07**	0.79	**F#3 minus 18 cents**
A#4 / B♭4	190.29	190.75	192.15	191.76	**191.2375**	0.86	**G3 minus 43 cents**
B4	211.42	207.71	210.24	211.15	**210.13**	1.69	**G#3 plus 21 cents**
C5	227.33	226.4	228.54	224.78	**226.7625**	1.59	**A#3 minus 48 cents**
C#5 / D♭5	247.12	247.75	248.39	248.49	**247.9375**	0.64	**B3 plus 7 cents**
D5 (with palm keys)	260.15	258.68	259.02	258.8	**259.1625**	0.67	**C4 minus 16 cents**
D#5 / E♭5 (with palm keys)	276.21	278.22	276.84	277.45	**277.18**	0.86	**C#4 plus 0 cents**
E5 (with palm keys)	299.49	298.62	298.52	299.69	**299.08**	0.60	**D4 plus 32 cents**
F5 (with palm keys)	320.03	320.29	320.44	320.09	**320.2125**	0.19	**D#4 plus 50 cents**
F#5 / G♭5 (with palm keys)	349.98	348.86	349.73	349.54	**349.5275**	0.48	**F4 plus 1 cent**

Chapter 3
Tongue Ram

3.1 - Description of Technique - https://youtu.be/y8T0yWYQT0I

The tongue ram technique involves forcefully inserting the tongue directly into the aperture hole of the saxophone neckpiece. [Plays an improvisation using the tongue ram technique]. The resulting sound comes from the vigorous forcing of air into the body of the saxophone by the tongue, creating a hollow-like sound that subsequently resonates through the length of the saxophone tube. This sound is similar to the slap technique produced by common practice saxophone playing. The tongue ram technique can produce rather violent sounds. This is due to the force of the air needed before the tongue is forced into the neckpiece. The rush of air before the actual tongue ram is, in fact, an air pitch sound. This air pitch can be shortened somewhat so that the only perceivable sound is that of the tongue ram. [Demonstrates]. However, a degree of air sound will always be present.

3.2 - Technical Parameters - https://youtu.be/FU9QTYw5U-o

Transposition:
Without the mouthpiece, the pitch is detuned from common practice playing. Additionally, with all SWMP techniques, it is impossible to determine a standard and all-encompassing transposition. However, a transposition chart for each saxophone, soprano, alto, tenor, and baritone, is provided below this main video.

Range:
Like the air pitch technique, the range of the tongue ram technique is limited. This is because the use of the octave key does not affect the pitch. Starting from the lower tessitura the range begins with B♭3 (or A3 on baritone) and extends chromatically upward to C#5. [Demonstrates range]. From here, I skip the normal fingering for D5 and instead use the C1-5 side keys (or to C6 on soprano) to extend the range by a further major third (or a perfect fourth on soprano). [Demonstrates range]. This extension is achieved without using the octave key. The full range of the tongue ram technique on alto saxophone would then be: [plays full range].

Discussion:
Performers, composers, and researchers can draw parallels between the tongue ram and other contemporary techniques. Firstly, there are two techniques from standard saxophone practice that evoke inspiration and imitation: the slap tongue and the common practice tongue ram. With the mouthpiece, the typical popping sound of the slap tongue is reminiscent of the SWMP tongue ram technique despite their very different means of production. [Demonstrates].

The tongue ram technique can also be produced with a mouthpiece, and it is referred to by the same name. This may cause confusion in determining whether it is intended with or without a mouthpiece; in addition to clear distinctions in notation, succeeding and

preceding musical events should give a clear context for the performer to decide what is needed. In *The Techniques of Saxophone Playing*, Weiss and Netti comment on both option as if they were the same due to their similar means of production, despite them leading to completely different sonic results (Weiss and Netti 2010: 148). Although the actions are similar, the tongue ram with a mouthpiece yields a significantly weaker sound due to the smaller opening the air is forced into.

There are stronger parallels with contemporary flute techniques sharing the same name. The means of production is also very similar. Kientzy posits the historical standpoint that the common practice slap technique served as a catalyst for the tongue ram technique among flutists, subsequently influencing saxophonists to emulate the flute's tongue ram: "[The tongue ram] is the mode of playing that flutists use to imitate the slap technique of saxophonists" (Kientzy 2007: 475). In their contemporary guide, *The Techniques of Flute Playing*, Carin Levine and Christina Mitropoulos-Bott elucidate three approaches to employing the tongue ram technique. The second is interesting for my discussion here. According to Levine and Mitropoulos-Bott, in this approach "the embouchure hole is completely covered with the lips [...] [and] with a strong thrust of air, the tongue is propelled into the embouchure hole where it is stopped" (Levine and Mitropoulos-Bott 2003: 28). This is the same method of production used by saxophonists.

According to Weiss and Netti, the tongue ram is the "staccato of 'alla tromba' playing" (Weiss and Netti 2010: 149).[36] However, this assessment seems only partially correct. Fundamentally, the tongue ram and trumpet sounds techniques are related because they both exploit the closed-end air column properties of the saxophone tube. The tongue ram is essentially the undeveloped fundamental harmonic of the trumpet sounds technique. However, after examining the sonic material from these two techniques, there are distinguishable discrepancies in the resultant pitches. For example, on the alto saxophone, the F4 fingering produces a sounding A3 plus a quarter-tone with the tongue ram technique. With trumpet sounds, the same fingering produces a G#3 plus an eighth-tone. Let me demonstrate that for you. [Demonstrates difference]. A performer or composer would have to ignore this microtonal difference to understand Weiss and Netti's claim that the tongue ram technique is simply the staccato of the trumpet sounds technique. However, imagining the tongue ram technique as the staccato of trumpet sounds is useful despite the inherent pitch differences. Saxophonists can leverage this to gain insights into the specific pitch they should target when employing the trumpet sounds technique. (Consult the transposition charts for each technique to ensure accuracy).

While the tongue ram technique remains effective across all saxophones, it is noteworthy that, as the tessitura ascends, the resulting sound tends to diminish in strength. The decrease in diameter and length of the saxophone tube as the register ascends is the

[36] 'Alla tromba' in Italian means 'like a trumpet' or 'on a trumpet'. This indicates that a player needs to buzz their lips and play the saxophone as if it were a trumpet. For further information on the trumpet sounds technique, please refer to Chapter 4.

contributing factor to the diminishing sound in higher registers. Both Kientzy (Kientzy 2007: 475) and Weiss and Netti (Weiss and Netti 2010: 148) express a similar viewpoint, suggesting that the tongue ram technique is most effective when applied to the lower registers. Kientzy asserts that the tongue ram technique exhibits greater effectiveness on larger saxophones (Kientzy 2007: 475). While this evaluation holds true in general, it should not dissuade composers from incorporating the tongue ram technique with alto or soprano saxophones.

3.3 - Performance and Practice - https://youtu.be/2MbgUF3wyuM

To execute a successful tongue ram, a performer should initially cultivate proficiency and flexibility with the air pitch technique. To produce the desired sound, a short burst of air is required behind the tongue ram. This burst provides the necessary speed and pressure for the tongue to forcefully jam and slap itself into the aperture of the neckpiece. The resulting sound is influenced by the specific keys that are depressed during the execution of the technique.

Dynamic Range:
The tongue ram technique can generate a broad dynamic range from *ppp-mf*. [Demonstrates dynamic scaling].

This dynamic range will vary widely depending on the saxophone. Broadly speaking, the baritone, with its larger and more resonant tube will resonate louder than the soprano saxophone with its smaller tube. However, the dynamic output primarily hinges on the force of the tongue and the air pressure behind it. Consequently, a high-pressurized tongue attack will yield a louder dynamic, while a low-pressure tongue attack will result in a weaker sound. In addition, an audible sympathetic air pitch sound always accompanies the tongue ram attack, with its dynamic mirroring that of the tongue ram or being slightly louder.

Speed of Articulation:
Artistically, this technique is an effective replacement of the slap sounds. However, the physicality of the technique is more demanding since the tongue must be retracted from the aperture of the neckpiece for each articulation. Due to this additional movement, the tongue ram technique should not be employed in extremely fast passages. [Demonstrates].

3.4 - Personal Development - https://youtu.be/R89jZZ-cQHg

Much like practicing other techniques, especially various articulations, a performer should start by slowly exploring repeated single pitches on one note. Focus on the position of the tongue, how it interacts with the aperture of the neckpiece, and discover the dynamic limits of that particular pitch.

Personally, I would start on the lowest pitch of the saxophone – here, the resultant sound is quite present. Since I am using an alto saxophone, I will begin on the low B♭. Play four tongue rams at a slow yet consistent tempo with a *mezzo-forte* dynamic. Focus on how your tongue feels entering the aperture of the neckpiece and notice how much of that air pitch is needed to propel the tongue forward. As a practical tip, keep the tongue tight and pointed for better entry into the aperture, resulting in an overall improved tone quality of the tongue ram. Here I will demonstrate this low B♭. [Demonstrates].

After exploring the low B♭, I recommend working up chromatically through the saxophone. Note the weaker dynamic sound result when moving to higher tessituras. When reaching the higher tessitura using the palm keys, spend extra time refining the balance between the dynamic of the tongue ram and the accompanying air pitch sound. I will demonstrate here the palm key D. [Demonstrates]. Once one has a functional understanding of how the tongue works and of the balance between ramming and air pitch sounds, try the same exercise in different dynamic ranges.

After gaining a thorough understanding of how the tongue functions with this articulation, I recommend speeding up the movement of the tongue. Stay on the same pitch, and this time, start with standard articulation exercises to build speed. Utilize a metronome set to 40 beats per minute and articulate first in quarter notes, then eighth notes, followed by triplets, and finally sixteenths. [Demonstrates]. Taking a slow pedagogical progression, add two clicks per minute and increase the metronome to 42 beats per minute. [Demonstrates]. One can continue this process until encountering difficulty. Reduce the metronome to a tempo marking lower and practice until the tongue movement becomes faster. Performers can gradually increase the metronome speed as their comfort level grows.

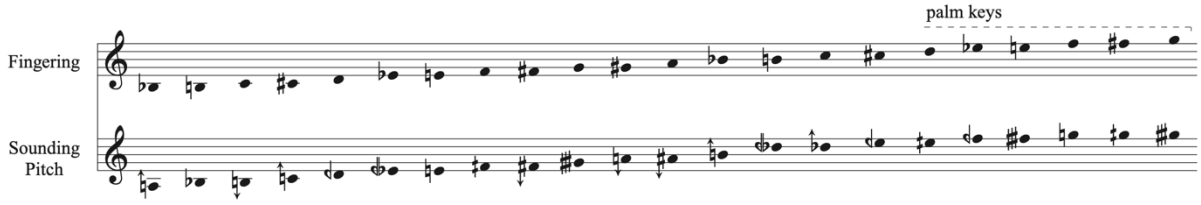
Then, I recommend practicing with full-range scales. Begin with B♭ Major as an example, starting from the lowest pitch of the saxophone. Start at a slow pace and gradually increase the speed. To demonstrate, I will use a metronome set at 40, beginning with eighth notes. [Demonstrates]. Practice this approach with all scales, gradually working up the tempo.

3.5 - Pedagogy - https://youtu.be/_7c31dVxbjA

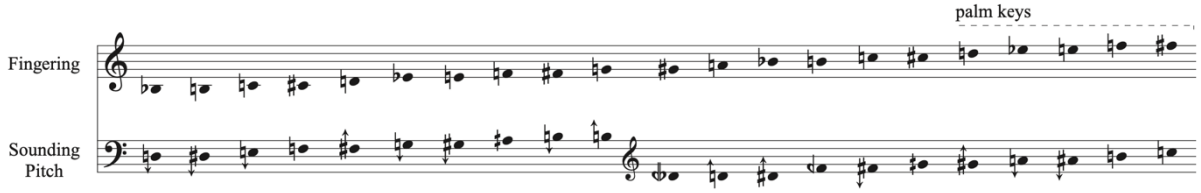
If necessary, adjust the neckstrap to the proper height so that the neckpiece is aligned with the mouth. [Demonstrates]. Prepare the desired fingering. [Demonstrates]. Align the lips with the aperture of the neckpiece and prepare the embouchure. [Demonstrates]. Breathe in. [Demonstrates]. And, upon exhaling, forcefully jam the tongue through the opening of the neckpiece. [Demonstrates].

3.6 - Transposition Charts for Tongue Ram

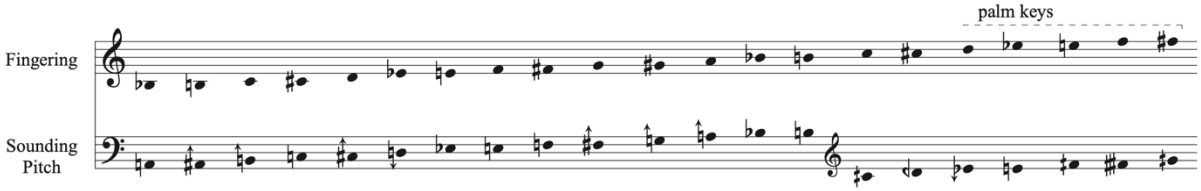
Soprano Saxophone



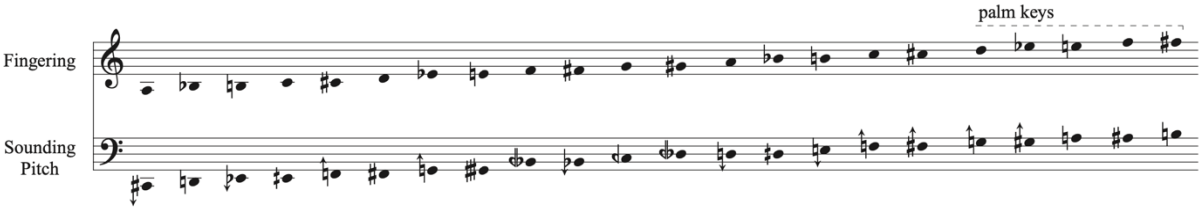
Alto Saxophone



Tenor Saxophone



Baritone Saxophone



3.7 - Demonstration Videos for Tongue Ram

Below, I will demonstrate the tongue ram technique on all four main saxophones, showcase various transitions with other SWMP techniques, and perform it in combination with common practice saxophone playing. Each video is accompanied by a brief text for further elaboration.

Chromatic Scale Played on Soprano, Alto, Tenor, and Baritone Saxophones:
https://youtu.be/14gPxh8Cgl0
Here, I demonstrated the tongue ram technique on all four primary saxophones performing the full chromatic range for each saxophone. Notice the difference in dynamic between the smaller and larger saxophones.

Tongue Ram in Combination with Other SWMP Techniques:
Since the tongue ram is a single-event articulation, combining it with other modes of playing is achieved by chaining one event to the next. Unlike the other SWMP techniques, which can be prolonged for any duration at the performer's discretion, the tongue ram has a short duration.

Tongue Ram to Trumpet Sounds:
https://youtu.be/vaE_rOTCpq8
The tongue ram technique can be seamlessly integrated with the trumpet sounds technique. Although the pitch of the tongue ram closely aligns with that of the trumpet sounds, there are discernible differences in the same fingerings between these two techniques. To help develop the trumpet sound pitch, a saxophonist can utilize the tongue ram as a close reference for the fundamental pitch of the trumpet sound. Compositionally, it is crucial to approach the tongue ram technique as distinct from that of trumpet sounds, although swift transitions between these two techniques are feasible.

Tongue Ram to Air Pitch:
https://youtu.be/MzGu2tW3gEk
Combining tongue ram and air pitch techniques is relatively straightforward, given that the air pitch technique precedes and accompanies the tongue ram. Allowing a moment for the tongue to retract from the neckpiece is essential for a successful execution of the air pitch following a tongue ram articulation.

Tongue Ram to Saxo-Flute Hybridity:
https://youtu.be/zITKs2Y-EZI
The main challenge in combining the tongue ram technique with saxo-flute hybridity is the need to reposition the entire saxophone body and neck. The saxophonist must find the correct angle to blow across the aperture hole of the neckpiece for the saxo-flute hybridity technique. While this adjustment can be achieved with dedicated practice, it is advisable to allow the performer several seconds to position the saxophone correctly.

Tongue Ram to Normal Playing:
https://youtu.be/mCFk4_Ll5Bw
While combining any SWMP technique with playing using the mouthpiece is feasible, there are a few important factors to consider. The first is the transition time required to reattach the mouthpiece. Allow the saxophonist approximately five to ten seconds to pick up their mouthpiece, properly place it on the saxophone, potentially adjust the neckstrap, and prepare themselves to play with the mouthpiece again. This pause can be utilized to create a sense of musical drama through silence or by considering the taking off or placing back of the mouthpiece as a theatrical element. Alternatively, a composer can introduce a transition of different musical materials and techniques.

The second consideration is the possibility of the mouthpiece making a sound as it rubs against the cork of the neckpiece. While applying cork grease before the performance may alleviate this noise, it is not a foolproof solution. However, it could also offer a new sonic element and be heard as aesthetically interesting. A third factor to note is the tuning of the instrument after placing the mouthpiece back on. This is generally not a significant problem because experienced saxophonists will intuitively know where to position the mouthpiece for proper tuning. However, it is crucial to be aware that relying solely on intuition is not infallible. Therefore, if intonation is important, it is advised to have the saxophonist take a moment to retune when they return the mouthpiece to the neckpiece.

3.8 - Pitch Manual for Tongue Ram

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	222.63	221.28	222.63	222.42	**222.24**	0.65	**A3 plus 18 cents**
B3	232.41	232.33	231.37	233.08	**232.2975**	0.70	**A#3 minus 6 cents**
C4	245.31	245.18	245.95	245.38	**245.455**	0.34	**B3 minus 10 cents**
C#4 / D♭4	260.92	265.15	262.49	266.29	**263.7125**	2.45	**C4 plus 14 cents**
D4	290.29	286.69	286.44	283.28	**286.675**	2.87	**D4 minus 42 cents**
D#4 / E♭4	304.31	303.35	305	306.17	**304.7075**	1.19	**D#4 minus 36 cents**
E4	329.13	325.08	330.37	330.6	**328.795**	2.56	**E4 minus 4 cents**
F4	357.24	358.42	359.61	355.49	**357.69**	1.76	**F4 plus 41 cents**
F#4 / G♭4	367.82	365.16	365.64	365.16	**365.945**	1.27	**F#4 minus 19 cents**
G4	429.99	426.94	427.03	413.22	**424.295**	7.52	**G#4 plus 37 cents**
G#4 / A♭4	436.77	435.07	433.21	431.08	**434.0325**	2.45	**A4 minus 24 cents**
A4	460.19	465.29	459.16	458.4	**460.76**	3.11	**A#4 minus 20 cents**
A#4 / B♭4	487.13	500.96	514.48	484.13	**496.675**	13.95	**B4 plus 10 cents**
B4	545.71	537.08	536.76	550.4	**542.4875**	6.71	**C#5 minus 37 cents**
C5	565.36	573.38	568.3	565.45	**568.1225**	3.76	**C#5 plus 42 cents**
C#5 / D♭5	651.54	639.7	636.25	655.93	**645.855**	9.38	**E5 minus 36 cents**
D5 (with palm keys)	663.95	663.73	662.78	663.55	**663.5025**	0.51	**E5 plus 11 cents**
D#5 / E♭5 (with palm keys)	677.83	674.51	678.24	687.5	**679.52**	5.58	**F5 minus 48 cents**
E5 (with palm keys)	727.61	715.72	716.16	727.29	**721.695**	6.65	**F#5 plus 43 cents**
F5 (with palm keys)	788.25	784.01	785.25	777.4	**783.7275**	4.58	**G5 minus 1 cent**
F#5 / G♭5 (with palm keys)	803.56	X	809.44	801.56	**804.8533333**	4.10	**G5 plus 45 cents**
G5 (with palm keys)	844.67	848.4	857.41	X	**850.16**	6.55	**G#5 plus 40 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	146.79	144.44	146.24	145.23	**145.675**	1.05	**D3 minus 14 cents**
B3	154.74	154.87	154.3	154.65	**154.64**	0.24	**D#3 minus 10 cents**
C4	163.83	163.89	163.19	163.15	**163.515**	0.40	**E3 minus 14 cents**
C#4 / D♭4	175.57	175.4	175.07	174.92	**175.24**	0.30	**F3 plus 6 cents**
D4	187.78	186.45	186.24	185.16	**186.4075**	1.08	**F#3 plus 13 cents**
D#4 / E♭4	192.38	193.27	193.78	193.63	**193.265**	0.63	**G3 minus 24 cents**
E4	204.6	204.36	204.17	205.05	**204.545**	0.38	**G#3 minus 26 cents**
F4	226.98	223.33	223.83	224.54	**224.67**	1.62	**A3 plus 36 cents**
F#4 / G♭4	243.65	242.5	242.38	242.78	**242.8275**	0.57	**B3 minus 29 cents**
G4	251.31	251.67	250.61	250.23	**250.955**	0.65	**B3 plus 28 cents**
G#4 / A♭4	273.35	269.18	272.72	273.2	**272.1125**	1.97	**C#4 minus 32 cents**
A4	297.96	297.51	297.98	296.22	**297.4175**	0.83	**D4 plus 22 cents**
A#4 / B♭4	316.57	313.47	312.24	312.78	**313.765**	1.94	**D#4 plus 15 cents**
B4	347	340.72	339.23	337.61	**341.14**	4.11	**F4 minus 41 cents**
C5	368.52	365.73	363.48	364.7	**365.6075**	2.15	**F#4 minus 21 cents**
C#5 / D♭5	397.84	394.17	394.23	393.88	**395.03**	1.88	**G4 plus 13 cents**
D5 (with palm keys)	425.34	410.53	422.02	413.35	**417.81**	7.01	**G#4 plus 10 cents**
D#5 / E♭5 (with palm keys)	434.19	439.3	430.54	430.6	**433.6575**	4.13	**A4 minus 25 cents**
E5 (with palm keys)	462.16	464.7	465.84	461.6	**463.575**	2.02	**A#4 minus 10 cents**
F5 (with palm keys)	494.9	495.02	492.9	494.14	**494.24**	0.97	**B4 plus 1 cent**
F#5 / G♭5 (with palm keys)	521.48	521.88	523.57	520.49	**521.855**	1.28	**C5 minus 5 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	110.4	110.55	110.49	110.56	**110.5**	0.07	**A2 plus 8 cents**
B3	117.38	117.84	117.88	117.81	**117.7275**	0.23	**A#2 plus 18 cents**
C4	124.57	125.86	124.21	124.94	**124.895**	0.71	**B2 plus 20 cents**
C#4 / D♭4	129.41	130.84	129.77	133	**130.755**	1.62	**C3 minus 1 cent**
D4	140.59	139.32	140.24	139.16	**139.8275**	0.70	**C#3 plus 15 cents**
D#4 / E♭4	144.24	148.64	144.7	145.19	**145.6925**	2.00	**D3 minus 13 cents**
E4	155.91	155.37	155.9	155.77	**155.7375**	0.25	**D#3 plus 2 cents**
F4	165.75	165.33	165.91	165.43	**165.605**	0.27	**E3 plus 8 cents**
F#4 / G♭4	174.58	176.21	175.11	175.03	**175.2325**	0.69	**F3 plus 6 cents**
G4	186.89	186.85	186.3	186.58	**186.655**	0.27	**F#3 plus 15 cents**
G#4 / A♭4	198.93	198.66	198.91	198.29	**198.6975**	0.30	**G3 plus 24 cents**
A4	220.47	221.24	221.19	222.46	**221.34**	0.83	**A3 plus 11 cents**
A#4 / B♭4	232.88	231.08	233.12	232.1	**232.295**	0.92	**A#3 minus 6 cents**
B4	246.57	246.2	246.86	246.21	**246.46**	0.32	**B3 minus 3 cents**
C5	269.89	269.11	267.53	267.15	**268.42**	1.30	**C4 plus 44 cents**
C#5 / D♭5	289.92	288.48	288.56	287.82	**288.695**	0.88	**D4 minus 30 cents**
D5 (with palm keys)	307.66	307.2	305.3	305.58	**306.435**	1.17	**D#4 minus 26 cents**
D#5 / E♭5 (with palm keys)	333.5	328.99	328.44	326.5	**329.3575**	2.96	**E4 minus 1 cent**
E5 (with palm keys)	363.49	364.5	362.8	361.62	**363.1025**	1.21	**F#4 minus 33 cents**
F5 (with palm keys)	379.03	379.77	382.4	379.4	**380.15**	1.53	**F#4 plus 47 cents**
F#5 / G♭5 (with palm keys)	403.17	405.98	401.41	403.17	**403.4325**	1.89	**G4 plus 50 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3	68.77	68.42	68.3	68.51	**68.5**	0.20	**C#2 minus 20 cents**
A#3 / B♭3	73.57	73.77	73.7	73.4	**73.61**	0.16	**D2 plus 5 cents**
B3	76.36	77.32	76.54	76.86	**76.77**	0.42	**D#2 minus 23 cents**
C4	84.04	84.15	84.49	84.32	**84.25**	0.20	**E2 plus 38 cents**
C#4 / D♭4	88.87	87.17	87.44	88.41	**87.9725**	0.80	**F2 plus 13 cents**
D4	92.63	92.66	92.65	92.55	**92.6225**	0.05	**F#2 plus 2 cents**
D#4 / E♭4	100.06	98.68	100.58	99.31	**99.6575**	0.83	**G2 plus 29 cents**
E4	106.18	106.39	106.3	106.57	**106.36**	0.16	**G#2 plus 42 cents**
F4	114.54	114.45	113.12	113.98	**114.0225**	0.65	**A#2 minus 38 cents**
F#4 / G♭4	116.62	115.42	116	115.57	**115.9025**	0.54	**A#2 minus 10 cents**
G4	129.07	128.31	126.6	127.92	**127.975**	1.03	**C3 minus 38 cents**
G#4 / A♭4	136.34	135.33	135.08	135.26	**135.5025**	0.57	**C#3 minus 39 cents**
A4	146.73	145.75	144.55	144.67	**145.425**	1.02	**D3 minus 17 cents**
A#4 / B♭4	150.74	151.14	150.94	150.01	**150.7075**	0.49	**D3 plus 45 cents**
B4	162.69	162.9	163.12	162.56	**162.8175**	0.25	**E3 minus 21 cents**
C5	176.21	175.31	176.6	176.13	**176.0625**	0.54	**F3 plus 14 cents**
C#5 / D♭5	188.52	186.45	185.23	185.85	**186.5125**	1.43	**F#3 plus 14 cents**
D5 (with palm keys)	197.21	198.71	199.54	196.14	**197.9**	1.52	**G3 plus 17 cents**
D#5 / E♭5 (with palm keys)	206.3	206.75	205.81	206.21	**206.2675**	0.39	**G#3 minus 12 cents**
E5 (with palm keys)	221.68	220.3	221.22	221.54	**221.185**	0.62	**A3 plus 9 cents**
F5 (with palm keys)	233.84	233.44	233.85	233.02	**233.5375**	0.39	**A#3 plus 3 cents**
F#5 / G♭5 (with palm keys)	248.08	248.07	247.45	247.02	**247.655**	0.52	**B3 plus 5 cents**

Chapter 4
Trumpet Sounds

4.1 - Description of Technique - https://youtu.be/3Aa94ht86Ws

When a saxophonist wants to play the trumpet sounds technique, the lips should vibrate against the open hole of the saxophone neckpiece to produce a characteristic brass sound. [Plays an improvisation using the trumpet sounds technique]. Sound is made by blowing a thin stream of air through the instrument while the lips produce a buzz which resonates through the instrument in the same way that a brass instrument is played. [Demonstrates]. Pitch is affected by the harmonic partial selected and determined by the strength and flexibility of the saxophonist's embouchure and, of course, fingerings.

4.2 - Technical Parameters - https://youtu.be/a0WEp-GyZF4

Proper Embouchure:
Saxophonists must be able to lightly press their lips together while still allowing a thin stream of air to pass through the opening of the embouchure. The characteristic buzzing sound of the typical brass player embouchure is desired. The lips are lightly pressed against the aperture of the saxophone. [Demonstrates]. The pressure level is pivotal to create a just and in-tune intonation. Practice with a tuner is encouraged at the beginning stages.

Something that should be avoided is placing the neckpiece aperture hole off-center to the lips. [Demonstrates]. This alters the pitch and pressure balance of the technique. While Weiss and Netti advocate for the opposite in their method to “protect against cramping in the lips” (Weiss and Netti 2010: 148), through my own practice, and working with other saxophonists, I have found that diligent embouchure exercises and training of this technique allow a saxophonist to gain the endurance to produce this technique without many issues.

Transposition:
As with all saxophone techniques that exclude the mouthpiece, it is infeasible to establish a universal transposition applicable to each saxophone. Nevertheless, a transposition chart for each type of saxophone – soprano, alto, tenor, and baritone – is provided below the primary video.

Range:
Trumpet sounds have a variable and large range, depending largely on the flexibility of the saxophonist's embouchure, the development of the buzzing technique used to create this sound, and the specific saxophone being played. In general, the trumpet sounds technique spans from B♭3 to B♭5. One will find that the octave key causes little change when oscillating between C#5 and D5. However, since there is little change, one might find it helpful to use the octave key with the desired fingering as a guide and for comfort.

Below, I specify the written range for each saxophone:

- On soprano saxophone, the range is B♭3 to G5.
- On alto saxophone, the range is B♭3 to B♭5.
- On tenor saxophone, the range is B♭3 to C6.
- On baritone saxophone, the range is A3 to A5. There are multiple harmonic partials possible to achieve with the same fingerings. Due to this, in the D5 to A5 range, there are disparate notes that a saxophonist is capable of producing depending on whether they utilize the primary or secondary octave.

The ranges specified are suggestions based on my own personal experience and development of this technique. Since the trumpet sounds technique requires flexibility and training of the lips, it is possible that theses ranges could be extended and developed further in the future. To hear the full range on each of the four main saxophones, click on the chromatic scale video in the section entitled Demonstration Videos.

Speed and Precision:
When discussing trumpet sounds and employing this technique in contemporary compositions, it is important to consider how quickly one can execute this technique. Depending on the required precision and stability of pitch, a saxophonist can perform the technique with some fluidity. However, achieving this level of proficiency will require diligent practice and repetition. The velocity parameter is directly linked to the saxophonist's comfort level with the buzzing embouchure. This type of embouchure manipulation is quite distinct from any technique taught within common saxophone pedagogy. As a result, saxophonists will need to train their lips to build endurance in maintaining this embouchure. Without the necessary endurance, the integrity of pitch and precision may suffer. Additionally, one may have the impulse to play faster than the embouchure allows, as the key mechanisms to vary pitch remain the same as the knowledge of common practice playing. [Demonstrates various playing speeds].

Several authors discuss the speed and precision of trumpet sounds. Kientzy suggests that the technique's speed is limited and that, when a few leaps are indeed necessary, it is “nearly essential that they be composed using partials from the same row” (Kientzy 2007: 428). While Kientzy's idea is understandable given the difficulty of the technique and the embouchure required, it immediately limits the compositional possibilities. With dedicated practice, an understanding of the resultant pitches of desired notes, and embouchure work, saxophonists can fluently play different partials from different rows, making the technique more versatile. [Demonstrates].

Londeix and Charrier are vaguer, stating that while performing this technique, “legato and staccato may be played fairly swiftly throughout the entire range of the saxophone” (Londeix 1989: 69). While this is not untrue, one should be aware of the possibility of losing pitch precision when combining staccato playing with speed. In my own practice, I

am comfortable performing sixteenth-notes at around MM=120. Any faster, and I risk losing precision and clarity of pitch.

I recommend composers to consider and develop material with a brass player in mind. While large leaps are not impossible, they are challenging for saxophonists who are not accustomed to buzzing their lips. For this reason, I encourage composers to collaborate with performers to determine what is comfortable and achievable for them.

Sound Quality and Brass Mouthpiece Addition:
The quality of sound produced by the trumpet sounds technique is characteristically brass-like, although it lacks the complexity of harmonics typical of brass instruments. Weiss and Netti comment on this, stating that playing trumpet sounds on saxophones possess "a sound weak in overtone content" (Weiss and Netti 2010: 147). They further mention that, depending on the instrument, the sound can resemble that of a bass or alto flute, or that of a wooden trumpet (Weiss and Netti 2010: 147). When I perform this technique in concerts, audience members often describe the trumpet sounds as having a tone quality like that of an alto horn or alto flute - somber and hollow. Various authors use suggestive adjectives to describe the sound as primitive and modest (Kientzy 2007: 428), sad, mournful, and muffled (Londeix 1989: 68), or crude and primordial (Weiss and Netti 2010: 147).

One of the most controversial elements of the trumpet sounds technique is the question whether the saxophonist should integrate the use of a bespoke tube, hose, brass mouthpiece, etc., to aid in the sound production. Two reasons have been discussed in favor of using such aids.
The first one is to uphold the integrity of the pitch of the common practice saxophone by elongating the tube to where the mouthpiece would generally be placed. Among those who make this claim, Weiss and Netti advocate this method for longer passages of trumpet sounds playing (Weiss and Netti 2010: 147). Similarly, Kientzy claims that by adding a tube of the same length and volume as the saxophone mouthpiece, the pitch of the instrument is "restored" (Kientzy 2007: 429). While elongating the tube may affect the intonation of the saxophone, there is no evidence that the trumpet sounds will automatically be tuned to the same transposition as the common practice saxophone. The pitches are still somewhat detuned from their common practice fingerings, likely due to the regular shape of the tube as opposed to the irregular shape of a saxophone mouthpiece chamber.

Secondly, saxophonists must make the artistic and technical decision whether to use a brass mouthpiece to produce trumpet sounds. This decision might also require the approval of the composer, if they are available to discuss such artistic choices. The advantages of using a brass mouthpiece include the potential of a more resonant, full, and warmer sound, as well as improved precision in identifying and placing pitches. However, there are also drawbacks: the metal often rubs against the inside of the saxophone tube,

causing unwanted scraping marks and micro-indentations inside the neckpiece. Additionally, the technical limitations of the saxophonist as a brass player might become more apparent, as trained brass players spend years refining their embouchure. When a saxophonist opts to use a brass mouthpiece, there is an expectation that they will perform at a level comparable to professional brass players. However, saxophonists may always lag behind in this regard due to the specialized training and experience required in brass instrument technique. Therefore, this decision should be made proactively by the saxophonist to align with the needs of the work, practice, and the composer's intentions.

While I consider the trumpet sounds technique to offer limitless artistic possibilities, I advise composers to exercise caution if they intend to treat it akin to virtuosic trumpet writing. Saxophonists must develop their lip buzzing embouchure and ensure confidence in placing pitches accurately across the instrument's range, spanning various octaves.[37]

4.3 - Performance and Practice - https://youtu.be/7IDE1hp8rc4

To properly execute the trumpet sounds technique, a saxophonist should first familiarize themselves with the brass embouchure. Begin with the lips. Bring them together as if forming a kiss. [Demonstrates]. With the lips loosely clamped shut, focus a stream of air through the lips, vibrating them against each other. [Demonstrates]. One should not need to force the lips or the air too much to create this sound. Before introducing the saxophone neck and body, one must be able to create this typical sound with ease.

However, there are many other ways to consider the vibrating lips embouchure. In *Hello! Mr. Sax,* Londeix and Charrier briefly discuss and quote French brass pedagogue Michel Ricquier concerning trumpet embouchure. Ricquier refers to the trumpet embouchure as forming the "mask." He states: "Close the mouth, then slightly separate the jaws, without opening or drawing back the lips, as if you were going to pass your tongue over your lips to moisten them. When the tongue has enough room to pass between the teeth, tighten the lips against each other so that only a tiny stream of air can pass between the lips when you blow" (Londeix 1989: 68). By thinking about the new embouchure in this way, a model is given to refer to.

Another model is presented by American trumpet player and pedagogue Andy Kozar. In his book *Response*, he advocates for an approach whittled down to the following steps: start with the air first, breathe in the vowel "hope"; find a simple buzzing embouchure that does not force any tension in the lips; then, produce a focused sound and find the center of pitch (Kozar 2022: 4-6). This model is simple and easy to follow, allowing the performer to focus on the main aspects of proper tone production. When reproducing this method on the saxophone, one should develop the concepts of tone and embouchure from

[37] Adding a brass mouthpiece to the neckpiece of the saxophone is a next step and, for now, outside this dissertation's scope.

the basics, ensuring they have a balanced air-first approach and not to use too much pressure while buzzing.[38]

Once this embouchure is achieved, rehearse with just the mouth. This will build ease, flexibility, and, most importantly, endurance with this new type of embouchure. My favorite types of exercises are long tones and single articulations. Do these exercises for about ten minutes before moving on to the neck of the saxophone. [Demonstrates].

Next, introduce solely the neckpiece. As is also common in common practice playing, I like to do only neck exercises to continue to work on the embouchure and the experience of the saxophone neck against my lips. The neck poses several challenges for anyone who buzzes their lips against it. First, the edges of the neck can be somewhat sharp as they are not designed to be in contact with the human skin. Second, one should avoid forcefully pressing the neckpiece into the lips. This will hurt and ultimately leave the saxophonist unable to play until the lips heal. Bring the neckpiece gently to the center of the lips and vibrate the lips against it. [Demonstrates]. It is recommended to incorporate exercises that enhance familiarity, flexibility, and endurance in this configuration.

Given the multitude of possible pitches, it is advisable to have the target pitches in mind before attempting to play them. The pitch manual provided on this page will be beneficial for this exercise. When approaching trumpet sounds for the first time in an unfamiliar score, I often find it helpful to sing the part before attempting to play it on the saxophone. In this way, I have an aural reference before using the saxophone; Weiss and Netti encourage the same (Weiss and Netti 2010: 148).

Dynamic Range:
Trumpet sounds can be played across a dynamic range from *pianissimo* to *fortissimo*, depending on the range of the instrument. It is nearly impossible to play in the lower tessitura of the instrument outside of the *piano* to *mezzo-piano* range. However, in the highest ranges, it is almost impossible to do the opposite, relying on a solid *mezzo-forte* to *fortissimo* range. [Demonstrates].

Articulations:
Single Tongue:
While buzzing the lips, the tongue should be directed towards the center of the lips to momentarily interrupt the airflow. Despite the absence of the mouthpiece, the tonguing remains largely similar to standard playing techniques. [Demonstrates].
Double Tongue:
Double tonguing is also possible and somewhat easier compared to common practice playing when the mouthpiece is not present. One will want to think of the tongue as

[38] There are many other articles, methods, and pedagogies that detail the complexity of brass embouchure. To interact with all these methods would be a dissertation on its own. For the sake of focus, I will not provide too many examples but will reference other documents for saxophonists to read while working on embouchure.

having a rebound action. The first articulation is a single tongue where the tongue is aimed toward the center of the lips. Immediately after, retract the tongue slightly and force the back of the tongue up to articulate on the soft palate. Repeat this procedure over and over in the desired rhythm and tempo. What I like to think about is a "Too-Koo" articulation, which mirrors what the tongue must do in order to double tongue. [Demonstrates].

Flutter Tongue:

Flutter tonguing can be easily combined with trumpet sounds. For saxophonists who can perform the flutter tongue technique with the mouthpiece, they simply need to get used to the sensation of fluttering without the resistance of the mouthpiece while buzzing their lips. This should not be too difficult. Performers and composers should be aware that adding the flutter tongue technique will increase the dynamic output of the trumpet sounds. Additionally, flutter tonguing might affect the pitch center of the sound. [Demonstrates].

Glissandi:

Much like in common practice brass playing, glissandi are possible when performing the trumpet sounds technique. This can be achieved by slowly altering between fingerings, manipulating the embouchure, or a combination of both. The manipulation of the embouchure can occur through several different means: adjusting the strength or weakness of the lips on the neckpiece, altering how close the neckpiece is to the vibrating lips, or adjusting the openness of the throat. A fair amount of trial and error will be necessary to determine which method will work best on the respective saxophone and desired pitch sets. [Demonstrates].

Barrissement:

The barrissement technique is a subset technique that involves the over pressurization of the trumpet sound embouchure. [Demonstrates]. "Barrissement" in French means the roar of an elephant, aptly named due to the evocative sound it produces. When the amount of air forced into the saxophone neckpiece saturates the sound, a roar-like effect is achieved. The amount of pitched content is nearly equal to the amount of air, as the air being forced through the lips and neckpiece is hyper-pressurized. The pitch is very difficult to control since the air itself is out of control. Despite the typical lack of control, desired pitches can be achieved through diligent practice. One should take caution when performing this technique, as the amount of pressure exerted by the lips is extraordinary and can lead to cramps and headaches if overperformed. The pressure can be released by often taking rests when practicing. Found throughout the literature for SWMP, this technique is often used in pieces that do not require precision of pitch but rather a textured and colorful sound world.

4.4 - Personal Development - https://youtu.be/di-GONYpy2I

Extremes in tessitura can be challenging depending on the saxophone used. For example, it is very difficult to produce sounds lower than a low C on tenor and baritone saxophone without first starting slightly higher in range, whereas this difficulty is not as apparent with the alto and soprano saxophones. Like all techniques, mindful practice is essential to mastery.

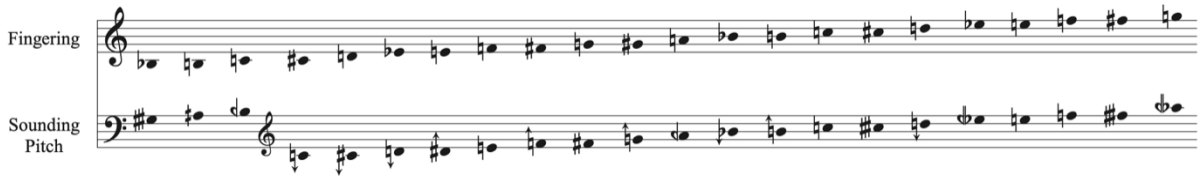
What I like to do when I need to play very precise trumpet sounds and be exact with pitch is to pull out my old method books and play the simple melodies there. Working through these exercises allows me to focus on the sound, accuracy of pitch, and development of embouchure strength.

4.5 - Pedagogy - https://youtu.be/hlE7rcureco

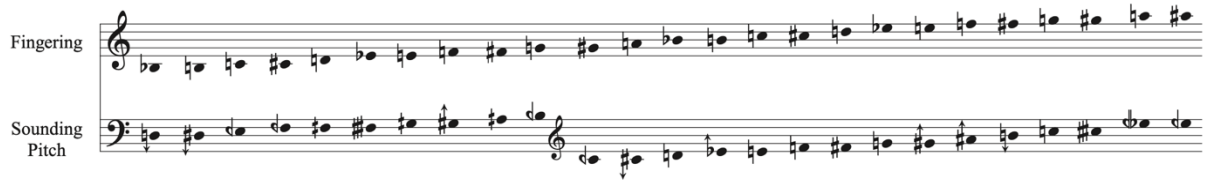
Position the center of the neckpiece of the saxophone to the center of the lips. [Demonstrates]. Choose the correct and desired fingering. [Demonstrates]. Form the buzzing embouchure by lightly pressing the lips together, creating a kissing shape with the mouth while keeping the top and bottom teeth slightly spaced apart inside the oral cavity. [Demonstrates]. Hear the desired pitch in the mind's ear before blowing. Breathe in. [Demonstrates]. And, blow a focused stream of air through the lips and into the neckpiece producing a successful trumpet sound through the saxophone. [Demonstrates].

4.6 - Transposition Charts for Trumpet Sounds

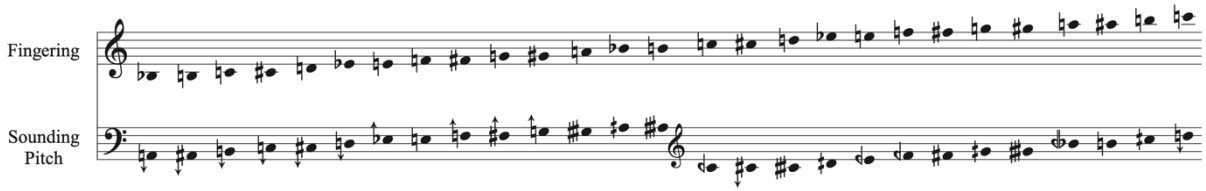
Soprano Saxophone



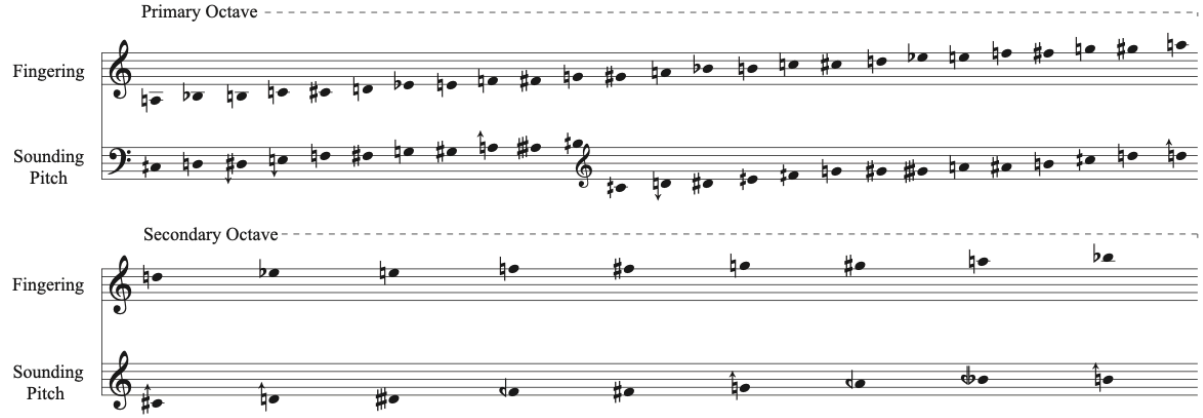
Alto Saxophone



Tenor Saxophone



Baritone Saxophone



4.7 - Demonstration Videos for Trumpet Sounds

Below, I will demonstrate the trumpet sounds technique on all four main saxophones, show transitions with the other SWMP techniques, and perform combinations with singing and common practice saxophone playing. Each video is accompanied by a brief text for further elaboration.

Chromatic Scale Played on Soprano, Alto, Tenor, and Baritone Saxophones:
https://youtu.be/5xtt0epuDoQ
In this section, I demonstrate the full range of possible notes on all four standard saxophones. It is important to note that at the extremes of tessitura, producing pitches with precision and exactitude becomes increasingly challenging. In many cases, it is advisable to begin from a more accessible starting point and gradually work higher or lower to achieve the desired pitches.

The ranges presented here reflect what was achievable for me at the time of recording the Pitch Manual in March 2022. However, each player may have a functional range that extends beyond the indicated limits, depending on their familiarity and comfort with the trumpet sounds technique.

Barrissement Technique:
https://youtu.be/aFxG3n6KjHM
Alternating between regular trumpet sounds and the barrissement technique is both possible and highly effective in creating distinct sound worlds. However, composers should be mindful that a player's endurance may be compromised by rapid shifts between these two techniques. It is also important to note the potential risk of injury when performing extended passages using the barrissement technique, due to the over-pressurization of air. To prevent damage to the embouchure, it is advisable to take breaks and rest when experiencing headaches or excessive cramping in the lips.

Articulations:
https://youtu.be/509W_iOB7Ms
Single Tongue:
Single tonguing articulation within the context of trumpet sounds technique should be adapted from common practice playing, with the key difference being the reduced resistance inside the mouth due to the absence of the mouthpiece. Composers are encouraged to collaborate with saxophonists to determine the maximum speed at which they can single tongue while maintaining the trumpet sound embouchure. When the speed increases, clarity often becomes a challenge; therefore it is, important to find a balance between articulation speed and sound quality.
Double Tongue:
Similarly, a saxophonist should adapt their knowledge of double tonguing from common practice technique. Most saxophonists will be familiar with the “TOO KOO” or “DUH GUH”

approach to double tonguing. At slower speeds, the back of the tongue may interfere with the pitch and sound quality. To minimize this, the tongue should be moved quickly into position, striking the back of the soft palate and interrupting the airflow to create the double tongue articulation. This quick movement will help maintain clarity and sound quality.

Flutter Tongue:

The flutter tongue technique can be applied while performing trumpet sounds, and it can be produced in two ways: the front rolling "R" and the back rolling "R." The front rolling "R" creates a more aggressive attack, which naturally increases the dynamic intensity. In contrast, the back rolling "R" produces a more intimate sound, although it can be difficult to hear in certain contexts.

Glissandi:

https://youtu.be/-loEVta0-FE

There are multiple ways to produce glissandi effects using the trumpet sounds technique. Saxophonists may need to incorporate a combination of different techniques depending on the desired starting and target notes. By manipulating the embouchure, adjusting the opening of the throat, altering fingerings, and varying the distance between the lips and the saxophone neckpiece, one can achieve a range of glissandi effects. These various methods offer flexibility and options for creating smooth, continuous pitch shifts.

In Combination with Other SWMP Techniques:

Trumpet Sounds to Tongue Rams:

https://youtu.be/C8ViRu5lJsA

The trumpet sounds technique can be seamlessly integrated with the tongue ram technique. While the pitch of the tongue ram closely matches that of trumpet sounds, there are subtle differences in the same fingerings. To aid in developing the trumpet sound pitch, a saxophonist can use the tongue ram as a close reference for the fundamental pitch of the trumpet sound. Swift transitions between these two techniques are feasible and can be effectively utilized in performance.

Trumpet Sounds to Air Pitch:

https://youtu.be/BdsCX4aOSFQ

Trumpet sounds can be easily combined with the air pitch technique, though the resultant pitches will differ even when similar fingerings are used. If a composer wishes to blend these techniques, it is recommended to instruct the saxophonist to perform the air pitch technique with a "straight on" playing position. There is an inherent dynamic inconsistency between these two techniques, which the saxophonist must address through dynamic scaling or which the composer can utilize creatively. The speed of transition between the techniques can be quite rapid, depending on the distance between the neckpiece and the saxophonist's mouth while performing the air pitch technique. This close distance may allow for a seamless transition between the two techniques.

Trumpet Sounds to Saxo-Flute Hybridity:
https://youtu.be/9GyjNTGh9W0
Creating a smooth transition between trumpet sounds and saxo-flute hybridity is challenging. Due to the drastically different embouchures required for each technique, making fluid and rapid succession is nearly impossible. However, the inherent change in tone quality between these techniques can create striking sonic shifts in both compositions and improvisations. Since the transpositions between the two techniques differ significantly, saxophonists and composers should consult the respective fingering charts to achieve similar sonic results when transitioning from one fingering to the next.

In Combination with Other Techniques:
Trumpet Sounds and Growl/Singing:
https://youtu.be/Ftjl4pBEPuU
Playing trumpet sounds and singing simultaneously is feasible. However, the balance between the trumpet sounds and the singing voice may require adjustment based on the dynamic level demanded. Often, the singing voice can become quite harsh due to the interaction of lip buzzing and vocal production. This unique combination can be employed to create harmonies with a typically monophonic instrument, enriching the overall texture and expanding sonic possibilities.

Trumpet Sounds to Normal Playing:
https://youtu.be/DtRJY4BrIsw
Combining any SWMP techniques with traditional playing using the mouthpiece is possible, though there are a few important considerations to keep in mind.

Firstly, the transition time required to reattach the mouthpiece is significant. Allow the saxophonist approximately five to ten seconds to pick up the mouthpiece, properly place it on the instrument, adjust the neckstrap if necessary, and prepare to play with the mouthpiece again. This delay can also be used creatively, for example to generate musical drama through silence or by emphasizing the physical act of removing or replacing the mouthpiece. Alternatively, a composer may choose to fill this transition with different musical material or techniques.

Secondly, there is the possibility of the mouthpiece making noise as it rubs against the cork of the neckpiece. While applying cork grease before performing can mitigate this noise, it is not a guaranteed solution. Composers might also consider incorporating this rubbing sound into their compositions.

The third factor to consider is the tuning of the instrument after reattaching the mouthpiece. While this is typically not a major issue since experienced saxophonists will intuitively know where to place the mouthpiece to play in tune, it is important to acknowledge that this intuition is not foolproof. If precise tuning is critical, composers should include a designated moment in the piece for the saxophonist to retune.

4.8 - Pitch Manual for Trumpet Sounds

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / Bb3	209.63	210.7	211.15	215.03	**211.6275**	2.36	**G#3 plus 33 cents**
B3	220.65	224.63	226.65	227.06	**224.7475**	2.93	**A3 plus 37 cents**
C4	240.08	241.63	242.34	244.92	**242.2425**	2.02	**B3 minus 33 cents**
C#4 / Db4	259.14	259.37	259.26	259.68	**259.3625**	0.23	**C4 minus 15 cents**
D4	272.31	273.13	275.99	273.88	**273.8275**	1.58	**C#4 minus 21 cents**
D#4 / Eb4	293.68	291.58	292.52	289.72	**291.875**	1.67	**D4 minus 11 cents**
E4	310.4	313.92	313.76	313.78	**312.965**	1.71	**D#4 plus 10 cents**
F4	328.69	331.35	330.21	329.45	**329.925**	1.13	**E4 plus 2 cents**
F#4 / Gb4	347.43	355.52	354.67	354.26	**352.97**	3.73	**F4 plus 18 cents**
G4	369.88	368.01	371.34	371.64	**370.2175**	1.66	**F#4 plus 1 cent**
G#4 / Ab4	400.82	393.59	396.77	399.67	**397.7125**	3.23	**G4 plus 25 cents**
A4	427.23	432.16	434.5	432.47	**431.59**	3.09	**A4 minus 33 cents**
A#4 / Bb4	456.24	462.08	463.66	466.05	**462.0075**	4.18	**A#4 minus 16 cents**
B4	502.54	504.6	500.22	501.23	**502.1475**	1.89	**B4 plus 29 cents**
C5	519.34	530.96	524.49	523.56	**524.5875**	4.80	**C5 plus 4 cents**
C#5 / Db5	564.11	569.28	560.66	565.02	**564.7675**	3.55	**C#5 plus 32 cents**
D5	576	577.77	579.76	576.99	**577.63**	1.59	**D5 minus 29 cents**
D#5 / Eb5	599.86	606.22	606.52	608.23	**605.2075**	3.67	**D#5 minus 48 cents**
E5	658.69	659.9	651.89	657.87	**657.0875**	3.56	**E5 minus 6 cents**
F5	694.21	698.1	700.28	703.63	**699.055**	3.95	**F5 plus 1 cent**
F#5 / Gb5	753.18	754.69	754.65	753.16	**753.92**	0.87	**F#5 plus 32 cents**
G5	824.28	826.58	810.24	807.19	**817.0725**	9.78	**G#5 minus 28 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	143.19	145.08	144.93	144.33	**144.3825**	0.86	**D3 minus 29 cents**
B3	154.08	154.06	154.52	154.04	**154.175**	0.23	**D#3 minus 16 cents**
C4	161.42	161.56	162.19	161.08	**161.5625**	0.46	**E3 minus 34 cents**
C#4 / D♭4	169.43	170.9	170.75	169.72	**170.2**	0.73	**F3 minus 44 cents**
D4	178.65	179.38	179.26	181.45	**179.685**	1.22	**F3 plus 50 cents**
D#4 / E♭4	186.9	188.9	190.25	190.42	**189.1175**	1.63	**F#3 plus 38 cents**
E4	198.57	200.41	200.36	200.56	**199.975**	0.94	**G3 plus 35 cents**
F4	210.39	209.36	211.68	212.52	**210.9875**	1.39	**G#3 plus 28 cents**
F#4 / G♭4	223.71	224.38	225	225.82	**224.7275**	0.90	**A3 plus 37 cents**
G4	239.22	240.84	241.5	243.76	**241.33**	1.88	**B3 minus 40 cents**
G#4 / A♭4	257.89	252.47	254.96	257.86	**255.795**	2.61	**C4 minus 39 cents**
A4	275.29	273.37	275.95	277.74	**275.5875**	1.80	**C#4 minus 10 cents**
A#4 / B♭4	292.63	291.18	291.73	294.15	**292.4225**	1.30	**D4 minus 7 cents**
B4	313.26	314.9	316.75	313.83	**314.685**	1.54	**D#4 plus 20 cents**
C5	326.61	324.04	335.96	336.72	**330.8325**	6.45	**E4 plus 6 cents**
C#5 / D♭5	353.06	348.5	350.41	347.84	**349.9525**	2.34	**F4 plus 4 cents**
D5	370.32	371.71	371.98	372.56	**371.6425**	0.95	**F#4 plus 8 cents**
D#5 / E♭5	393.2	394.13	395.34	391.74	**393.6025**	1.52	**G4 plus 7 cents**
E5	415.55	420.18	422.24	422.24	**420.0525**	3.15	**G#4 plus 20 cents**
F5	442.02	455.05	459.12	459.28	**453.8675**	8.14	**A#4 minus 46 cents**
F#5 / G♭5	487.75	487.22	489.48	490.82	**488.8175**	1.65	**B4 minus 18 cents**
G5	522.07	526.75	525.91	527.71	**525.61**	2.47	**C5 plus 8 cents**
G#5 / A♭5	571.86	566.98	567.47	567.78	**568.5225**	2.25	**C#5 plus 44 cents**
A5	606.01	612.96	608.07	612.23	**609.8175**	3.33	**D#5 minus 35 cents**
A#5 / B♭5	644.57	644.55	640.9	648.21	**644.5575**	2.98	**E5 minus 39 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	107.73	107.45	108.72	108.8	**108.175**	0.69	**A2 minus 29 cents**
B3	115.19	114.37	117.88	114.71	**115.5375**	1.60	**A#2 minus 15 cents**
C4	122.18	122.48	122.94	122.17	**122.4425**	0.36	**B2 minus 14 cents**
C#4 / D♭4	130.01	129.45	129.13	128.4	**129.2475**	0.67	**C3 minus 21 cents**
D4	137.93	137.89	136.59	138.12	**137.6325**	0.70	**C#3 minus 12 cents**
D#4 / E♭4	147.28	143.76	145.79	145.33	**145.54**	1.45	**D3 minus 15 cents**
E4	156.43	158.72	158.36	158.74	**158.0625**	1.10	**D#3 plus 28 cents**
F4	164.62	163.6	165.76	166.87	**165.2125**	1.41	**E3 plus 4 cents**
F#4 / G♭4	174.07	176.12	176.7	178.35	**176.31**	1.77	**F3 plus 17 cents**
G4	185.41	187.66	185.83	185.78	**186.17**	1.01	**F#3 plus 11 cents**
G#4 / A♭4	195.72	198.19	199.56	200.29	**198.44**	2.01	**G3 plus 21 cents**
A4	212.37	213.13	210.79	213.08	**212.3425**	1.09	**G#3 plus 39 cents**
A#4 / B♭4	224.2	223.91	225.91	226.02	**225.01**	1.11	**A3 plus 39 cents**
B4	237.44	237.94	236.52	238.89	**237.6975**	0.99	**A#3 plus 34 cents**
C5	254.16	255.08	255.13	258.68	**255.7625**	2.00	**C4 minus 39 cents**
C#5 / D♭5	272.43	272.43	272.33	273.49	**272.67**	0.55	**C#4 minus 28 cents**
D5	282.66	283.67	284.78	284.36	**283.8675**	0.93	**C#4 plus 41 cents**
D#5 / E♭5	298.81	300	300.25	300.48	**299.885**	0.74	**D4 plus 36 cents**
E5	321.74	322.4	319.14	322.12	**321.35**	1.50	**E4 minus 44 cents**
F5	341.16	341.63	340.37	342.61	**341.4425**	0.94	**F4 minus 39 cents**
F#5 / G♭5	370.78	369.77	366.95	366.55	**368.5125**	2.08	**F#4 minus 7 cents**
G5	396.3	398.31	400.36	397.34	**398.0775**	1.73	**G4 plus 27 cents**
G#5 / A♭5	424.43	422.36	424	423.32	**423.5275**	0.90	**G#4 plus 34 cents**
A5	457.18	454.68	453.71	455.56	**455.2825**	1.47	**A#4 minus 41 cents**

A#5 / B♭5	483.4	494.09	494.53	495.37	**491.8475**	5.66	**B4 minus 7 cents**
B5	532.17	530.43	528.48	554.35	**536.3575**	12.09	**C5 plus 43 cents**
C6	583.5	581.8	581.98	580.68	**581.99**	1.16	**D5 minus 16 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3 - 1°	133.45	132.7	135.2	136.47	**134.455**	1.70	**C3 plus 48 cents**
A#3 / B♭3 - 1°	147.75	147.13	146.79	142.48	**146.0375**	2.40	**D3 minus 9 cents**
B3- 1°	153.06	153.51	151.98	155.88	**153.6075**	1.65	**D#3 minus 22 cents**
C4 - 1°	162.01	162.67	162.4	162.66	**162.435**	0.31	**E3 minus 25 cents**
C#4 / D♭4 - 1°	174.78	173.31	174.52	174.97	**174.395**	0.75	**F3 minus 2 cents**
D4 - 1°	183.41	185.08	185.15	185.82	**184.865**	1.03	**F#3 minus 1 cent**
D#4 / E♭4 - 1°	194.83	194.84	196.26	194.84	**195.1925**	0.71	**G3 minus 7 cents**
E4 - 1°	205.35	203.27	209.34	209.05	**206.7525**	2.95	**G#3 minus 8 cents**
F4 - 1°	218.31	221.67	222.25	223.17	**221.35**	2.12	**A3 plus 11 cents**
F#4 / G♭4 - 1°	236.35	238.69	238.18	240.15	**238.3425**	1.57	**A#3 plus 39 cents**
G4 - 1°	251.44	252.89	253.6	252.22	**252.5375**	0.92	**B3 plus 39 cents**
G#4 / A♭4 - 1°	268	270.46	270.79	271.96	**270.3025**	1.66	**C#4 minus 44 cents**
A4 - 1°	288.87	287.92	290.03	292.59	**289.8525**	2.02	**D4 minus 23 cents**
A#4 / B♭4 - 1°	306.97	309.44	309.62	312.33	**309.59**	2.19	**D#4 minus 9 cents**
B4 - 1°	336.54	335.76	336.7	335.04	**336.01**	0.77	**E4 plus 33 cents**
C5 - 1°	355.31	357.36	358.31	361.71	**358.1725**	2.67	**F4 plus 44 cents**
C#5 / D♭5 - 1°	390.35	390.27	393.6	393.98	**392.05**	2.02	**G4 plus 0 cents**
D5 - 1°	416.46	414.05	413.81	415.43	**414.9375**	1.24	**G#4 minus 2 cents**
D#5 / E♭5 - 1°	418.04	418.66	421.94	421.69	**420.0825**	2.02	**G#4 plus 20 cents**
E5 - 1°	441.15	442.53	437.79	442.35	**440.955**	2.20	**A4 plus 4 cents**
F5 - 1°	477.46	477.43	477.07	478.17	**477.5325**	0.46	**A#4 plus 42 cents**

F#5 / G♭5 - 1°	495.52	497.72	496.86	494.92	**496.255**	1.27	**B4 plus 8 cents**
G5 - 1°	537.64	537.84	538.91	540.67	**538.765**	1.39	**C#5 minus 49 cents**
G#5 / A♭5 - 1°	586.37	586.65	589.99	588.65	**587.915**	1.72	**D5 plus 2 cents**
A5 - 1°	597.98	590.98	598.06	598.36	**596.345**	3.58	**D5 plus 26 cents**
D5 - 2°	278.57	279.92	281	281.21	**280.175**	1.21	**C#4 plus 19 cents**
D#5 / E♭5 - 2°	292.22	298.25	298.78	298.82	**297.0175**	3.21	**D4 plus 20 cents**
E5 - 2°	317.48	319.31	319.54	320.85	**319.295**	1.39	**D#4 plus 45 cents**
F5 - 2°	337.88	341.62	342.25	343.54	**341.3225**	2.43	**F4 minus 40 cents**
F#5 / G♭5 - 2°	367.36	366.7	368.75	371.8	**368.6525**	2.27	**F#4 minus 6 cents**
G5 - 2°	393.76	397.65	398.16	398.54	**397.0275**	2.21	**G4 plus 22 cents**
G#5 / A♭5 - 2°	428.87	429.08	429.55	429.18	**429.17**	0.28	**A4 minus 43 cents**
A5 - 2°	459.76	456.67	457.03	456.85	**457.5775**	1.46	**A#4 minus 32 cents**
A#/B♭ 5 - 2°	501.15	501.2	493.18	497.25	**498.195**	3.82	**B4 plus 15 cents**

Chapter 5
Saxo-Flute Hybridity

5.1 - Description of Technique - https://youtu.be/y0Z5muhbog8

Saxo-flute hybridity is a technique in which the saxophone is played in a manner similar to a flute or the ney (an ancient Egyptian wind instrument, considered the ancestor of the modern-day flute, still practiced in the world today, especially in folk music traditions of the near and middle East). [Plays an improvisation using the saxo-flute hybridity technique]. Acoustically, this technique is a direct evolution of the air pitch technique. However, unlike the air pitch technique, the performer blows across the open hole of the neck to produce full-bodied pitches. Changes in pitch occur through manipulation of the keywork, while different octaves can be played by adjusting the embouchure and airflow. [Demonstrates.] Sound quality and timbre are influenced by the flexibility of the embouchure, the speed of airflow, and the air pressure. Sometimes, an airy sound may accompany the technique; however, if desired and with practice and experience, this can be minimized. Given that the saxophone is a conical instrument not technically designed for such playing, considerable effort is required to produce the desired effects. Despite this challenge, the technique can be effectively applied to all four main saxophones.

5.2 - Technical Parameters - https://youtu.be/zHGcLtJUadM

Embouchure:
The saxophonist must adopt a new embouchure to execute this technique, closely resembling that used for the flute and the ney. Begin by puckering the lips as if pronouncing the word “pooh.” Position the saxophone neck between the lips, and direct a focused stream of air over the hole in the neckpiece. Adjust the angle of the saxophone neck as needed to achieve the desired sound. [Demonstrates].

Transposition:
The transposition of saxo-flute hybridity closely follows the detuned scale defined in the air pitch technique. However, determining a comprehensive transposition is impossible due to the absence of the mouthpiece.

Range:
As of today, the range of saxo-flute hybridity remains highly limited, in large part due to the lack of training on the part of the saxophonist and to the conical shape of the tube which is not designed to produce sounds in this way. The functional range, which every saxophonist should familiarize themselves with as a basis, spans from C5 to F#5 (G5 on soprano), utilizing the palm keys from D5 upwards. [Demonstrates range on alto]. However, this range may be extended further depending on the performer's comfort and skill level with the technique and embouchure manipulation. Yet, as they explore the lower tessitura of this technique, it becomes more difficult to produce audible pitches.
For more advanced players, the range can be extended by over- or under-blowing the base octave much in the same way that a flutist will overblow to the octave:

- Soprano: The technique can be extended from F#4 to G5.
- Alto: Two octaves are possible. The lower octave ranges from B♭4 to F#5, while the middle octave ranges from D#4 to F#5.
- Tenor: Two octaves are possible. The middle octave ranges from E4 to F#5, while the higher octave ranges from G4 to F#5.
- Baritone: There are four different octaves that the player can execute. In the low octave, the range is B4 to F#5. In the middle octave, the range is C5 to F#5. In the high octave, the range is C5 to F#5. Additionally, by overblowing into this higher octave, one can attain a limited altissimo range of D5 to E♭5.

To hear the full range on each of the four main saxophones, click on the chromatic scale video in the section entitled Demonstration Videos.

Discussion:
Saxo-flute hybridity is a rather new phenomenon in the history of saxophone playing. For this reason, not many saxophonists have either heard them or seen them in written music. Despite this, several contemporary musicians have taken these techniques to heart. Apart from myself, for example Philippe Geiss and Ola Asdahl Rokkones, have made these techniques an integral part of their artistic practice.

My first introduction to saxo-flute hybridity was hearing Geiss perform live. Geiss is a staunch advocate for this technique, especially on sopranino saxophone. It was from his performance that I started to grow curious about this way of playing the saxophone. Here is an excerpt from one of those concerts featuring Geiss as soloist. [Short excerpt of *Calderosaxo* (2012) by Phillipe Geiss plays] In this work, *Caldersaxo* for 12 saxophones and saxophone solo (2012), the soloist is asked to improvise on written out chord progressions in a legato style. In doing so, Geiss weaves a dreamy sound world to the opening of this rhythmically active work.[39]

Another deeply devoted saxophonist to this technique is Ola Asdahl Rokkones. He has developed it for several years, performing his own works or those of Scandinavian composers. Memorable is his work in the mixed ensemble Zwei-Mann-Orchester (two musicians playing various instruments at once) where many techniques are used to create a rich tapestry of sounds. Notable is the use of saxo-flute hybridity in the work *Scener fra et Nabolag* (2015) composed by Lars Skoglund. Here the tenor saxophone, played by Rokkones, is used to create flute sounds in between trumpet sounds from the other musician on the baritone saxophone.

Kientzy is the only author to mention the saxo-flute hybridity technique, briefly in his *Saxologie*. He classifies its sounds as "possessing the qualities of the flute and that of the ney" (Kientzy 2007: 511). Kientzy therefore names it the "saxnay technique." The analogy

[39] Interestingly, many of the supporting musicians are asked to play saxophone without mouthpiece techniques as well.

comes from the position of the lips to the open bocal used to create the characteristic sounds, much in the same way that the ney is performed.

Kientzy falsely claims that the technique is only possible on the higher saxophones (sopranino, soprano, and alto saxophones). However, the ranges for the soprano and alto saxophones are inconsistent with the current possibilities on these instruments. Moreover, the outlined transposition and pitches that are detailed are inconsistent with my own findings on the same saxophones. Below, in the Video Demonstration section, you will find examples of me performing this technique on all four standard saxophones.

5.3 - Performance and Practice - https://youtu.be/TpHacwEZbSA

Dynamic Range:
In general, the dynamic range of saxo-flute hybridity is dependent on several factors, including the saxophonist's comfort with producing these sounds, the type of saxophone being used, the desired octave, and the fingering employed. Typically, dynamics can have a broad range between *ppp* to *fff*. I will demonstrate the two different octaves available on alto saxophone: [Demonstrates].

Articulation:
Articulation is entirely possible while producing saxo-flute hybridity sounds. Saxophonists should shift away from their conventional understanding of playing when approaching this technique. To perform it effectively, put the tongue behind the top teeth at the soft palate and articulate naturally, as if producing the consonant "TOO." It is crucial to control the speed of articulation to execute consistent articulations without losing the base saxo-flute hybridity pitch. [Demonstrates].

Glissandi:
Due to the fragile nature of the sounds produced, saxophonists must approach the saxo-flute hybridity technique delicately. Despite this delicacy, glissandi are inherently possible. Depending on the starting and ending notes of the desired glissando, there are two effective ways to execute it.
Fingered Glissando:
The first technique involves using the keys, which will be familiar to saxophonists as it is commonly used in regular playing. Simply hold a note and slowly depress or open the key preceding or succeeding the base note. [Demonstrates].
Embouchure Glissando:
The second method involves using the embouchure and air to perform a glissando. This approach may present challenges related to maintaining sound stability and endurance in sustaining the new embouchure and air pressure. While holding the base note, direct the airstream either downwards or upwards, depending on the intended direction of the glissando. At the same time, adjust the openness of the throat to match the note being

targeted with the glissando. While this second method requires significant practice, it proves effective in many situations. [Demonstrates].

Vibrato:
Developing vibrato within this technique can greatly enhance expression in the sound. Saxophonists aiming to achieve this effect should study how similar wind instruments – particularly the flute – produce vibrato. Instead of relying on jaw movements, which is common for saxophonists, use the air to create streams of vibrating columns, similar to techniques used by singers or flutists. [Demonstrates]. For further information on flute vibrato development, excellent pedagogical resources such as *The Techniques of Flute Playin*g by Carin Levine and Christina Mitropoulos-Bott, *The Flute Vibrato Book* by Patricia George and Phyllis Avidan Louke, or *Practice Book for the Flute* by Trevor Wye, are available. While my research does not delve into the debate on how vibrato should be performed on the flute, it serves to provide a context for saxophonists to consider and adjust their common vibrato usage.

5.4 - Personal Development - https://youtu.be/aamQ-1ff7Gs

It is crucial for saxophonists to develop muscle memory with the new embouchure and to find the optimal angle for the neckpiece to produce a full-bodied flute sound rather than just an air pitch. [Demonstrates].
Begin by working exclusively with the neckpiece of an alto saxophone. Experiment with different angles and air pressures to achieve the desired sound. Practice repeatedly to find the angle that consistently produces the desired result. [Demonstrates].
Next, before attaching the neck to the saxophone body and introducing keywork, focus on producing pitches at the octave. [Demonstrates]. This will enhance flexibility and familiarize musicians with the new air usage and embouchure manipulation.
Once octaves can be produced consistently and easily, progress to adding keys. Attach the neckpiece to the saxophone body and open the C1 key. Slur between the D with the C1 key and the open C#. Gradually add keys ascending the scale to F#. [Demonstrates]. When comfortable with this, work at the higher octave, gradually adding keys ascending the scale to F# again. [Demonstrates].
To introduce lower pitches, descend from the D. Manipulating the tube while descending may prove to be a challenge at first, but with practice, it is possible to produce lower pitches. [Demonstrates].

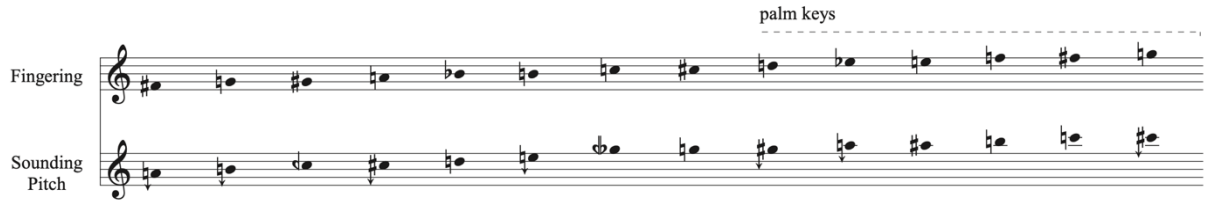
5.5 - Pedagogy - https://youtu.be/pi2EwvfHuJA

If necessary, adjust the neckstrap to the proper height so that the neckpiece is aligned with the mouth. [Demonstrates]. Position the neckpiece halfway between the lips. [Demonstrates]. If performing on soprano saxophone, consider holding the instrument to the right, in a typical flute or ney fashion. [Demonstrates]. Form the “pooh” embouchure with the mouth. [Demonstrates]. Prepare the desired fingering. [Demonstrates]. Breathe

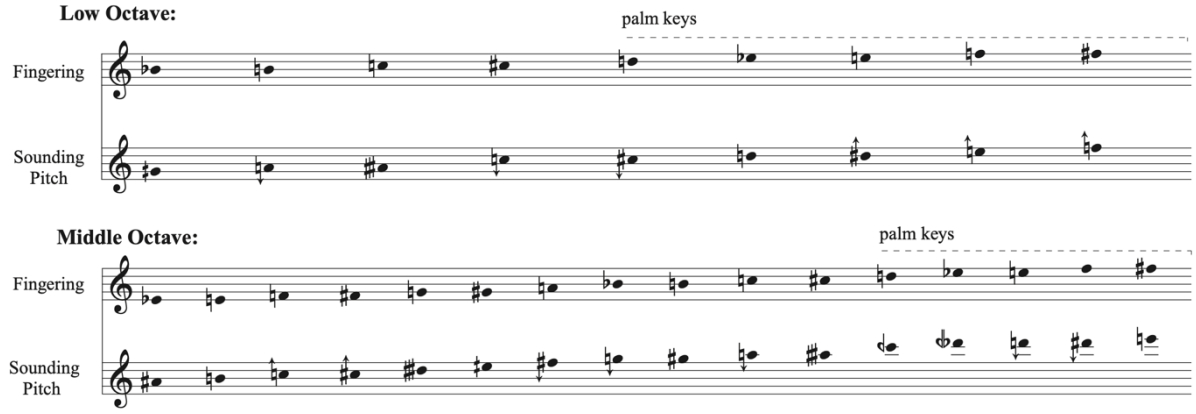
in. [Demonstrates]. Exhale with a fast airstream into the saxophone producing the saxo-flute hybridity technique. [Demonstrates].

5.6 - Transposition Charts for Saxo-Flute Hybridity

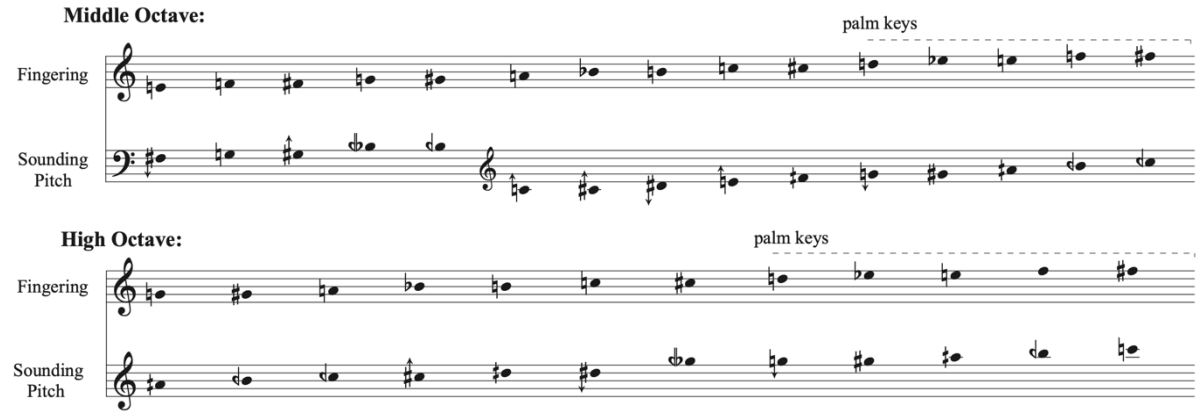
Soprano Saxophone



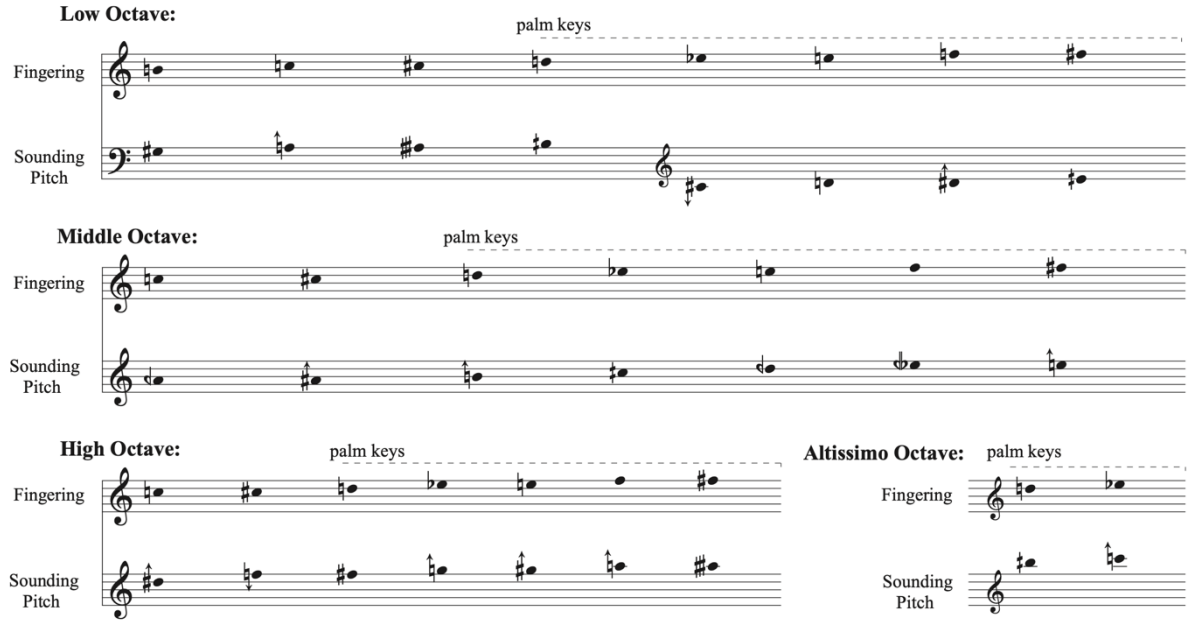
Alto Saxophone



Tenor Saxophone



Baritone Saxophone



5.7 - Demonstration Videos for Saxo-Flute Hybridity

Below, I will demonstrate the saxo-flute hybridity technique on all four main saxophones, show various transitions with the other SWMP techniques, and perform combinations with singing and common practice saxophone playing. Each video is accompanied by a brief text for further elaboration.

Chromatic Scale Played on Soprano, Alto, Tenor, and Baritone Saxophones:
https://youtu.be/BVQQB7Mpsho
Here, I demonstrate the saxo-flute hybridity technique across all four main saxophones. The technique is more challenging to execute fully in the lower tessitura. Saxophonists will need to dedicate considerable time to developing control in the lower registers to achieve optimal results.

Articulations:
https://youtu.be/scpMLyE9jac
Single Tongue:
Saxophonists should shift away from the conventional method of articulation and instead adapt their knowledge of single tongue articulation, with a focus on developing both speed and accuracy while maintaining the specific embouchure required for saxo-flute hybridity. The most essential element is to maintain clarity of sound despite introducing the tongue in order to articulate.
Double Tongue:
Similarly, double tongue articulations can be adapted from common practice techniques. It is important to maintain a rapid tongue speed when alternating between the front and back of the soft palate. The articulation structures I recommend are “TOO KOO” for shorter, more staccato double tonguing, and “DUH GUH” for more legato double tonguing passages.
Flutter Tongue:
As with the air pitch and trumpet sounds techniques, flutter tonguing can be combined with saxo-flute hybridity too. However, with saxo-flute hybridity it is crucial to maintain the correct embouchure and angle of the saxophone; the front rolling “R” may disrupt the airflow too significantly, potentially causing a lapse in sound production. Conversely, the back rolling “R” might be too subtle to be heard clearly without amplification.

Glissandi:
https://youtu.be/WdnYBfB4lBg
Similar to the trumpet sounds technique, glissandi are highly effective in saxo-flute hybridity. The method for producing the required glissando largely depends on the specific pitches involved. Most saxophonists are accustomed to employing various methods to achieve the desired intervals. By combining different fingerings and adjusting the throat opening, a wide range of possibilities exists for creating a smooth and fluid pitch shift.

Vibrato:
https://youtu.be/ZCLv7NXVYGE
Vibrato should be approached similarly to the way singers or flutists practice it. Undulations should be achieved through modulation of the air rather than through the jaw, as is common in traditional saxophone playing. It is advisable to integrate pedagogical methods from flute playing, and to approach vibrato systematically, focusing on gradually increasing speed and consistency.

In Combination with Other SWMP Techniques:
Saxo-Flute Hybridity to Air Pitch:
https://youtu.be/yoNWXABL0fg
Combining saxo-flute hybridity with air pitch is quite logical, as the air pitch technique can be seen as a precursor to saxo-flute hybridity. The pitched sound produced through air pitch serves as a "shadow" of the fully developed sound produced by saxo-flute hybridity. To facilitate a smooth transition, it is advisable to use an air pitch from a playing position that complements the saxo-flute hybridity technique, particularly if the transition needs to be executed quickly.

Saxo-Flute Hybridity to Tongue Ram Technique:
https://youtu.be/A6dR_R9ErB4
The primary challenge in combining saxo-flute hybridity with the tongue ram technique lies in the need to reposition the entire saxophone body and neck. In order to produce the saxo-flute hybridity technique, a saxophonist must adjust the angle of the instrument to blow correctly across the aperture hole of the neckpiece. This contrasts with the embouchure required to produce a successful tongue ram. Although this adjustment can be mastered through dedicated practice, it is advisable to allow the performer a second or two to properly position the saxophone.

Saxo-Flute Hybridity to Trumpet Sounds:
https://youtu.be/FBXgYTjRDf4
Achieving a smooth transition between saxo-flute hybridity and trumpet sounds is challenging due to the significantly different embouchures required, making rapid and fluid succession nearly impossible. Nevertheless, the inherent tonal shift between these techniques can result in striking sonic contrasts. Given the substantial differences in transpositions between the two techniques, performers and composers should refer to the respective fingering charts to achieve consistent sonic results when transitioning from one technique to the other.

In combination with Other Techniques:
Saxo-Flute Hybridity and Singing:
https://youtu.be/40IwcTvDO00
Singing while performing saxo-flute hybridity can be an effective auxiliary technique, enabling the production of multiple pitches simultaneously. The primary challenge lies in maintaining the precise embouchure and angle required for playing the saxo-flute hybridity technique while also singing.

Saxo-Flute Hybridity to Normal Playing:
https://youtu.be/626DGywlNHU
As with all saxophone techniques performed without the mouthpiece, it is possible to combine saxo-flute hybridity with common practice playing. The primary challenge is reattaching the mouthpiece to the neckpiece. Composers should allow saxophonists approximately five to ten seconds to replace the mouthpiece, return to the normal playing position, adjust their neckstrap, and wet the reed. Additionally, they should consider how to address the silence that occurs during the transition between common practice playing and SWMP techniques.

5.8 - Pitch Manual for Saxo-Flute Hybridity

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
F#4 / G♭4	436.11	437.19	436.24	438.39	**436.9825**	1.05	**A4 minus 12 cents**
G4	X	482.69	496	485.63	**488.1066667**	6.99	**B4 minus 20 cents**
G#4 / A♭4	510.14	512.96	508.33	513.97	**511.35**	2.58	**C5 minus 40 cents**
A4	550.4	550.8	550.77	551.2	**550.7925**	0.33	**C#5 minus 11 cents**
A#4 / B♭4	586.74	592.53	589.81	583.74	**588.205**	3.80	**D5 plus 3 cents**
B4	654.23	655.3	653.02	654.33	**654.22**	0.93	**E5 minus 13 cents**
C5	730.15	722.74	721.38	720.99	**723.815**	4.29	**F#5 minus 38 cents**
C#5 / D♭5	780.34	781.32	780.49	780.46	**780.6525**	0.45	**G5 minus 7 cents**
D5 (with palm keys)	811.94	827.51	826.87	828.38	**823.675**	7.85	**G#5 minus 15 cents**
D#5 / E♭5 (with palm keys)	873.01	869.77	870.96	879.56	**873.325**	4.37	**A5 minus 13 cents**
E5 (with palm keys)	926.99	937.65	929.43	926.18	**930.0625**	5.24	**A#5 minus 4 cents**
F5 (with palm keys)	985.14	985.4	987.43	994.01	**987.995**	4.14	**B5 plus 0 cents**
F#5 / G♭5 (with palm keys)	1035.97	1043.18	1040.27	1049.26	**1042.17**	5.58	**C6 minus 7 cents**
G5 (with palm keys)	1093.91	1108.74	1096.14	1109.11	**1101.975**	8.08	**C#6 minus 11 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#4 / B♭4 - Low Octave	402.44	401.79	401.06	398.47	**400.94**	1.74	**G4 plus 39 cents**
B4 - Low Octave	438.62	435.99	435.54	437.99	**437.035**	1.50	**A4 minus 12 cents**
C5 - Low Octave	476.25	476.27	473.9	475.88	**475.575**	1.13	**A#4 plus 35 cents**
C#5 / D♭5 - Low Octave	519.66	519.03	514.73	520.65	**518.5175**	2.61	**C5 minus 16 cents**
D5 (with palm keys) - Low Octave	547.13	545.22	547.64	548.09	**547.02**	1.26	**C#5 minus 23 cents**
D#5 / E♭5 (with palm keys) - Low Octave	587.95	588.63	589.66	589.05	**588.8225**	0.72	**D5 plus 4 cents**

E5 (with palm keys) - Low Octave	621.06	622.94	627.5	632.18	**625.92**	4.97	**D#5 plus 10 cents**
F5 (with palm keys) - Low Octave	667.21	664.22	665.21	664.45	**665.2725**	1.36	**E5 plus 16 cents**
F#5 / G♭5 (with palm keys) - Low Octave	700.15	710.73	704.31	710.24	**706.3575**	5.06	**F5 plus 19 cents**
D#4 / E♭4 - Mid Octave	466.59	466.65	464.69	463.01	**465.235**	1.74	**A#4 minus 3 cents**
E4 - Mid Octave	493.77	487.97	492.06	488.99	**490.6975**	2.69	**B4 minus 11 cents**
F4 - Mid Octave	528.14	525.99	529.7	528.12	**527.9875**	1.52	**C5 plus 16 cents**
F#4 / G♭4 - Mid Octave	560.85	561.29	556.86	556.52	**558.88**	2.54	**C#5 plus 14 cents**
G4 - Mid Octave	632.77	632.94	632.98	633.86	**633.1375**	0.49	**D#5 plus 30 cents**
G#4 / A♭4 - Mid Octave	675.13	681.5	683.01	675.24	**678.72**	4.13	**E5 plus 50 cents**
A4 - Mid Octave	730.25	732.26	724.36	729.32	**729.0475**	3.36	**F#5 minus 26 cents**
A#4 / B♭4 - Mid Octave	767.29	780.93	778.35	779.75	**776.58**	6.28	**G5 minus 16 cents**
B4 - Mid Octave	829.54	827.76	829.27	830.66	**829.3075**	1.19	**G#5 minus 3 cents**
C5 - Mid Octave	871.73	871.49	876.13	862.15	**870.375**	5.88	**A5 minus 19 cents**
C#5 / D♭5 - Mid Octave	952.58	951.62	950.44	942.51	**949.2875**	4.60	**A#5 plus 31 cents**
D5 (with palm keys) - Mid Octave	1017.1	1020.09	1015.66	1022.94	**1018.9475**	3.24	**C6 minus 46 cents**
D#5 / E♭5 (with palm keys) - Mid Octave	1078.89	1082.02	1089.15	1097.42	**1086.87**	8.24	**C#6 minus 34 cents**
E5 (with palm keys) - Mid Octave	1157.28	1165.98	1160.97	1167.53	**1162.94**	4.70	**D6 minus 17 cents**
F5 (with palm keys) - Mid Octave	1226.2	1223.29	1229.68	1232.34	**1227.8775**	3.96	**D#6 minus 23 cents**
F#5 / G♭5 (with palm keys) - Mid Octave	1310.78	1315.21	1309.93	1322.08	**1314.5**	5.56	**E6 minus 5 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
E4 - Mid Octave	182.47	186.43	183.43	183.28	**183.9025**	1.74	**F#3 minus 10 cents**
F4 - Mid Octave	195.56	194.58	195	195.66	**195.2**	0.51	**G3 minus 7 cents**
F#4 / G♭4 - Mid Octave	212.56	209.39	210.57	210.39	**210.7275**	1.33	**G#3 plus 25 cents**
G4 - Mid Octave	229.54	226.46	227.47	226.61	**227.52**	1.42	**A#3 minus 42 cents**

G#4 / A♭4 - Mid Octave	241.13	241.81	242.37	242	**241.8275**	0.52	**B3 minus 36 cents**
A4 - Mid Octave	267.26	260.64	263.57	261.82	**263.3225**	2.89	**C4 plus 11 cents**
A#4 / B♭4 - Mid Octave	283.73	282.1	279.57	280.19	**281.3975**	1.89	**C#4 plus 26 cents**
B4 - Mid Octave	304.05	307.8	306.17	308.4	**306.605**	1.95	**D#4 minus 25 cents**
C5 - Mid Octave	331.93	333	330.91	334.02	**332.465**	1.34	**E4 plus 15 cents**
C#5 / D♭5 - Mid Octave	360.29	358.68	360.46	357.18	**359.1525**	1.54	**F4 plus 49 cents**
D5 (with palm keys) - Mid Octave	387.56	389.09	386.75	383.47	**386.7175**	2.37	**G4 minus 23 cents**
D#5 / E♭5 (with palm keys) - Mid Octave	414.77	416.73	416.97	419.54	**417.0025**	1.96	**G#4 plus 7 cents**
E5 (with palm keys) - Mid Octave	447.27	448.04	449.02	448.01	**448.085**	0.72	**A4 plus 32 cents**
F5 (with palm keys) - Mid Octave	476.89	481.66	489.55	480.53	**482.1575**	5.33	**B4 minus 42 cents**
F#5 / G♭5 (with palm keys) - Mid Octave	509.68	510.12	515.03	512.55	**511.845**	2.47	**C5 minus 38 cents**
G4 - High Octave	448.03	458.27	453.55	451.21	**452.765**	4.31	**A4 plus 50 cents**
G#4 / A♭4 - High Octave	483.12	486.91	485.91	485.48	**485.355**	1.61	**B4 minus 30 cents**
A4 - High Octave	525.41	519.03	520.72	515.27	**520.1075**	4.21	**C5 minus 10 cents**
A#4 / B♭4 - High Octave	556.63	567.63	565.72	564.65	**563.6575**	4.84	**C#5 plus 29 cents**
B4 - High Octave	602.01	601.77	600.13	602.18	**601.5225**	0.94	**D5 plus 41 cents**
C5 - High Octave	X	633.8	631.65	630.41	**631.9533333**	1.72	**D#5 plus 27 cents**
C#5 / D♭5 - High Octave	720.35	724.66	719.24	724.31	**722.14**	2.75	**F#5 minus 42 cents**
D5 (with palm keys) - High Octave	775.56	774.44	771.93	772.74	**773.6675**	1.64	**G5 minus 23 cents**
D#5 / E♭5 (with palm keys) - High Octave	824.44	825.33	826.2	829.73	**826.425**	2.32	**G#5 minus 9 cents**
E5 (with palm keys) - High Octave	890.88	897.76	898.29	902.43	**897.34**	4.79	**A5 plus 34 cents**
F5 (with palm keys) - High Octave	968.93	968.32	971.38	974.26	**970.7225**	2.70	**B5 minus 30 cents**
F#5 / G♭5 (with palm keys) - High Octave	1041.27	1042.13	1044.57	1041.83	**1042.45**	1.46	**C6 minus 7 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
B4 - Low Octave	208.76	206.18	205.67	205.92	**206.6325**	1.43	**G#3 minus 9 cents**
C5 - Low Octave	221.7	220.88	223.59	223.99	**222.54**	1.49	**A3 plus 20 cents**
C#5 / D♭5 - Low Octave	237.22	236.8	238.79	236.31	**237.28**	1.07	**A#3 plus 31 cents**
D5 (with palm keys) - Low Octave	252.19	253.15	252.16	254.84	**253.085**	1.26	**B3 plus 43 cents**
D#5 / E♭5 (with palm keys) - Low Octave	272.18	273.72	272.1	273.92	**272.98**	0.97	**C#4 minus 26 cents**
E5 (with palm keys) - Low Octave	292.49	294.17	291.2	292.2	**292.515**	1.23	**D4 minus 7 cents**
F5 (with palm keys) - Low Octave	311.79	314.24	312.69	313.29	**313.0025**	1.03	**D#4 plus 10 cents**
F#5 / G♭5 (with palm keys) - Low Octave	337.45	338.19	339.39	338.18	**338.3025**	0.80	**E4 plus 45 cents**
C5 - Mid Octave	431.73	431.16	428.9	427.54	**429.8325**	1.96	**A4 minus 40 cents**
C#5 / D♭5 - Mid Octave	469.31	472.51	469.84	466.06	**469.43**	2.65	**A#4 plus 12 cents**
D5 (with palm keys) - Mid Octave	501.92	499.23	500.25	501.16	**500.64**	1.16	**B4 plus 24 cents**
D#5 / E♭5 (with palm keys) - Mid Octave	530.94	531.75	535.01	537.63	**533.8325**	3.08	**C5 plus 35 cents**
E5 (with palm keys) - Mid Octave	574.19	574.26	578.79	579.24	**576.62**	2.77	**D5 minus 32 cents**
F5 (with palm keys) - Mid Octave	608.65	611.5	613.1	611.17	**611.105**	1.84	**D#5 minus 31 cents**
F#5 / G♭5 (with palm keys) - Mid Octave	661.23	671.01	672.91	671.04	**669.0475**	5.29	**E5 plus 26 cents**
C5 - High Octave	635.43	631.9	629.46	631.98	**632.1925**	2.45	**D#5 plus 27 cents**
C#5 / D♭5 - High Octave	688.4	693.95	694.96	692.48	**692.4475**	2.88	**F5 minus 15 cents**
D5 (with palm keys) - High Octave	743.2	738.14	739.37	745.88	**741.6475**	3.55	**F#5 plus 4 cents**
D#5 / E♭5 (with palm keys) - High Octave	790.86	783.07	792.1	796.26	**790.5725**	5.51	**G5 plus 14 cents**
E5 (with palm keys) - High Octave	840.19	840.58	838.92	838.92	**839.6525**	0.86	**G#5 plus 19 cents**
F5 (with palm keys) - High Octave	895.75	892.29	895.24	892.2	**893.87**	1.89	**A5 plus 27 cents**
F#5 / G♭5 (with palm keys) - High Octave	947.57	959.62	953.25	961.43	**955.4675**	6.33	**A#5 plus 42 cents**

D5 (with palm keys) - Altissimo Octave	1008.32	1005.88	1007.49	1010.15	**1007.96**	1.78	**B5 plus 35 cents**
D#5 / E♭5 (with palm keys) - Altissimo Octave	1059.27	1063.31	1068.6	1059.56	**1062.685**	4.35	**C6 plus 27 cents**

Chapter 6
Notation for Saxophone Without Mouthpiece

6.1 - Individualism in Notation

Throughout music history, notation has been a topic of deep and, at times, heated debate. The methods by which one reads and interprets music have shifted, evolved, and transformed over the centuries. When examining forms of written music throughout the Western tradition, one encounters countless examples of signs and symbols used to represent music. Major shifts in notation have often accompanied changes in our understanding of specific classifications of Western music. For instance, plainchant, recognizable throughout the Medieval period, is one of the earliest widely used examples of notation for the documentation and repetition of song. As polyphony developed during the Medieval period, early forms of staff notation emerged, with symbols placed on a staff to indicate pitch relationships. Despite these pitch relationships being represented, rhythm was often not precisely notated. However, during the Renaissance, composers such as Palestrina and Josquin des Prez refined their notation to indicate rhythm more precisely, using new note shapes to denote duration and time, reflecting compositional and performative needs. This trend of evolving notation to align with artistic and compositional practices continues throughout the course of music history into the present, with composers modifying, evolving, and creating new forms of notation as necessary.

In the 20th and 21st centuries, composers have not only continued the evolution of notational practices to suit their needs but by doing so have introduced entirely novel approaches to notation. During these periods, a single overarching or standardized notation system has never been achieved nor been pursued. And why should it? This unique individualism in notation enriches a work's artistic depth, facilitates the performance and recreation of novel and unheard-of sounds, and provides performers with the opportunity to learn and adapt to new signs and symbols. Novel forms of notation, whether intentionally or unintentionally, often transform a simplistic set of symbols and signs into something more complex.

However, Erhard Karkoschka, in his seminal work *Notation in New Music: A Critical Guide to Interpretation and Realization* (1972), emphasizes the dual importance of the efficacy of notation and its appropriateness to the music it represents. He argues that “the appropriateness of a notation to the music it represents is not the only criterion by which it is to be judged; its efficiency is just as important” (Karkoschka 1972: 1). In 1988, Richard Toop, in his pivotal article at the dawn of the so-called “New Complexity,” highlights composer Chris Dench’s views on the importance of notating music that is both complex and interpretable. Dench asserts, “I’m not interested in writing music that can’t be played - that’s stupid. If there is no mechanism by which something can be done, it simply gives the performer a hard time” (Toop 1988: 5). Toop identifies a unifying characteristic among four British “New Complexity” composers—Chris Dench, Michael Finnissy, Richard Barrett, and James Dillon—which is the maximalist complexity of their notation. Due to this complexity, Toop notes that the surface appearance of these

composers' notation is “very meticulously written” (Toop 1988: 5). However, he also argues that the calligraphy of each composer’s notation should not be “an aesthetic component of the musical idea”; instead, it should merely be “a vehicle for it” (Toop 1988: 5). Regardless of this distinction, Toop states that Brian Ferneyhough, another leading figure of “New Complexity,” approaches notation in a more “mannerist” way where the notation itself is also a form of artistic expression in addition to being a means to communicate musical ideas (Toop 1988: 5). Asserting this, Toop suggests that Ferneyhough’s scores may have an aesthetic dimension beyond musical function, where the visual appearance of the notation is an integral part of the artistic concept of the work. In the same article, Richard Barrett discusses that indeterminacy will always play a role in the performance of his works despite the meticulously notated music he crafts. He explains, “I would rather set down the musical ideas as they are, and accept a certain amount of indeterminacy from the players, than say ‘I can’t do this’, and then not do it and thus produce a work which, to an even greater extent, is a betrayal of the musicality behind it” (Toop 1988: 5). These arguments underpin the importance of notations role in the transmission of a composer’s musical ideas even in the most complexly notated music.

Commenting on Ferneyhough’s music, and the music of “New Complexity” composers more broadly, musicologist Richard Taruskin challenges the notational density that has seemingly become commonplace in this music:

> to speak of the appearance of the music is in this case not trivial, because composers associated with the New Complexity put much effort into finding notations for virtually impalpable microtones, ever-changing rhythmic divisions and tiny gradations of timbre and loudness in an effort to realize their idea of infinite musical evolution under infinitely fine control and presented with infinite precision, with absolutely no concession to ‘cognitive constraints’. (Taruskin 2010: 475-476)

Upon examining some of these scores (and my performance of many of them), one might empathize with Taruskin's palpable exasperation regarding the notational density and cognitive strain on performers. However, this also raises an intriguing question about the artistic potential that such works, characterized by saturated notation, could achieve in the hands of performers.

Trombonist Kevin Fairbairn, in his dissertation on physically polyphonic works for trombone, directly addresses the artistic potential inherent in such notational variation. He observes, “despite the complex web of associations and mutual influences that are clearly present, no two notations are the same, even from the same composer. Somehow, the exploration of physical polyphony as an organizational principle for notation has proven resistant to systemization, even within single composers’ works” (Fairbairn 2020: 23). This diversity of notation, which has proven immune to standardization, can be seen

as both evolving and devolving over time as needed for the sonic output the score demands. Musicologist Stuart Paul Duncan, in his examination of Ferneyhough's use of physically polyphonic notation in two different works written for cello (*Time and Motion Study II* (1977) and his *Second String Quartet* (1979-1980)), reflects on this notion, offering a perspective that seemingly inverts Taruskin's argument. Examining the two works and the systems of notation and treatment of the cello implemented in them, Duncan makes the claim that Taruskin's argument is problematic: "Had he used the example from *Time and Motion Study II* to demonstrate 'New Complexity's' apparent evolution of musical notation to a point of no return, his assertion would surely have had greater impact. Instead, his use of the *Second String Quartet* undermines the argument that the composers were only focused on the embodiment of complexity through notational 'evolution'" (Duncan 2010: 145-146). This distinction not only undermines Taruskin's argument but also shows that Ferneyhough alters his use of notation as needed to bring his sonic ideas to life and not only to fulfill a need to continually evolve the concept of notation itself.

The ongoing flux of notational diversity has resulted in a rich and multifaceted exploration. This evolution both frustrates (as in the case of Taruskin) and encourages (as in the case of Fairbairn) artistic expression. Ultimately, the choice of notation rests with the composer. Fairbairn also addresses the reluctance among his fellow performers to engage with works that employ unconventional notational practices: "The disorientation from traditional techniques required to reimagine instrumental practice when approaching these experimental notations seems to be the primary—if not only—defining feature demarcating the limits of the repertoire that resides behind this barrier of entry" (Fairbairn 2020: 24). Fairbairn acknowledges the limitless potential of different notations, particularly those that use multiple staves to represent a multifaceted array of parameters. Inherently boundless in its artistic value, notation is ultimately meant to be understood so that a performer can interpret an aural image of the given signs and symbols, thereby bringing that aural image to life.

This chapter focuses on the notation used to represent SWMP techniques, driven primarily by performance and practice considerations. Throughout my career, I have performed and practiced an innumerable amount of works for saxophone, including those without mouthpiece, many of which are inspired by or rooted in "New Complexity." When I perform SWMP pieces, I often encounter two common reactions: awe at the capabilities of the saxophone in producing these unique sounds, and curiosity about how composers successfully notate and incorporate these techniques into their works. Discussions with composers about employing these techniques frequently reveal a significant barrier: the challenge of notation and the lack of accessible, reliable information on their proper usage. Conversations with fellow saxophonists consistently highlight the necessity of standardizing the notation for these techniques. Moreover, many saxophonists tend to avoid both complex and simple works that utilize SWMP techniques, stating that the notation and lack of resources are major obstacles to their

performance. Given these concerns, this chapter will examine and analyze existing models of notational practices for these techniques. By doing so, I aim to clarify for saxophonists the intended meanings behind these notations, discuss why certain notations are successful or problematic, and provide guidance on interpreting them more effectively. Subsequently, I will offer my own notational suggestions, presenting a model that composers can adopt. This model aims to diminish the frequently mentioned barriers, thereby facilitating the broader adoption and performance of these innovative techniques. While advocating for a more standardized model of notation for these techniques, I will also propose the importance of the performer-composer relationship. Using some ideas outlined in Roland Barthes seminal text "The Death of the Author" (1967), I will seek to show that in many cases the meaning of a text (score) is often defined by the interpretation of the reader (performer) rather than the author (composer).

6.2 - Notational Practices in the 20th and 21st Century

It is neither possible nor the aim of this research to exhaustively trace the evolution and development of all notational practices; however, some common trends and themes can be identified. These will be discussed in the overview of notation used in the repertoire for SWMP. In the early 20th century, the works of early serialists and atonal composers were already pioneering new notational territories. Especially during the period of free atonality,[40] composers such as Schoenberg, Webern, and Berg required new forms of notation to articulate their musical ideas in a clear and detailed way. A primary deviation from traditional notational practice by these composers pertained to structural compositional elements: musical scores began to exhibit greater rhythmic complexity, characterized by intricate beat subdivisions, precise tempo markings, an extensive range of dynamic instructions, unconventional scales (whole-tone, octatonic, chromatic scales, etc.)[41] that also included early microtonality – as speculated by Ferruccio Busoni in his essay *Sketch of a New Esthetic of Music* (1907 [1911]) – and sophisticated pitch arrangements derived from both traditional and novel compositional techniques. These developments required more exact notations.

In the mid-20th century, the ascendancy of experimentation marked another significant shift as composers sought to explore new methods of organizing sound and to challenge conventional conceptions of musical form and notation. This period witnessed the emergence of graphic notation as a pivotal development, with prominent figures such as John Cage, Earle Brown, Karlheinz Stockhausen, and Cornelius Cardew employing visual symbols and diagrams to convey their musical ideas. Graphic notation offered enhanced flexibility and interpretative freedom, thereby encouraging performers to engage more creatively with the score. It endowed composers with an unprecedented level of

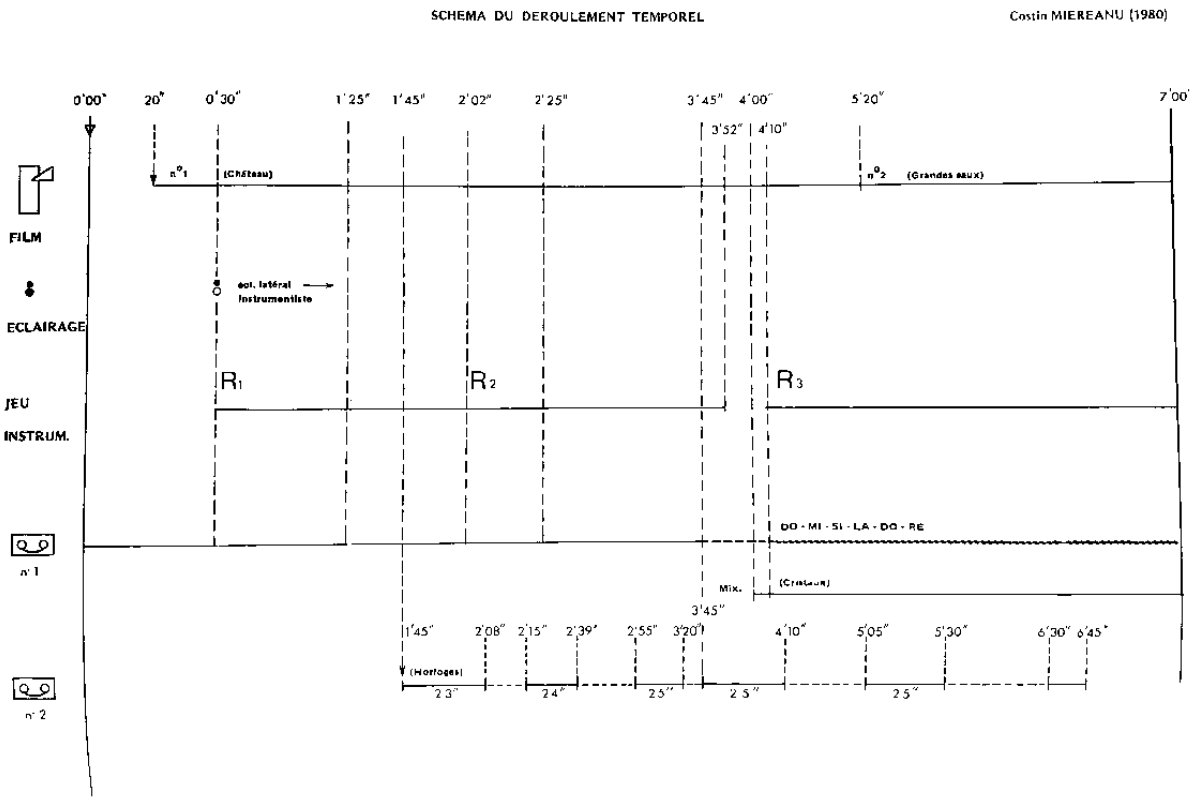
[40] "Free atonality" appeared roughly between 1908 and 1923 and preceded the development of a more structured atonality characterized by the Second Viennese School.
[41] While unconventional scales were still notated using the traditional diatonic system, the widespread use of tonal centers and key signatures began to fade among contemporary composers of the time. This distinction led to more meticulously notated music with more signs and instructions for the performers.

expressiveness, allowing them to convey complex and nuanced ideas that were difficult or impossible to represent with traditional notation. The use of non-traditional symbols, shapes, and diagrams expanded the notational vocabulary available to composers. This could include anything from geometric shapes, lines, and colors to more pictorial or abstract designs. The notation designed by Cardew or Brown, for example, inspired imaginative realizations by experimental and daring performers.

Expanding the sonic possibilities of traditional instruments through innovative playing techniques (such as multiphonics, microtones, and preparation) became the logical progression for composers and performers in the late 20th century and necessitated new and different forms of notation. The notation for these techniques grew increasingly detailed and specific, often necessitating annotations or supplementary instructions to elucidate performance methods. These varied innovations of the past required deviations from standard and traditional forms of notation.

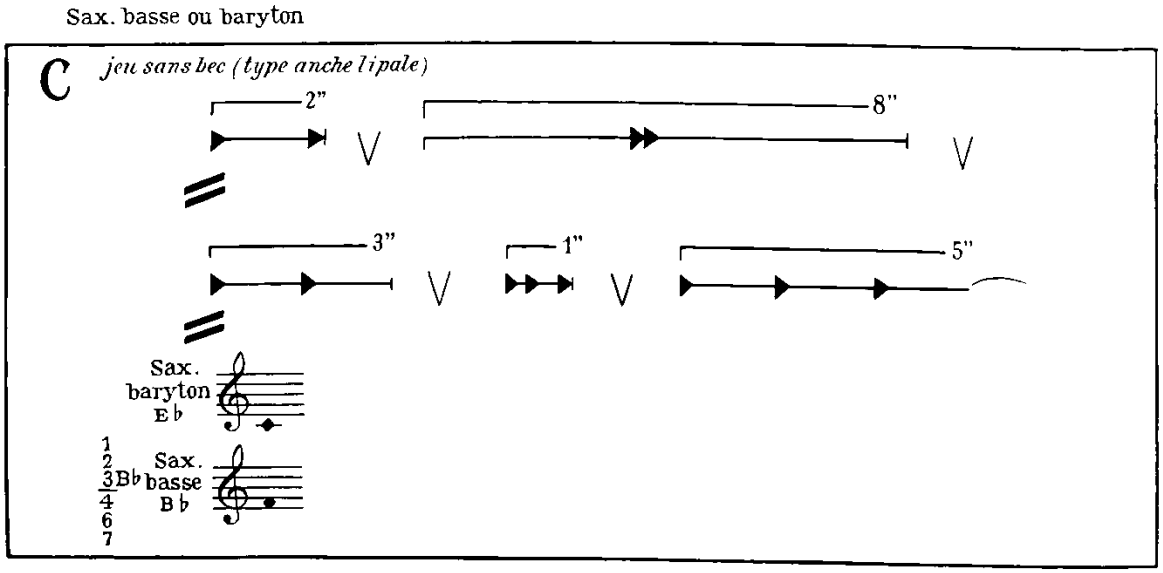
The notation used to represent SWMP naturally integrates and continues to evolve from these practices of the past. For example, In *Do-Mi-Si-La-Do-Ré* (1980/1981), Costin Miereanu employs a notation system that combines both conventional and unconventional elements because the piece entails a diverse array of playing techniques. The notation of this piece consists of two layers (see the figure below which outlines the timeframe of the first half of the work). The first layer connects five larger, numbered sections (R1, R2 … R5) to tape and film elements. Miereanu calls these sections "réservoirs." Each reservoir holds blocks of musical material which should be performed within a determined amount of time. The choice to either play or not play these blocks, the order in which the blocks may be played, and the time it takes to transition from one block to another is up to the saxophonist to determine.

DO-MI-SI-LA-DO-RE



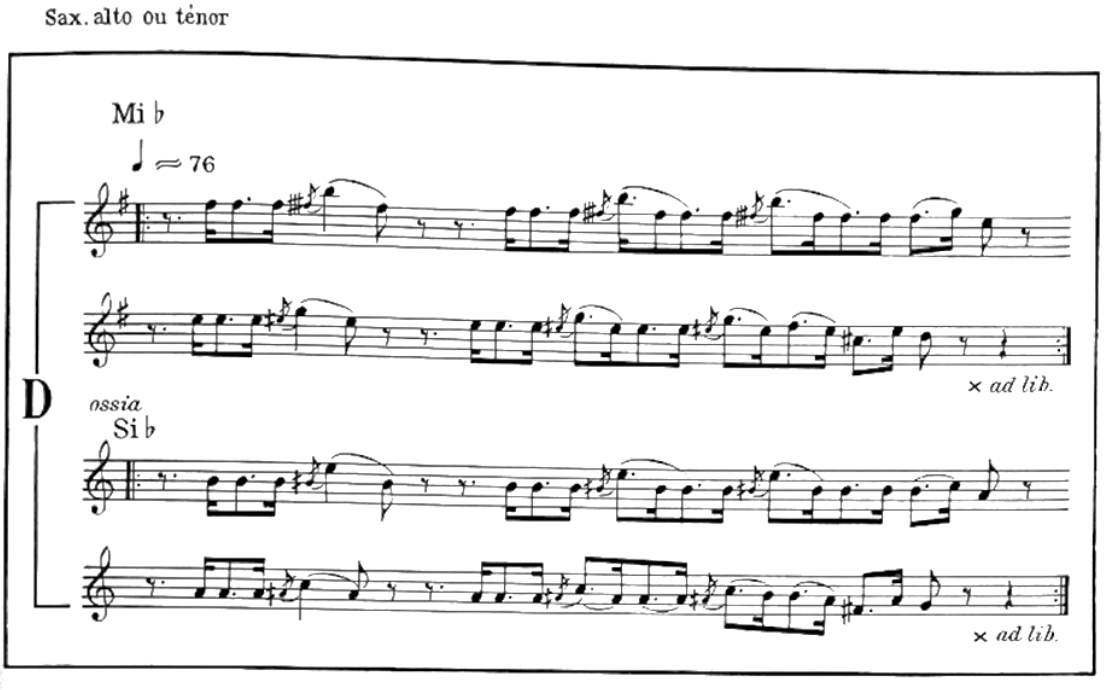
Costin Miereanu's *Do-Mi-Si-La-Do-Ré* for saxophone, tape, and video (1980/1981), p. 2
In the figure above, Miereanu precisely plans the exact timeframe of each element of the work. "R1," "R2," etc. indicate the precise timing of the "réservoirs." The performer must keep in mind this larger structural framework while performing the blocks of musical material contained within each reservoir.

So, whereas the first layer consists of the reservoirs, that is, the five numbered sections, the second layer is formed by the blocks of musical material that make up the reservoirs. These blocks are labeled with letters (see two examples below). Within each of them, Miereanu uses different types of notation (conventional and unconventional). For example, in the block labeled "C," the saxophonist is instructed to perform trumpet sounds, with a sideways triangle indicating articulations and a line indicating that they should sustain the pitch. The lengths of the notes are notated precisely, while the duration between sustained pitches and accents and the lengths of silences are left to the performer themself to determine. Elements of freedom also arise in how one interprets the trumpet sound notation, which saxophone the performer chooses to perform on, how often the instructions in the block are repeated, and the timeframe chosen between and within these blocks (for example, in block C, seen below, a performer might choose to interpret the silences longer or shorter depending on how much time they have in the reservoir due to the fact that Miereanu does not give a time indication for these rests).



Costin Miereanu's *Do-Mi-Si-La-Do-Ré* for saxophone, tape, and video (1980/1981), p. 6
This block C presents a straightforward graphical depiction of trumpet sounds. Within it, the saxophonist is instructed to produce individual notes, sustaining each for the specified duration indicated. Triangles denote instances of rearticulation, while continuous lines signify seamless transitions between successive notes, interspersed with brief pauses.

In contrast to the unconventional notation in block C, block D has a more traditional notation. Some freedom is permitted here for the performer, as seen in the choice of instrument and the flexibility in the amount of repetition, indicated by the "X ad lib" marking at the end of the second line, for example.



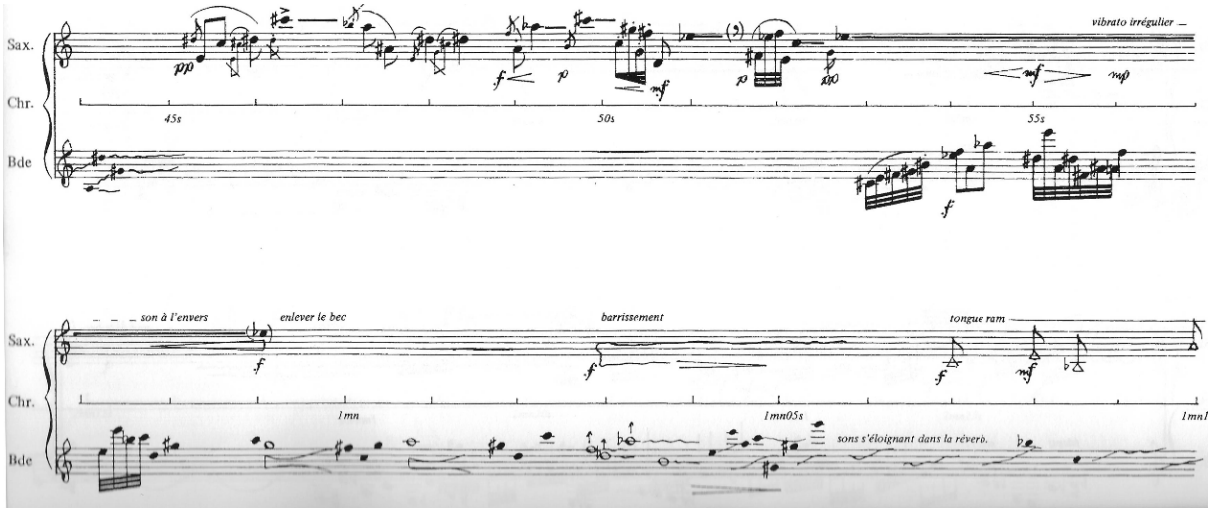
Costin Miereanu's *Do-Mi-Si-La-Do-Ré* for saxophone, tape, and video (1980/1981), p. 7
In block D the notation is traditional. I have it included here to show the juxtaposition between conventional and nonconventional systems of notation Miereanu has used.

This dual-layered approach to timing and notation in *Do-Mi-Si-La-Do-Ré* enhances the complexity and depth of the performance. Miereanu asks the performer to maintain a nuanced understanding of both macro- and micro-temporal frameworks while navigating the diverse expressive possibilities afforded by conventional and extended techniques. Miereanu's innovative notation invites the saxophonist to engage deeply with the interplay between structure and spontaneity, fostering a dynamic and expressive rendition of the work that allows each performance to be unique while maintaining the work's structural basis. Notably, *Do-Mi-Si-La-Do-Ré* stands among the pioneering works that delve into the SWMP practice. The minimalist nature of the notation mirrors the novel character of this practice during its inception.

The advent of electronic and computer-generated music brought forth new challenges and opportunities for both sound production and notation. As composers and musicians explored the capabilities of electronic instruments and digital technologies, traditional methods of musical notation were challenged and expanded to accommodate these innovations. Electronic music allowed for the creation of sounds that were previously unimaginable with acoustic instruments alone, such as synthesized tones, sampled sounds, and complex audio manipulations. These novel sonic textures required new approaches to notation to accurately represent their timbral qualities, spatial characteristics, and dynamic changes. Moreover, computer-generated music introduced algorithms and generative processes that could produce compositions beyond the scope of human-composed music. Notational developments in this realm involved translating algorithmic structures and computational parameters into readable scores or graphical representations that could guide performers. The evolution of electronic and computer-generated music thus prompted composers and music theorists to rethink traditional notational practices. Experimentation with graphical scores, algorithmic notation systems, and hybrid approaches led to the integration of traditional symbols with new graphical elements or digital instructions. These developments continue to shape contemporary music notation, reflecting ongoing advancements in technology and expanding possibilities for musical expression and performance.

In the realm of electronic and computer-generated music, the pursuit of innovation has led to a rich tapestry of developments. Composers like Karlheinz Stockhausen and Pierre Schaeffer stand out as pioneering innovators who developed specialized notation systems tailored to electronic music. These systems included graphic representations of sound waves and detailed instructions for manipulating tape recordings, reflecting a deep exploration of new sonic possibilities. The advent of computer technology enabled further innovations such as interactive scores and algorithmic compositions. Interactive scores allowed for real-time interaction between performers and computer-generated elements, while algorithmic compositions involved software generating music based on predefined rules.

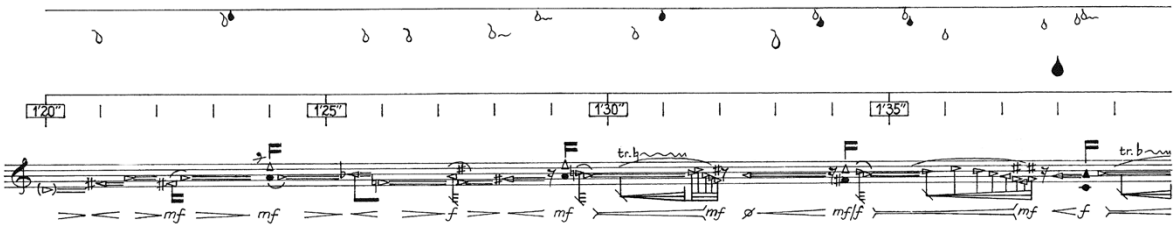
An example of this evolution can be seen in Jean-Claude Risset's *Voilements* (1987), where time is divided into precise intervals measured in seconds. The solo saxophonist must adjust their rhythm and gestures to synchronize with these intervals, while simultaneously responding to graphic notations demanded in the solo part and written in the tape part. The barrissement technique, seen in the middle of the second staff, is notated with a graphic block and a squiggly line without any pitch parameters. Here the saxophonist chooses their fingering and pitches at random, adhering to the dynamics and rhythm indicated by the block. Conversely, Risset follows the barrissement technique with very clear pitches from the tongue ram technique, indicated by hollow triangles. Below the saxophonist's staff, indicated by "Bde," is the transcription of the tape part. Risset has included some precise cues for the saxophonist to follow but has also left musical material more ambiguous by notating curved lines that follow the gesture of the sound rather than precise pitches. This dual approach grants the saxophonist freedom, while adhering to the cues provided by the tape component.



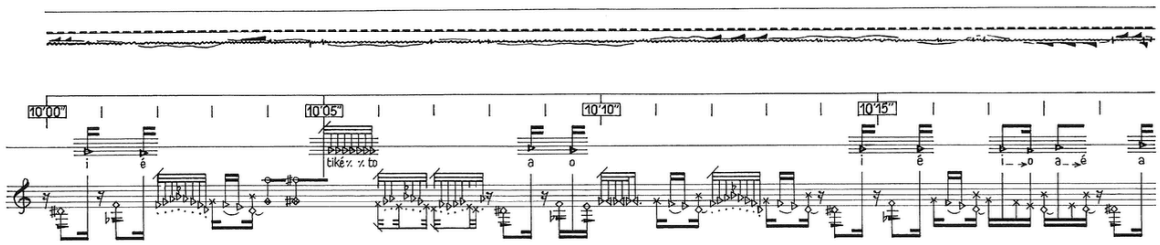
Jean-Claude Risset's *Voilements* for saxophone and tape (1987), p. 5
The evolution of notation often parallels technological advancements and the increasing technical proficiency enabled by notation software. In this excerpt, a blend of traditional notation conventions and handwritten graphical elements is evident, particularly noticeable in the tape component and instructions for SWMP techniques. In the second line, Risset directs the saxophonist to execute the barrissement technique followed by several tongue rams. The barrissement technique is depicted by a single unfilled and incomplete box, introducing ambiguity regarding the specific fingerings or sets of fingerings to be employed by the performer to achieve the desired sound texture. In contrast, the notation for tongue rams is presented with clarity and precision.

Bernard Carloséma's *Clepsydre* (1998) for solo saxophonist and tape represents a significant evolution in notational practices, providing extensive artistic freedom for the saxophonist while integrating a diverse array of notation forms. Similar to Risset's *Voilements*, time in *Clepsydre* is delineated in seconds, yet Carloséma's approach allows for greater complexity and variability in rhythmic notation, blending conventional and unconventional methods throughout the score. A notable feature of *Clepsydre* is its tape part, which is exclusively notated using graphic symbols. These symbols range from lines to small bubble structures indicating sound cells, as well as representations of sound

waves. This offers a visual guide for interpreting the electronic component emphasizing the composers' intentions to focus on timbral and gestural qualities rather than traditional pitch and strict rhythm. In contrast to Risset's approach, Carloséma provides a comprehensive table of contents detailing the precise function of his notation. This enhances clarity and facilitates the saxophonist's navigation of the score, ensuring a more nuanced and informed performance. This practice of detailed notation explanations would later become commonplace in new music scores, reflecting a broader trend towards transparency and accessibility. *Clepsydre* exemplifies how innovative notation can enhance artistic expression and collaboration between performer and electronic elements. By incorporating diverse notation forms and detailed explanations, Carloséma encourages interpretation and experimentation while advancing the frontier of electronic and acoustic integration in music composition. His work stands as a testament to the evolving complexity and richness of contemporary musical notation practices.



Bernard Carloséma's *Clepsydre* for saxophone and tape (1998), p. 2

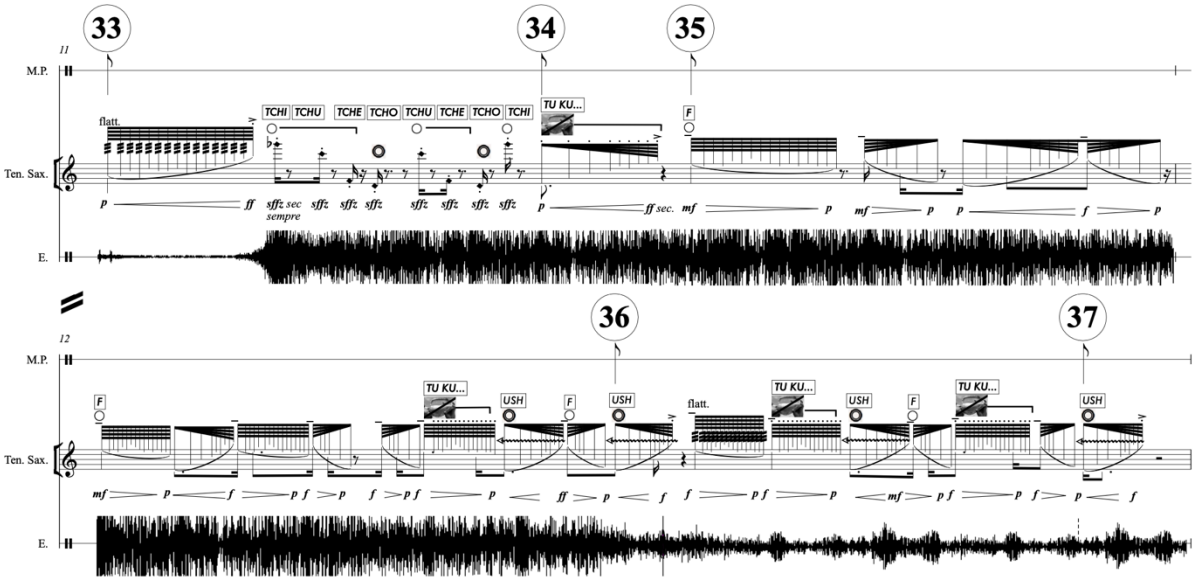


Bernard Carloséma's *Clepsydre* for saxophone and tape (1998), p. 11

In these two excerpts Carloséma utilizes multiple staves, each serving distinct purposes to depict various parameters. Particularly notable are the top two staves which visually represent the tape part, while directly beneath, the chronograph indicates the passage of time. In the first example, a variety of notehead variations are employed to signify different sounds. Additionally, rhythmic elements are intentionally imprecisely notated, affording performers a degree of freedom from strict rhythmic rigor. In contrast, in the second excerpt, the staves below the chronograph adhere more conventionally. They are separated to distinctly delineate the vocalized air pitch part from other techniques employed. The lowest staff specifies the execution of tongue rams, neutral exhaling and inhaling breath sounds, trumpet sounds, and key clicks.

With the advent of sophisticated software like MaxMSP, composers have embraced new artistic directions in music composition. Juan Arroyo's *Sikuri I* (2012) exemplifies this evolution, where traditional time-based notation gives way to a more dynamic representation of musical elements within the MaxMSP environment. In *Sikuri I*, Arroyo utilizes numbers to signify file event changes in the MaxMSP patch, rather than traditional time signatures. This approach allows for a flexible and non-linear temporal structure; the saxophonist interacts with the software in real-time, responding to cues indicated by

these numerical events. Beneath these numerical indicators Arroyo provides a waveform, offering visual insights into the sonic textures that will be manipulated within the MaxMSP patch. This dual-layered notation system combines technical precision with artistic freedom, enabling the saxophonist to interpret and shape the sonic output in collaboration with the software's capabilities. Moreover, Arroyo introduces new symbols in the notation, primarily representing sonic textures that will undergo manipulation through external sound processors. These symbols guide the performer in crafting expressive interpretations while interacting dynamically with the electronic components of the composition. This integration of advanced software and innovative notation exemplifies a broader trend where technological advancements in music composition influence and drive notational developments. As composers harness the capabilities of MaxMSP and similar platforms, they expand the expressive possibilities of electronic and acoustic music, pushing the boundaries of traditional notation to accommodate new modes of musical creation and performance. Traditional notation often is not able to represent what a composer wishes to convey to a performer.



Juan Arroyo's *Sikuri I* for saxophone and electronics (2012), p. 15

The evolution of notational innovations has been further extended through tools like MaxMSP, enabling performers to trigger programmable actions at their discretion. This capability fosters deeper expressions of uniqueness in each performance, where rhythmic and timed elements can be performed more ambiguously based on the performers intention in the moment. In Arroyo's score, new methods for notating SWMP techniques are prominently featured. Particularly striking is the depiction of the "half Incan trumpet sound," symbolized by an image of an Incan trumpet with a line crossing through it. This notation signifies the specific demand for the barrissement technique. Also notable are passages in which air pitch is indicated without specific noteheads, allowing saxophonists the latitude to determine fingerings based on the general contour of the line. These advancements underscore a shift towards notation that not only communicates musical intentions but also invites performers to contribute with their own creativity, enhancing the richness and individuality of each rendition.

In the contemporary landscape of music, notation serves a crucial role for both composers and performers, albeit with evolving challenges and opportunities. Notation acts as a bridge between the composer's creative vision and the performer's interpretation,

facilitating communication and guiding the realization of musical ideas. However, the expansive range of notational techniques and innovations—from traditional scores to graphic notation, electronic interfaces, and algorithmic systems—reflects both the liberating potential and the complexities faced by performers today. While contemporary notation offers unprecedented artistic freedom and innovation, it also challenges performers to navigate a diverse and sometimes complex landscape of musical languages and technologies. The role of the performer in interpreting notation is pivotal, requiring a balance between fidelity to the composer's intent and the exploration of personal artistic expression. Thus, the purpose of notation lies in facilitating a meaningful dialogue between composition and performance, and enriching the musical experience for both performers and audiences alike. In the following section, I will expand upon this multifaceted concept in discussing the purpose of notation for the contemporary performer.

6.3 - The Purpose of Notation for the Contemporary Performer

Today, as elaborated in the preceding sections, composers possess an extensive array of notational tools to communicate their aesthetic and auditory ideas. The potentialities of these tools appear boundless, engaging performers on both artistic and practical dimensions. From an artistic and practical dimension, the intricacy of graphical elements, symbols or texts within a score invariably influence a performer's interpretation – whether intentionally or unintentionally. This dynamic prompts a pertinent inquiry: What role does notation play for the contemporary performer?

As articulated by numerous composers and music theorists, and conceptually pivotal to this research, the paramount objective of notation is to eternize the composer's sonic ideas. However, the simultaneous interaction between composer, performer, score, instrument, electronic device, software, etc. is a complex intertwined web where all these entities are agents interacting with – and thus depending on – one another. While still acknowledging these inherent complexities, more agreement on how a particular sonic action should be notated could still be sought. Paulo de Assis elaborates on this in his essay on musical editing, the concept of an 'Urtext,' and the dichotomous roles and temporal positions of composers and performers:

> On the one hand, there is the composer, who engenders a structure, which he encodes according to the codes of his own time/space; on the other hand, there is the performer, who decodes the message of the composer, rendering the structure that was given to him. (Assis 2009: 7)

A performer must not only comprehend the composer's intentions but also actualize that delicate concept in future performances. The notation serves a seminal role in how the performer interacts with, interprets, and executes the music. Erhard Karkoschka, in

Notation in New Music, references historical pedagogy and the musician's experiential knowledge as the primary drivers for clear and visually representable notation. His perspective underscores that, regardless of the notation, the sonic result remains the essential element to be conveyed (Karkoschka 1972: 1). While not entirely contradictory nor affirming, experimental musician Cornelius Cardew, in his notes *Notation - Interpretation, Etc.* (1961), states that a composer must approach notation as both a creative and logical activity: "You have both aspects in your hand, but when you come to open your hand you find only one thing and it is not divisible" (Cardew 1961: 21). From this viewpoint, the composer faces the unenviable task of balancing logical and artistic perspectives, which may be in opposition; in many cases, one of these contending forces prevails. Ultimately, despite the notation being fixed for perpetuity and the composer ensuring their sonic vision is as clearly inscribed as possible, the performer must still make judicious decisions. This involves interpreting the notation accurately, stylistically, artistically, and convincingly, in order to bring the composition to life. Nevertheless, each notation leads (or can lead) to many different performances. In that sense, notation always fails. Or, on the contrary, it always succeeds in that there will never be a "final" (perfect) performance.

In the boundless creative domain of composers' language, and their myriad iterations of signs and symbols to notate their language, performers are often left to continually interpret and reinterpret these evolving signs and symbols. Each score encompasses its own microcosm of signs, symbols, explanatory notes, and textual additions, frequently resulting in an intentional or unintentional overload of information for the performer. When engaging with composers, I often encounter sentiments such as, "why should I limit my artistic expression through notation?" "Why should I sacrifice my style?" "A performer will inevitably need to learn the signs and symbols for each score regardless, so why should I conform to any standard practice?" Or "this is how I notate this particular sonic phenomenon; the performer will just have to deal with it," and similar remarks. In general, I comprehend and tend to sympathize with these perspectives. A performer bears the responsibility to interpret the score and its notations to the best of their abilities, perceiving it as the physical manifestation of a *meta*-physical phenomenon that they must engage with through rigorous daily practice. In this process, the performer will make interpretative decisions based on previously learned and embodied experiences. In "The Death of the Author" (1967), Roland Barthes argues that the traditional notion of the author as the central figure who bestows meaning upon a text is obsolete. Instead, the focus shifts to the language itself and the reader's role in interpreting the text. Barthes contends that

> a text is made of multiple writings, drawn from many cultures and entering into mutual relations of dialogue, parody, contestation, but there is one place where this multiplicity is focused and that place is the reader, not…the author. The reader is the space on which all the quotations that make up a writing are inscribed without any of

> them being lost; a text's unity lies not in its origin but in its destination. (Barthes 1967: 148)

The meaning of a text is ultimately determined by the reader rather than the author. This shift turns the reader into the primary agent of meaning-making, ultimately liberating the text from the constraints of authorial intent and emphasizing the dynamic interaction between reader and text. In this sense, a text (a score) is completed by the reader (performer). The reader (performer) therefore becomes a co-author of that text (score). However, does this idea exclude a more standardized notation? Shouldn't there be at least some agreement between author (composer) and reader (performer) regarding the sign system being used? Not so much to limit the freedom of the reader (performer), but to save them from all too obvious misunderstandings.

While the freedom to create works that challenge performers to push them out of their comfort zones, and to demand informed decisions is understandable, this must be balanced with a certain amount of clarity. Composers creating complex and novel compositions often produce highly dense, innovative scores with unique symbols and graphics that confront the performer with significant interpretative difficulties. Performers anticipate such challenges when agreeing to play such works. While a composers' notation should be intended to avoid complete misunderstandings, it should also foster a situation where performers can engage deeply with the work despite its complexity. An inherent element of any text, any score, is that it can be interpreted in more than one way. In other words, any notation will, by definition, be open to multiple interpretations. This idea, put forth by Barthes, also "explains" why it is interesting to listen to various performances of "the same" piece (which simultaneously becomes "another" piece with each performance).

The myriad notational choices available to composers serve both artistic and practical functions, deeply influencing how performers interpret and create music. As explored, the role of notation is to make future musical interpretations possible, as underscored by theorists like Assis and Karkoschka. This delicate balance between the logical and artistic facets of notation, highlighted by musicians like Cornelius Cardew, illustrates the inherent tension in the compositional process. Performers, tasked with decoding and bringing these encoded musical ideas to life, face the challenge of navigating diverse notational languages. Despite the frustrations that complex and non-standardized notations might cause, the pursuit of artistic expression through notation remains paramount. While composers should not be denied the freedom to innovate, they must also consider the practicalities of notation to ensure the possibility to create, through notation, a productive dialogue with performers, thus fostering a shared environment where both compositional vision and performance artistry thrive.

6.4 - Notation for SWMP Techniques

The notation for SWMP techniques is characterized by considerable variation and uniqueness, exhibiting few common traits across different compositions. This diversity has resulted in often disparate and innovative trends in notation. This multitude of notational choices renders it challenging for performers to fluidly transition from one piece to another without having to internalize an entirely new system each time. A significant portion of this confusion can be traced back to the early notational practices for these SWMP techniques. Furthermore, there exists an inherent cognitive dissonance in engaging with them, as the foundational rules established in traditional saxophone practice are almost entirely disregarded. Pre-existing notions such as the capabilities of the saxophone, the expected outcomes of opening or closing specific keys, and the logic of melodic lines following keywork patterns must all be fundamentally re-learned in the practice of SWMP.

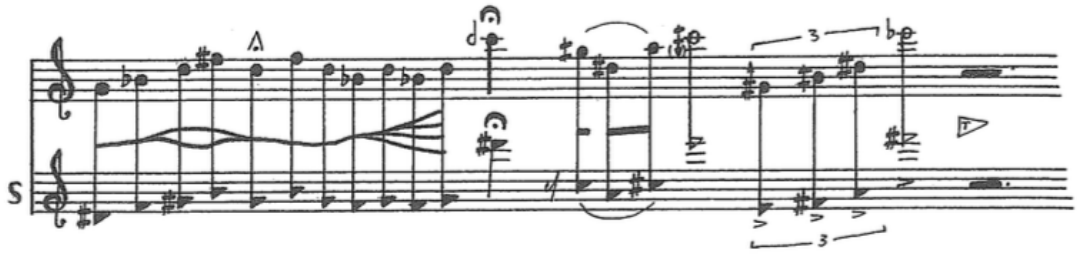
As a general trend, the notation for SWMP techniques is left entirely to the discretion of the composer. In the foreword to his *Saxologie*, Daniel Kientzy acknowledges that his notations are merely suggestions: "Only some of the possible ways of playing on the saxophone have been exploited in the written compositions to this day, and under signs that are rarely identical" (Kientzy 2007: 8). Moreover, Kientzy asserts that not all music must adhere to a uniform notational standard and expresses his preference for notation that is clear and "intelligent." In his saxophone technique guide, *Hello! Mr. Sax*, Jean-Marie Londeix observes that for trumpet sounds there is "no specific notation […]. It suffices to mark above the notes 'trumpet-like sounds'" (Londeix 1989: 68). This statement is overly simplistic when considering the wide range of sonic possibilities that can be categorized as trumpet sounds. Given the variety of pitches and octaves possible with the same fingering, it is imperative to envision a notation system that incorporates this variety. Lastly, Marcus Weiss and Giorgio Netti have compiled a comprehensive guide to numerous saxophone techniques utilized in the 21st century. They refrain from proposing their own notational system, opting instead to include "excerpts from scores of recent works for saxophone […] at the end of each chapter [which] should, among other things, demonstrate the variety of notational possibilities" (Weiss and Netti 2010: 10). In doing so, they simply illustrate the diversity of notational options, providing only subtle guidance toward the creation of new notational practices.

The innovations introduced by Kientzy represent a significant turning point in the classical saxophone's treatment. Due to the novelty and distinctiveness of the techniques he developed in collaboration with composers, he was tasked with creating notations that would facilitate the transition of these techniques from abstract sonic ideas to integral components of compositional works. Kientzy devised this notation primarily for his own use and for the composers with whom he closely collaborated. In partnership with these composers, Kientzy established a workable notation that served both him and his contemporaries.

I will now analyze, explain, and comment on his recommendations, examine alternative notational practices proposed in other technique guides, and subsequently reflect on several examples from the repertoire of each of the SWMP techniques.

6.4.1 - Notational Practices of Air Pitch

Kientzy suggests a two-staved solution for the notation of the air pitch technique. This is the image he introduces at the beginning of the chapter on air pitch:



Daniel Kientzy's *Saxologie* (2007), p. 453
Notational suggestion of air pitch

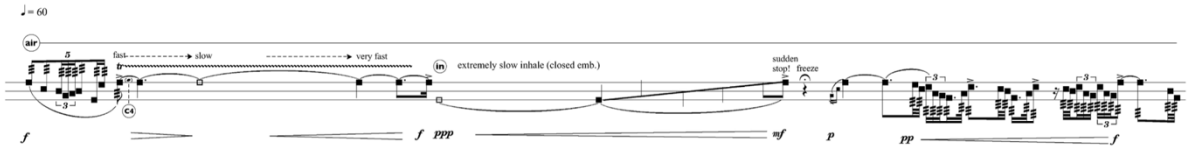
The fingerings are displayed in the bottom staff and the ensuing sounds are on the top staff. No indication of the vowel or consonant to color the sound is given; saxophonists would need to make that decision on their own. The notehead is a right triangle.

I do not think that a two staff solution is necessary for air pitch. With the limited range of the technique, displaying the real pitches that result from the technique only creates a cluttered and potentially confusing score. The notehead suggestion is quite acceptable: the saxophonist will still be able to read the difference between rhythmic structures via open or darkened right triangle noteheads.

Weiss and Netti do not overtly speak on the notation of air pitches but mention them more generally. Particularly relevant is their emphasis on the importance of detailing color changes in the air sound: "Depending upon the context, it may be useful to indicate a differentiation of various air noises (e.g., high—middle—low) or a certain amount of colors that may be indicated with numbers and leave the fingering choice up to the interpreter" (Weiss and Netti 2001: 158). These color changes shade and give texture to the sound; notating their relative tessitura allows a composer to add artistic depth to this technique.

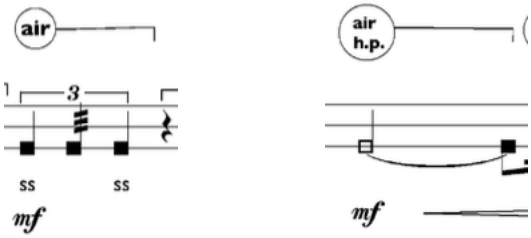
In Malin Bång's *delta waves* (2007), air pitch notation is treated on a three-line staff. Here the precise fingerings are not indicated or desired. The three lines indicate the range and the specific keys that should be opened or closed. This allows the saxophonist to use their own imagination and gives them some artistic freedom to interpret the rhythm and contour of the musical phrase. In her performance notes, included before the score, she

details that "the lines indicate the number of closed holes: bottom line = all main keys closed [,] middle line = the top half of the register closed [, and] top line = all main keys open" (Bång 2007: 2). Bång sometimes indicates vowel/consonant production but, in general, she only indicates if the air should be inhaled or exhaled through the saxophone. Below is an excerpt of *delta waves*:



Malin Bång's *delta waves* for saxophone (2007), p. 1
In this excerpt, it is most interesting to note the use of tessitura lines instead of the conventional five-line staff. The saxophonist will have to choose an appropriate fingering based on this limiting restriction.

The excerpt above is clear due to its inherent simplicity. The saxophonist need only follow a general contour and be rhythmically accurate. The fingerings used to create the desired textures are secondary to the importance of the sonic outcome and color change that Bång desires. The only uncertainty with Bång's usage of air pitch is the lack of consonants and vowels. Saxophonists must choose for themselves how they would like to color the sound here. This is confusing as later in the work she indicates precisely which consonants she demands of the performer:

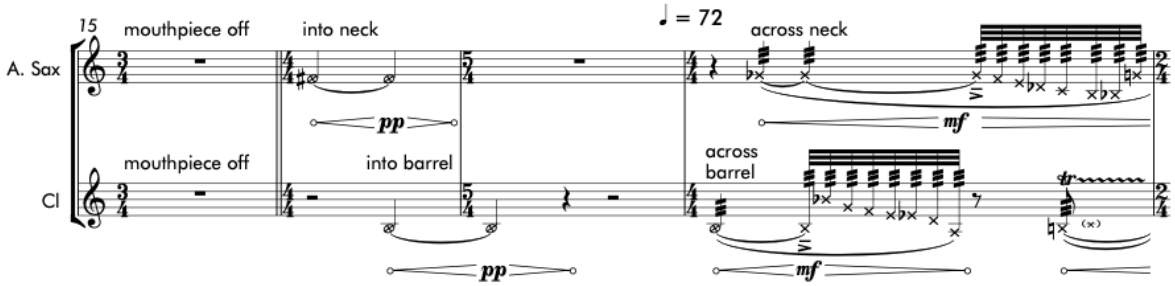


Malin Bång's *delta waves* for saxophone (2007), p. 1
In these two excerpts, Bång asks the saxophonist to produce different types of air pitches by indicating the "ss" underneath the staff, in the first excerpt, and by asking them to create "air with high pressure" in the second.

In the first example above, which curiously does not reappear elsewhere in the piece before the mouthpiece is reattached to the neck, the saxophonist is required to play a low B♭ while speaking the "ss" consonant sound followed by a flutter tongue and finished off with the "ss" consonant again. In the second example, the saxophonist is required to create a "high pressure" air pitch. With this technique, Bång asks the performer to make a sound that is "a combination of air and 'white noise'" (Bång 2007: 2). To create such a sound that differs enough from the exhaled air pitches and the consonant "ss" sounds, the performer should adjust the dynamic scaling desired.

From a performer's perspective on clear notation, these three examples from Bång's score lack consistency. While performers have the flexibility to make artistic decisions, the notation needs clarity regarding the specific actions or techniques required. Bång could have included her own vowel/consonant designations for all air pitch sounds, which would have made the desired color changes clearer and more consistent.

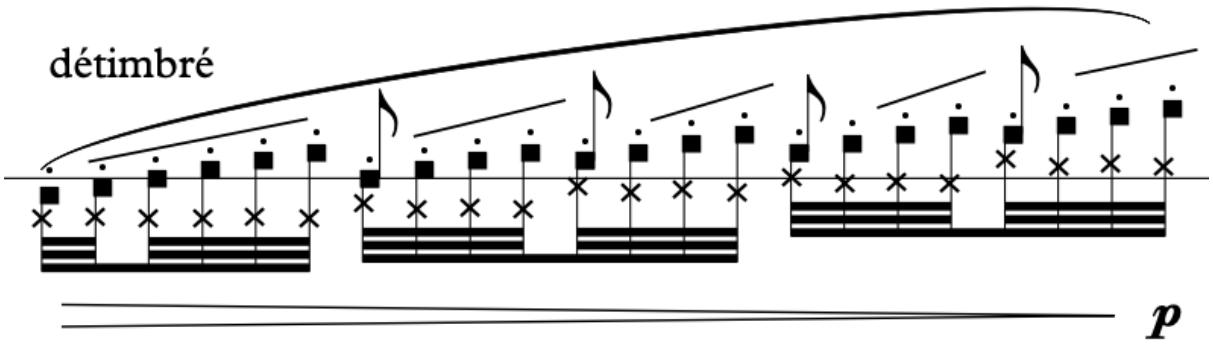
Max Grafe takes a more traditional and precise approach to notating air pitch sounds in his *Anemoi Dances* (2020). Grafe specifies more exactly which pitch the saxophonist must finger and he gives clear guidance of the direction in which they must blow. He has opted to use an "x" shape notehead for all air pitches. Grafe allows the performers enough time to remove and replace their mouthpieces and indicates this clearly, as can be seen in the figure below. The vowel or consonant shape and color is still left up to the performers to find what works best for them to create the texture indicated by the dynamics. This work was written for me, and I worked with Grafe on how I preferred to see the notation for air pitch. The clarinetist in my duo, Jackie Glazier, could also easily interpret the notation used for her clarinet without mouthpiece. If I were given the chance to work with Grafe again on this work, I would ask him to put phonemes underneath each gesture in order to shade the sound and texture to his exact liking.



Max Grafe's *Anemoi Dances* for saxophone and clarinet (2020), p. 6
In this figure, Grafe notates air pitches for both saxophonist and clarinetist. What is notable in this excerpt is that he dictates from where the performers must blow (into neck or across neck).

In her saxophone quartet, Ariadna Alsina Tarrés explores several SWMP techniques. Her usage and notation of air pitch is initially deceiving because she indicates the technique as a type of tongue ram. Though confusing at first, the saxophonist must read her instructions in the text that precedes the score where she explains that this particular notation indicates her wish for a tongue ram sound that is very dry and unpitched, obtained by articulating the tongue against the upper lip and the interior part of the mouth. After reading the instructions, the saxophonist will quickly understand that a proper tongue ram is not demanded but rather a double-tongued air pitch is required. The misnomer would be confusing for any performer; however, in working with Tarrés it became clear that she wants it to sound somewhat like a helicopter. This solidified my understanding of this notation as an air pitch. The parameter of fingerings is left up to the performer, as can be seen in the figure below. Tarrés removes the five lines of the staff opting for just one. In a quasi-aleatoric way, the saxophonist is given the freedom to

choose their fingerings following the notated sequence. The choice of the notehead is not important due to the desired lack of pitch precision. A simple way to make this notation much clearer would be to indicate the desired articulation syllables, such as "TOH KOH," "TU KU," or similar, underneath the notes.

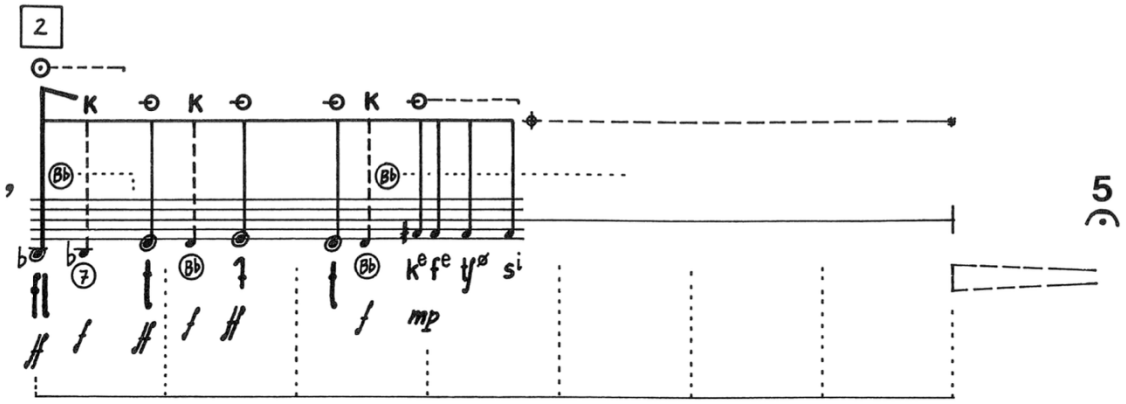


Ariadna Alsina Tarrés' *Flickering sparks in connecting tunnels* for saxophone quartet (2007), p. 2
Upon first inspection, one would think that Tarrés is asking the saxophonist to perform tongue rams, as this notation is usually reserved for slap tongue or tongue rams. However, a saxophonist will notice that at the speed indicated (quarter note = 60), it would be nearly impossible to do so. Instead, she is asking the saxophonist to perform air pitch.

Conceived in a distinctly maximalist approach, *Solo* (1988) for bass saxophone - part of Klas Torstensson's triptych *Licks & Brains* featuring various ensembles with saxophone - delves into the physicality of diverse sound gestures. The piece explores the transitions between disparate and similar sonic clusters and emphasizes the inherent theatricality and physicality in its demanding virtuosity. The notation requires the memorization of many new symbols alongside the occasional proportional time notation. Torstensson includes a very detailed notation guide that precedes the score which is needed for a performer to consider any attempt at realization.

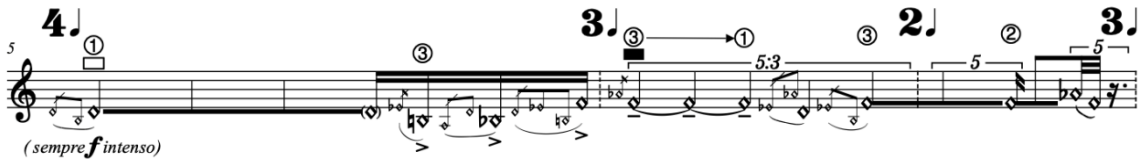
Despite this notation guide, the number of parameters that are asked to be interpreted at once is daunting at first. A saxophonist will need to memorize the physical movement and gesture between each technique. In the figure below, these parameters are clearly illustrated. Notice the multitude of symbols and signs that the saxophonist must engage with simultaneously. With regard to the notation of air pitch, Torstensson is quite clear in the fingerings, syllables, and distance from the mouthpiece. Within the staff, the notehead used for both air pitch and tongue ram sounds is a regular one with a circle around it. The difference is understood by the phonetic symbol below the staff. The "fl" phonetic spelling indicates a tongue ram. The "t" represents a "tongue-flap," or in the contemporary vernacular, a flutter tongue sound. The upside down "t" represents a hard "'t" sound produced from an attack against the hard palate. The other air pitches (see the image below, above the *mp* indication) are marked without a circle around the notehead. These are, however, still air pitched sounds. Torstensson uses phonetic symbols directly below the staff and provides English, French, Italian, and German language examples on how to

pronounce them properly. This is helpful for saxophonists who might not be familiar with proper diction and phonetic spellings. Above the staff, Torstensson includes parameters of how far away the mouth should be from the neckpiece, when the saxophonist must perform an unpitched or a pitched key click, and if the sound should be vocalized directly to the microphone. From a notation standpoint this work is extremely detailed and a strong showing of how to write down these techniques. However, there are clearer ways to notate these SWMP techniques; for example, clearly showing a notehead difference between an air pitch and a tongue ram might avoid unnecessary confusion.



Klas Torstensson's *Solo* for saxophone (1988), p. 1
Important to take notice in this excerpt is the demanded precision of vocal elements through the saxophone. Various phonetic syllables must be perfectly pronounced while performing these in conjunction with other SWMP techniques.

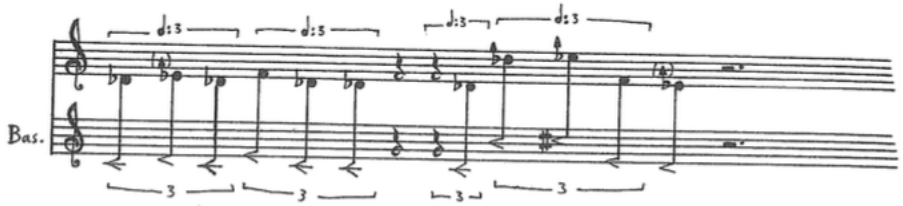
In Stratis Minakakis' massive solo piece for baritone saxophone, *For Felipe M.* (2021), the final movement is set for SWMP. In this movement he paints a shadow sound world that comments on the traditional playing that precedes it. His notehead choice for air pitch follows a similar usage of notation for air sounds throughout the rest of the work. I appreciate the similarity and connection with common practice playing. The only confusing part of this choice is that since the notehead is open, precision of traditional rhythm is lost. As can be seen below, there are two other parameters that he has included. The squares (either open, half open, or filled in) determine the amount of saturation of the air pitch - the open square indicating a slight saturation of sound and the filled in square meaning the sound should be completely saturated with air. The numbers, ranging from 1 to 3, indicate the distance the saxophonist should position their mouth from the neckpiece – with 1 indicating a few centimeters and 3 very close to the neckpiece. In my own performance of this work, I opted, with Minakakis' permission, to add my own syllables below the staff which would take the saturation levels into direct account. In this way, I can avoid reading the square altogether while performing. This allows me to focus on the direction of the gesture.



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 13
Minakakis clearly asks for different densities of sound and for the saxophonist to quickly modulate between them, creating an evolution of the air pitch in both distance from the neckpiece and how much air is actually blown into the neckpiece.

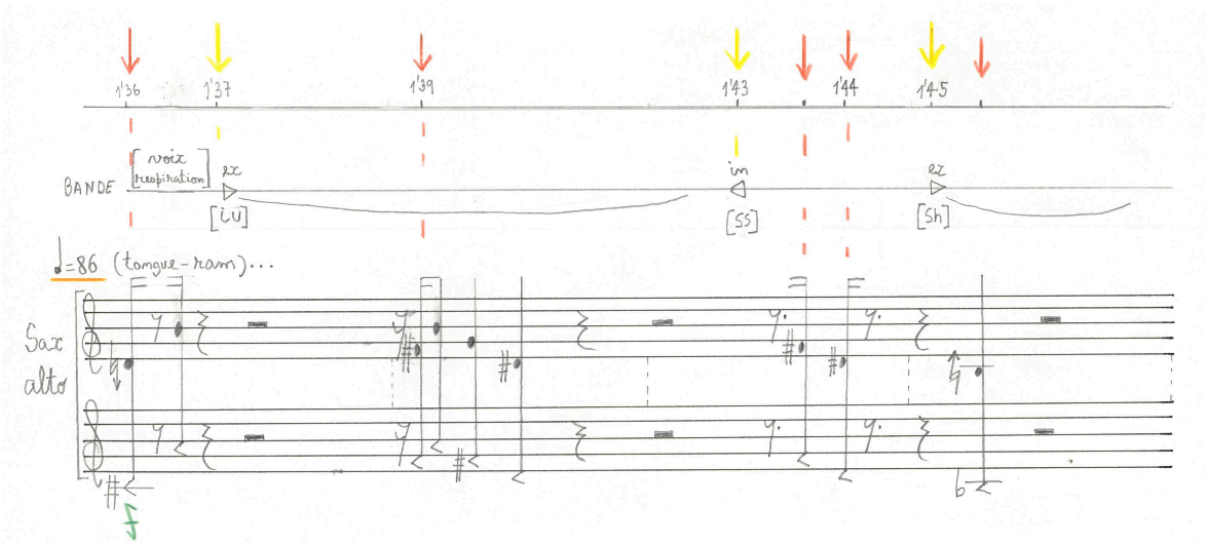
6.4.2 - Notational Practices of Tongue Ram

Tongue rams are notated similarly to the conventional slap tongue technique. Because tongue rams involve a quick, stopped attack with a short duration, the notational conventions are typically clear and precise. Many composers adopt a similar notation when incorporating tongue ram technique. Among notating SWMP techniques, this is the least contentious. Despite its inherent simplicity, Kientzy suggests an overly complicated notation. As can be seen below, he uses two staves where the bottom staff indicates the fingering, and the top staff the sonic result in C. However, I argue that the top staff is superfluous in this case: since the range of the tongue ram techniques is inherently limited and the sounds are fixed, based on one singular fingering per sound, there is no real need for the saxophonist to see the sonic result on their part or score.



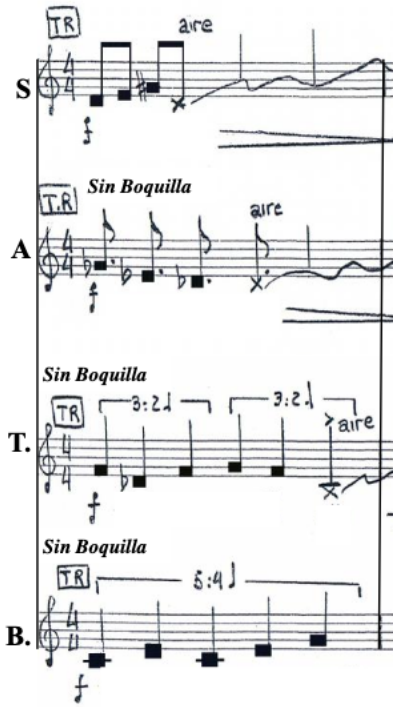
Daniel Kientzy's *Saxologie* (2007), p. 475
Notation suggestion of tongue rams.

Following this notational outline, Vitor Rua opens his work, *Saxopera II* (2001) for solo alto saxophone and electronics dedicated to Kientzy, by using tongue rams. As can be seen in the figure below, it is written in both proportional and traditional notation. Specifically interesting is that Rua uses two staves for the saxophone part, as per the suggestion of Kientzy. However, there are no indications as to which staff saxophonists should read for fingerings and which is the sonic result. Of course, they would quickly understand that the bottom staff is to be read for the fingerings, but this is not overtly stated in the score.



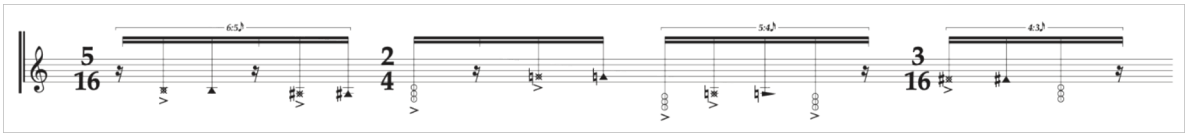
Vitor Rua's *Saxopera II* for saxophone and tape (2001), p. 2
Rua follows the same notational guidelines that are suggested by Kientzy. There is ambiguity with the two staves in that the saxophonist does not immediately know which staff is for fingerings and which contains the transposed notes.

In María Eugenia Luc's first saxophone quartet *YUN* (2012), SWMP techniques are only used at the beginning. Simply and effectively notated, Luc utilizes a square notehead for the notation of tongue rams and indicates precise pitches. As can be viewed in the score excerpt below, she also indicates that the technique is to be a tongue ram with the "TR" indication to avoid any confusion.



María Eugenia Luc's *YUN* for saxophone quartet (2012), p. 1
Square noteheads are used to indicate the tongue ram technique.

In *~drops~* (2017) by Stylianos Dimou, the saxophone quartet is asked to perform without mouthpiece for the entirety of the work, creating complex and rich textures that imitate different water droplet sounds. Despite the rhythmic and notational complexity of this work, the sonic result is often very simple. However, the patchwork of non-traditional symbols can be daunting and a limiting factor for saxophonists to choose to perform this work.

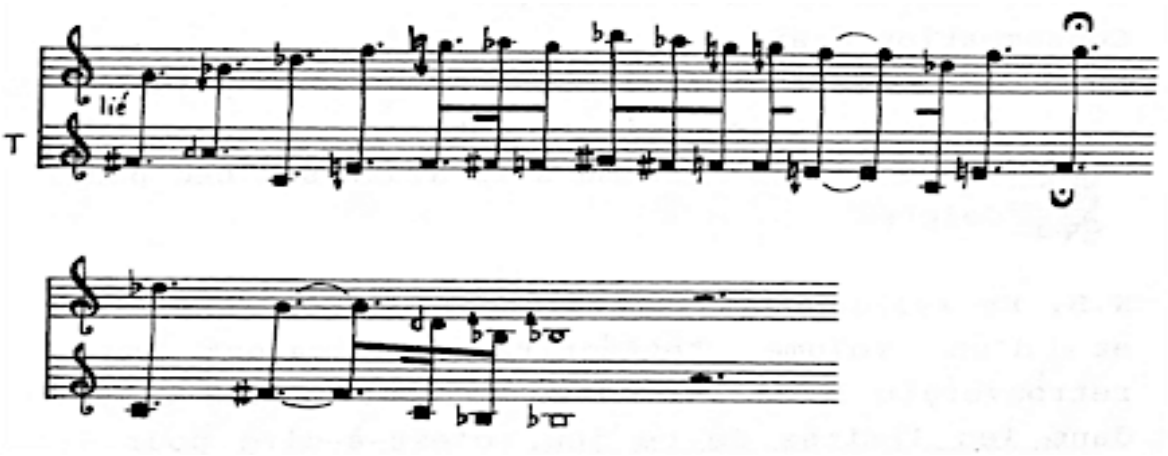


Stylianos Dimou's *~drops~* for saxophone quartet (2017), p. 12
Combining many different techniques, each in quick succession, this score excerpt shows how a saxophonist will need to get comfortable with the many different noteheads indicating the execution of highly specialized techniques – SWMP and otherwise.

Dimou weaves various parameters together. In the figure above, one can see just some of the various symbols he uses. In this particular example, the tongue ram is indicated by the equilateral triangle notehead. Key clicks are indicated by the circle with an x through it. Slap tongue is notated with an obtuse triangle notehead. The notehead with three open circles indicates the release of depressed keys. The two triangle signs (tongue ram and slap tongue) are confusing because, technically, one cannot slap tongue without the mouthpiece. After speaking with Dimou directly about this work and its notation, we agreed that the slap tongue technique should be a tongue crack sound articulated into the instrument where the tongue violently releases itself from the top of the soft palate. This type of attack is similar to the motion used to create an open slap sound with the mouthpiece. Therefore, this slap tongue technique is a derivative of the air pitch technique. Despite the novelty of the notation, the composer's intention with each symbol is clearly dictated in the legend that precedes the score.

6.4.3 - Notational Practices of Trumpet Sounds

Kientzy advocates for a double-staff notation system to represent trumpet sounds on the saxophone. The upper staff indicates the sounding pitches, while the lower staff denotes the required fingering. This approach, and its inverse, where the upper staff signifies fingerings and the lower staff shows the sounding pitches, is employed in various compositions. A significant advantage of this notation is that it allows the saxophonist to clearly discern the melodic contour that must be maintained, despite the cognitive dissonance caused by changing fingerings. Additionally, this notation employs square noteheads, enhancing clarity.



Daniel Kientzy's *Saxologie* (2007), p. 428
Notation suggestion of trumpet sounds.

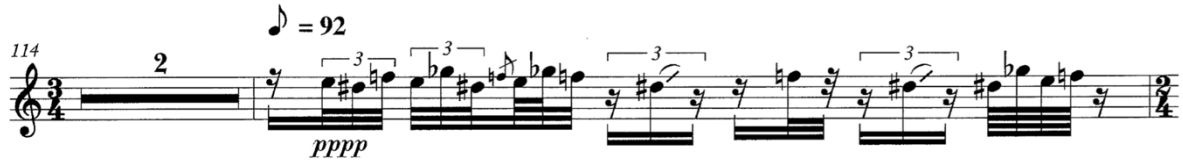
While the use of a double-staff system in notation is justified to a certain extent, it is not universally applicable and uncommon for saxophonists. It may serve as a pedagogical tool to help them familiarize with the trumpet sounds technique. Providing a guide for both the sound and the fingerings is not inherently detrimental. However, understanding the relationship between fingerings and the resultant pitches should be a practice-based endeavor for any saxophonist. Moreover, alternative fingerings may yield equivalent or even superior sonic results. Composers, using updated guides and methods, will understand that two different fingerings may produce either similar or completely unexpected sonic results. Both performer and composer bear the responsibility of understanding how this technique can produce the most optimal artistic result.

While the double-staffed notation may be beneficial as a practice aid or pedagogical reference, composers should avoid incorporating it into their scores unless other parameters, such as simultaneous singing while playing, necessitate its use. Practice aids would be better suited to the foreword of a score, where all technical aspects can be detailed. This would prevent the unnecessary complication of an already dense score with a double staff when prescore performance notes alone would suffice.

Weiss and Netti recommend a different notation. They suggest that "since this performance technique cannot be employed in fast alternation with normal playing, it is easiest to indicate the respective section with the phrase 'alla tromba' or 'trumpet embouchure' and notate it normally" (Weiss and Netti 2010: 148). This justification is simple and puts the responsibility on the saxophonist to find relevant and usable solutions to perform the technique. Their suggestion to notate the musical passage using normal rounded noteheads, is cogent as the sonic aural possibilities for trumpet sounds are more extensive than the other SWMP techniques up to this point.

The next excerpt is from Georges Aperghis' work *Crosswind* (1997) for solo viola and saxophone quartet. A significant issue arises with his treatment of SWMP in this work. It is entirely unclear whether the pitches indicated represent the actual sound or the

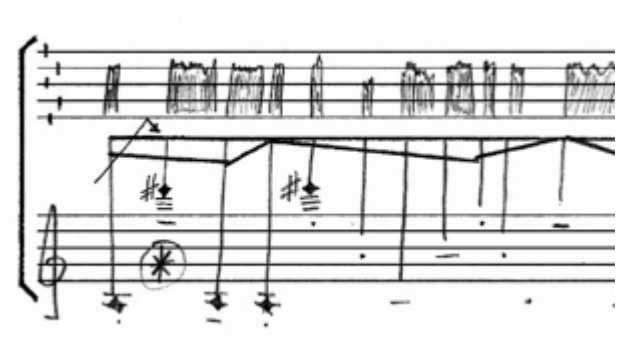
fingerings the performer should use. Additionally, Aperghis does not provide any pre-score performance notes or an explanation of the various techniques in the score, other than a simple directive to "take off the mouthpiece" before the section begins (Aperghis 1997: 11). This lack of clarity has led to various imaginative interpretations of this work. For example, some ensembles play this section with brass mouthpieces or plastic tubes inserted into the saxophone neck, despite the absence of such instructions.



Georges Aperghis' *Crosswind* for solo viola and saxophone quartet (1997), excerpt from the tenor saxophone part, p. 9
This excerpt shows an example of trumpet sounds notation by Aperghis for which he uses standard noteheads. He avoids indicating that the saxophonist should perform these sounds as trumpet sounds although the established performance practice is to perform them as such.

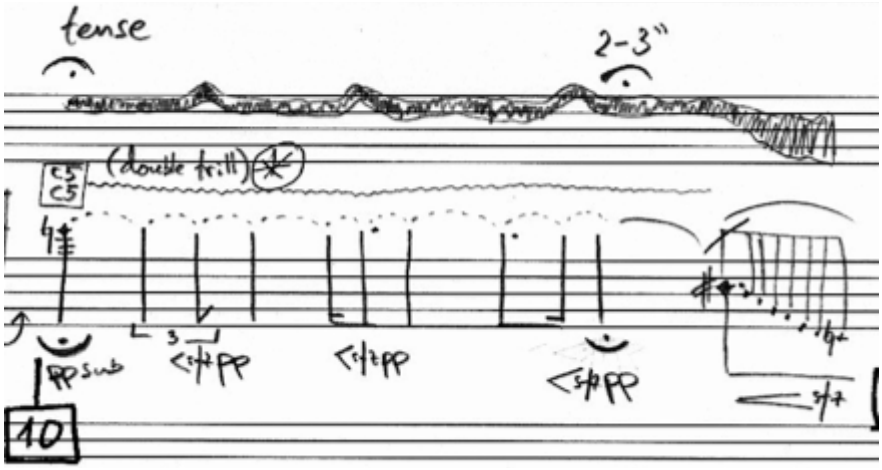
German Alonso addresses the notation of trumpet sounds differently in his work *el gran cabrón* (2012). He focuses more on the density of the sound rather than pitch precision. In sections written for SWMP, Alonso employs two staves: the top stave typically indicates density (and sometimes articulated rhythm), while the lower stave depicts fingerings, articulations on specific pitches, and relative rhythms. A particular challenge with Alonso's notation lies in interpreting the appropriate density for each note. In his foreword, he explains the requirements for performing the trumpet sounds technique and the meaning of the density factor:

> A drawing filling the whole vertical space...represents a dense, compact[,] 'low' sound [...], while a thinner drawing represents a greater lips [sic] tension, i.e. a more focused sound in terms of pitch, but still noisy. (Alonso 2013: vi)



Germán Alonso's *el gran cabrón* for baritone saxophone and electronics (2012), p. 1
Notation of barrissement technique. In several instances the choice of fingering is left up to the performer who must only respect the relative tessitura. However, in other instances, Alonso desires precise fingerings indicated by diamond noteheads. The staff above the standard staff indicates the relative density of the desired sounds.

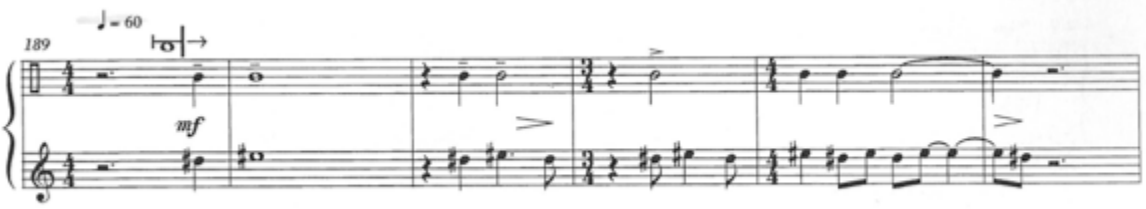
In the above figure, one would interpret the markings with a dense, compact, and low sound. This is opposed to the figure below where the marking is much thinner; therefore, one should interpret this to be a more precise and focused sound. At the end of this excerpt, the density returns to the former dense, compact, and low sound with the downward progression of notes starting from C# to the lower octave C♮.



Germán Alonso's *el gran cabrón* for baritone saxophone and electronics (2012), p. 4
Notation of barrissement technique with a thinner density marking indicate a focus on producing a more precise and compact sound.

In these excerpts, it is apparent that there are differences in the quality of the barrissement sound. Alonso's notation, however, leaves many parameters open. This is largely due to his disinterest in specifying, or hearing, which exact pitches come from the saxophone. He explains that "this key is used to indicate the relative range and density for barrissement [...] displaying the spectro-morphology of sound [...] It is especially important to avoid the production of a precise pitch as standard brass instrument embouchure would produce" (Alonso 2013: vi). Alonso is interested in the sound mass application of trumpet sounds as well as the density in terms of a quantifiable sound output. Conversely, he is not interested in creating melodic structures using this technique. Unlike the previous two excerpts, the technique is being used in much less precise ways to achieve a completely different sound concept – richer and more complex.

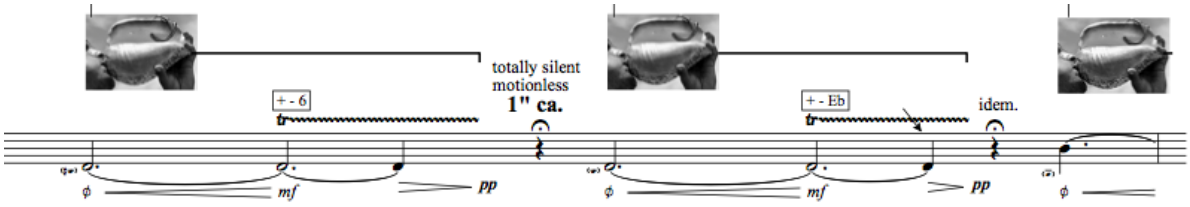
Robin Hoffmann created yet another system. The entire middle section of his quartet, *Der blutige Schaffner* (1996), is devoted to an exploration of SWMP techniques. Throughout this middle section he notates every technique using a consistent two stave system while utilizing a set of different signs and symbols to represent each disparate technique.



Robin Hoffmann's *Der blutige Schaffner* for saxophone quartet (1996), p. 14
In this example Hoffmann indicates all air sounds on the top staff and finger actions on the bottom staff.

The top stave indicates all air parameters (*Blasaktionen*) while the bottom stave is designated for the keys or fingerings (*Griffe/Klappen*) (Hoffmann 2001: v). Whereas his general method of notating extended techniques is laudable, the notation used for trumpet sounds is problematic. As seen in the above figure, especially in measures 192-193, the saxophonist would simply need to slur through most of this passage. In this way, Hoffmann has divorced articulation from pitch/fingering by separating these two parameters into two staves. It would be simpler to just notate this section with slurs and add the tenuto, accents, and dynamics in their normal places and then entirely remove the top staff. Nevertheless, despite the double-staff system separating parameters, his intentions are clear and easily interpretable.

A final example of notational practice for the trumpet sounds technique comes from Juan Arroyo's *Sikuri I* (2012). Arroyo makes a distinction between notes that need definition of pitch and notes that are not necessarily tied to any specific pitch. The former are labeled as "Inca's trumpet sound," the latter as "half Inca's trumpet sound" (Arroyo 2012: vi).

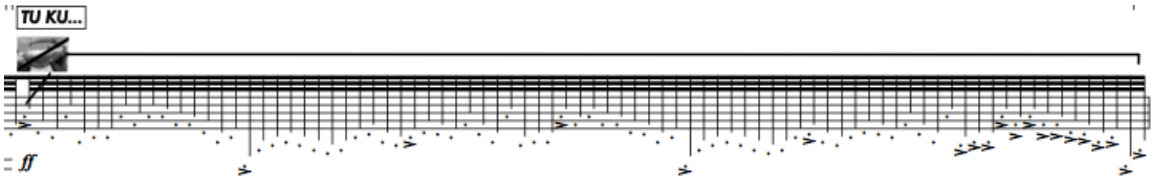


Juan Arroyo's *Sikuri I* for saxophone and electronics (2012), p. 6
Arroyo likened the sonic result to resemble that of a Peruvian instrument, the Incan trumpet.

What is particularly effective in this example is that Arroyo indicates the transposed note produced by the specific fingering used in the trumpet sound technique. This notation is both clear and unobtrusive, remaining small enough to avoid cluttering the score unnecessarily. Additionally, Arroyo did not use two staves to show the real pitch that will come out of the saxophone. However, while unique, using the "Inca's trumpet sound" as a symbol to infer a "pitched trumpet sound" is unpractical and misleading. The positive side is that the symbol is so large that it cannot be confused with any other technique.

The "half Inca's trumpet sound" is slightly more problematic. Since precise pitches are not important, Arroyo marks this parameter as open and to be chosen by the performer at random. Instead of distinct pitches, he indicates a relative guide to the tessitura in which he wishes the saxophonist to perform. However, Arroyo also indicates the syllable that he would like the performer to use. This can be seen above the half Inca's trumpet sound symbol in the figure below. This is effective when the relative pitch stays the same, but it becomes impossible to execute large leaps without changing the phonetic syllables that he suggests. The higher the leap the more closed the vowel will become; and, inversely,

the lower the leap the more open the vowel will become. So, when an upward leap is necessary, "TU KU" turns into "TEE KEE." With the leaps going into a lower range, the performer will need to change the vowel sound from "TU KU" to "TOH KOH" to have a noticeable change in pitch.

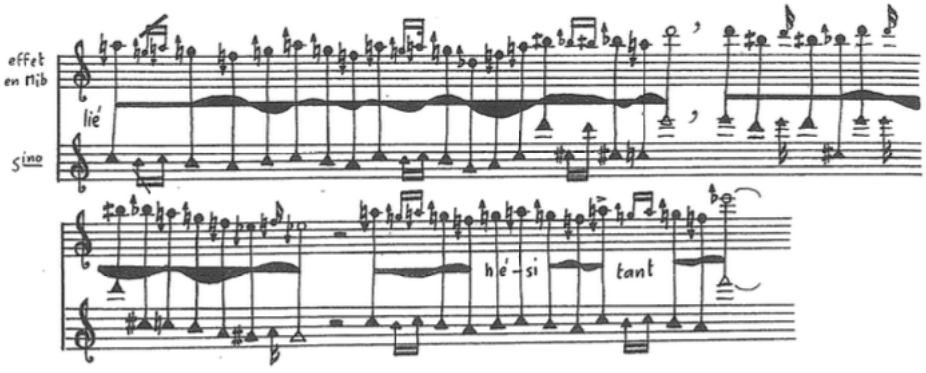


Juan Arroyo's *Sikuri I* for saxophone and electronics (2012), p. 5
Arroyo notates the barrissement technique with a graphic image of an Incan trumpet with a slash through it. He also indicates the phonetic syllables that a saxophonist should produce while performing this technique.

In *Sikuri I*, the first work in which Arroyo employed SWMP, he invented all new symbols. Much like Hoffmann, he did not seek out the advice of the Kientzy or Weiss/Netti saxophone guides; instead, he worked with the instrument himself and developed his own ideas on notation.

6.4.4 - Notational Practices of Saxo-Flute Hybridity

Since so few works have explored saxo-flute hybridity as of today, there are limited examples to gauge the notational practice used for this technique. Despite this, I will examine several works that give an overview of what has been used in the past.

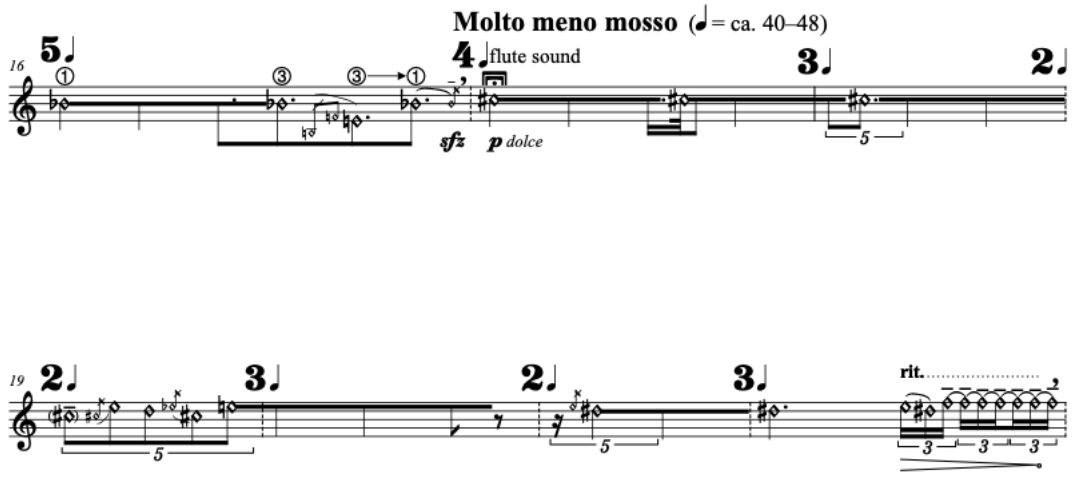


Daniel Kientzy's *Saxologie* (2007), p. 511
Notation suggestion of saxo-flute hybridity.

In *Saxologie*, Kientzy suggests notating these sounds with two staves. The top staff indicates the resulting sound, transposed to match the key of the saxophone being used. The bottom staff indicates the fingerings used to produce the pitches. There is a graphic element to Kientzy's notation in between the two staves. The meaning of this contoured line is not explained in his text nor is it understood as part of the notation itself. The only explanation that makes sense is that it is supposed to represent a slur to connect the

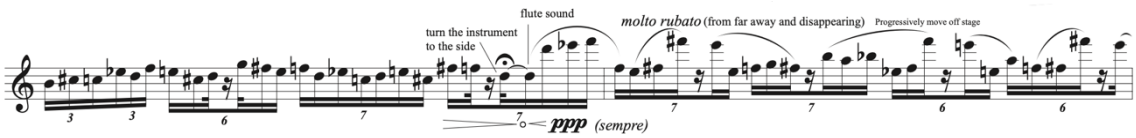
various gestures. The indication “lié” at the beginning indicates that all notes should be connected or slurred anyway, therefore, I am not certain this was the intention. In other techniques, trumpet sounds, for example, Kientzy does not use this odd graphic representation for a slur; he just marks that the notes should be connected. For the purposes of the discussion here, I will disregard this graphic element. The choice of an equilateral triangle is clear and allows a composer to be precise with rhythmic variations that hold duration by having open and closed triangles. The usage of two staves, one marking the fingering and the other showing the sonic result, is important for this technique, given the number of octaves or harmonics that can be performed, especially on the lower saxophones. I propose that the notation for the saxo-flute hybridity technique be approached similarly to the notation for trumpet sounds, given the wide range of octaves achievable with identical fingerings. This approach ensures clarity for performers.

The next excerpt is from Stratis Minakakis’ *For Felipe M.* (2021). The work ends with saxo-flute hybridity sounds. As can be seen in the figure below, Minakakis does not indicate any noticeable difference between the air pitch and saxo-flute hybridity; he uses the same notehead for both sounds. The only indication for the saxophonist to differentiate is the marking of “flute sound” above the note at measure 17. In 2020, when I worked with Minakakis on the conception of these sounds, I was not as proficient in these sounds and my research was still ongoing. I was unsure if a second or third octave was even possible. However, after his piece was completed, I realized my naiveté because I discovered the possibility of several other tessituras with saxo-flute hybridity on the baritone saxophone. Now, I would suggest to Minakakis to notate these sounds differently. He could achieve further clarity by using a modified notation that I will explain in a subsequent section (see Section 6.7.4) which follows the melodic contour without using two staves, employing a second staff to indicate both the sonic result and fingering, or specifying the tessitura where he prefers the flute sounds to be realized. This would enhance clarity and precision for performers.



Stratis Minakakis' *For Felipe M.* for saxophone (2021), p. 14
Minakakis uses the same notehead for saxo-flute hybridity as he does for the air pitch that comes before it. He simply mentions that the technique changes to flute sounds.

In the final part of Eleni Ralli's work for SWMP entitled, *Go Within* (2020), the saxophonist is asked to produce flute sounds. Here, as can be seen in the figure below, she chose to notate all non-air pitched or articulation sounds with normal noteheads. Trumpet sounds and saxo-flute hybridity sounds are represented with the same traditional notehead. To differentiate between these two, she simply indicates "trumpet sounds" or "flute sound." This is a simple solution that does not overly complicate a score that contains many techniques. To indicate a change in tessitura she simply changes the octave. Saxophonists will have to assume that the fingerings for most of the notes are performed using the side keys, as is customary for this technique. For the notated pitches G5, A5, B♭5, and B♮5, they will use standard fingerings; these pitches are challenging to produce but achievable. Like Minakakis' piece, this work was written for me, and I had a direct connection with Ralli while she was composing it. I asked her if she wanted to utilize two staves to indicate the resultant pitch and the fingering. She chose to keep things simpler, since the resultant pitches were not as important as the texture and untampered melodies.



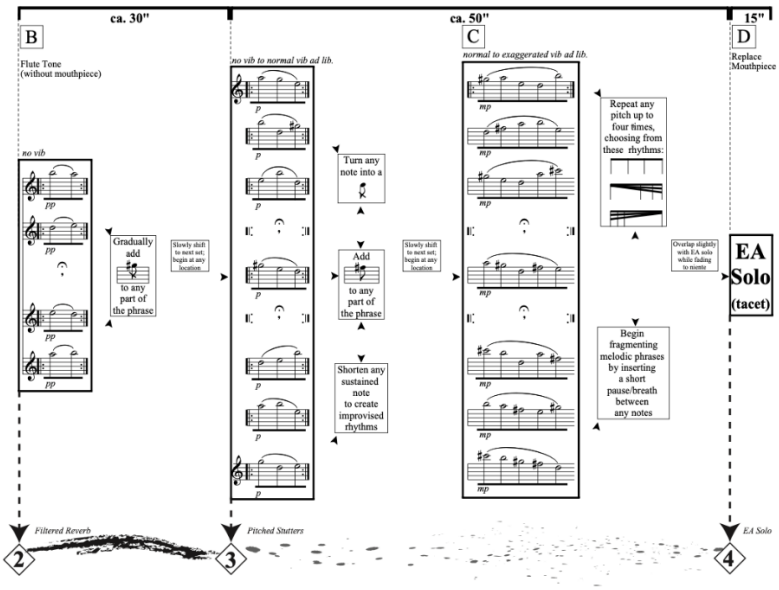
Eleni Ralli's *Go Within* for SWMP and saxophone with mouthpiece (2020), p. 8
Ralli does not distinguish a notehead difference between the flute sounds and the trumpet sounds. The performer is never asked to quickly switch between these two techniques except for the fermata moment where the trumpet sounds must, seamlessly, evolve into the flute sounds.

In her composition *Veiled Resonance* (2008), Elainie Lillios employs a mixture of traditional and non-traditional notation, directing the performer to utilize flute sounds in guided improvisations on soprano saxophone. The performer is instructed to play repeated material of their choosing from various sets of notated boxes, within a flexible time frame. As depicted in the figure below, Lillios specifies "'flute tone (without mouthpiece)" but leaves many parameters for the saxophonist to determine. All dictated note sets are technically feasible. However, the written G5, G#5, A5, and B5 will pose challenges as side keys cannot be utilized. This notation is precise in the sense that Lillios specifies which pitches she desires; however, it instructs the saxophonist to interpret these as fingerings rather than resulting pitches. In her performance instructions preceding the score, Lillios explains for the first movement:

> Play flute tones on the saxophone by removing the mouthpiece and blowing across the neck of the instrument. Move gradually from longer periods of silence to longer moments of sustained tones. As you progress, sustain tones as long as possible, and follow instructions that allow you to gradually improvise sustained

> melodic ideas and phrases. This movement should sound blended, sustained, and ethereal. (Lillios 2008: v)

I interpret the accuracy of the pitches as secondary to the sound texture Lillios aims to create through the integration of live saxophone and electronics. The flute sounds are integral to the opening, exploring improvisational air pitch sounds, where the focus lies more on the sonic qualities rather than on exact pitch precision. Therefore, this type of notation effectively communicates the composer's intentions.



Elainie Lillios's *Veiled Resonance* for saxophone and electronics (2008), p. 2
Allowing the saxophonist to improvise with just a few parameters, Lillios gives simple melodic gestures that they must perform for a specified amount of time. These pitch cells give them a great deal of freedom. The notehead is a conventional standard round notehead.

6.5 - Reinvention and Reexamination of Notation

Following an extensive examination of much of the SWMP repertoire, I have concluded that no particular notational practice can be deemed a priori superior or inferior to another. Many of the notational choices made by composers are inherently intuitive; some have left me confused and inclined to re-edit or re-notate the scores myself. Historically, composers have often done the same: when new signs and symbols allowed them to notate their works in clearer ways, they would often edit, re-notate, and republish new versions. György Ligeti revised his *Études for Piano* (1985-2001), making changes to the notation, dynamics, and articulation to achieve greater clarity and expressiveness. Many of these revisions were based on the feedback of performers. One such glaring example is his *Étude 14 Coloana infinită* for piano*;* it was deemed too demanding and he made a second version reducing the number of notes in each hand (Steinitz 2003: 310).

For “New Complexity” composers, it is common to invent novel notations, especially while working with extended techniques. Brian Ferneyhough pushed the concept of extended techniques and the density of competing parameters to an extreme in two of his works for solo flute: *Cassandra's Dream Song* (1970) and *Unity Capsule* (1976). These works feature layers upon layers of intricate instructions. Ferneyhough acknowledged that the conception of *Cassandra's Dream Song* was partly inspired by emerging questions and possibilities in musical notation. In his pre-score performance remarks, he states:

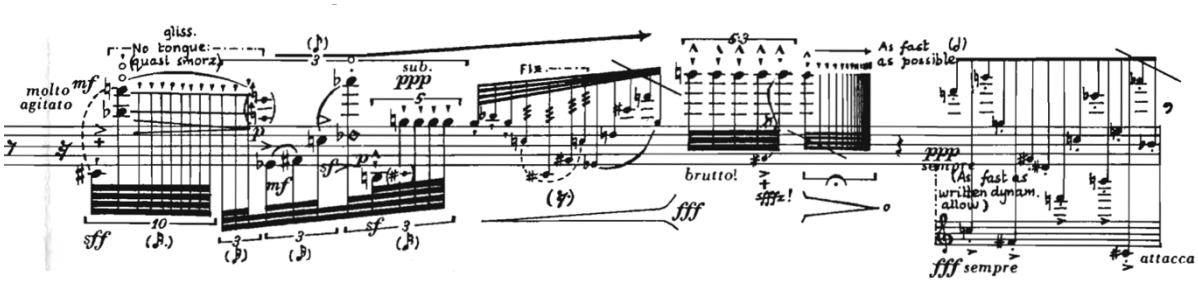
> The choice of notation in this instance was principally dictated by a desire to define the quality of the final sound by relating it consciously to the degree of complexity present in the score. The piece as it stands is, therefore, not intended to be the plan of an ‘ideal’ performance. The notation does not represent the result required: it is the attempt to realize the written specifications in practice which is designed to produce the desired (but unnotatable) sound-quality. (Ferneyhough 1970: i)

Often, the notational choices made by composers writing for SWMP adhere to this same conceptual framework; the scores are meant, with varying degrees of success, to represent the desired sonic outcomes.

This insightful recognition that notation alone is insufficient allows the performer to take risks while emphasizing the significance of the difficulty any dense set of actions should convey. Ferneyhough further articulates that “the audible (and visual) degree of difficulty is to be drawn as an integral structural element into the fabric of the composition itself” (Ferneyhough 1970: i). I would add that its performance should reflect this degree of difficulty.

In *Cassandra's Dream Song*, and other similar works, the notation serves not merely as a guide for producing specific sounds but as a framework within which the performer's engagement with the complexity of the score generates the intended sonic and expressive outcomes.[42] This approach underscores an emphasis on the interplay between performer and score, where the act of negotiating the intricacies of the notation becomes a crucial aspect of the artistic experience.

[42] The inclusion of *Cassandra's Dream Song* (1970) as an example highlights not just the specific notational choices used to represent contemporary playing techniques; I have used it to highlight Ferneyhough’s thought processes on the use of a highly dense and complex notation to represent a final sonic output. There are other works from Brian Ferneyhough’s oeuvre, such as *Unity Capsule* (1976) for solo flute, that present a broader undertaking of contemporary techniques.



Brian Ferneyhough's *Casandra's Dream Song* for solo flute (1970), p. 2, system A
In this iconic example of "New Complexity," Ferneyhough challenges the flutist to seamlessly and swiftly transition between traditional and unconventional techniques. Here, multiphonics, flutter tongue, and slap tongue are employed in rapid succession. The notation used exemplifies a maximalist approach found throughout the repertoire, requiring performers to dedicate considerable time to comprehend how these techniques function sequentially, and then to develop speed and proficiency in executing these nearly overlapping techniques. The intent behind this maximalist notation is integral to both the composition and performance of the score. It serves to intricately weave together diverse timbral and textural elements, demanding a high level of technical mastery and interpretative skill from the performer. By requiring such rapid shifts between techniques, Ferneyhough's notation not only challenges traditional boundaries of flute performance but also amplifies the expressive and aesthetic dimensions of the music. This deliberate complexity invites performers and audiences alike to engage deeply with the interplay of technique, interpretation, and artistic expression within the framework of the composition.

Despite such interplay between composer, performer, and score, Ferneyhough is yet another example of someone who reexamined his earlier works. He revised and refined the notation of his complex work for solo cello and electronics, *Time and Motion Study II* (1973-1976), many times. The revisions often aimed to clarify the intricate performance instructions and elaborated on the detailed rhythmic structures. Furthermore, performers have taken their own liberties in adjusting, editing, and recreating parts of the score and the original tape. For example, in performances by cellist Neil Heyde and sound engineer Paul Archbold, the analogue tape has been digitally remade through MaxMSP tools.

6.6 - Practice-led Possibilities for Notation of SWMP Techniques

For the purposes of my own practice, I have re-notated selected passages to facilitate precision and clarity in performance. If a notation does not work for me, I am quick to find one that will better aid in achieving a desired musical outcome. However, due perhaps to the esoteric nature of SWMP, many other performers have not sought out similar solutions. I often ponder if this is caused, in some part, by the lack of experience-based tools concerning a performers familiarity with the notation of these techniques.

It is with this ethos in mind, that I have come to provide my own solutions and guidelines for notating these techniques. These are, first and foremost, suggestions to composers and a place to start. With this notation being put into practice more and more, performers will slowly gain proficiency and familiarity with them, while composers do not have to reinvent new notations and be confident that performers will know what their notations

mean. Some composers will perhaps want to pursue notational choices that are very different from my suggestions and guidelines. However, my proposal is meant to support the compositional process and find a middle ground between performer confusion, score clarity, and composer inspiration. The notational suggestions which I will further elucidate in the forthcoming sections, will undoubtedly aid in the broader reception and performance of SWMP techniques, raise awareness of a repertoire often relegated to the margins of contemporary performance even among saxophonists, and enhance the transparency of techniques across disparate works by different composers. These suggestions can therefore be regarded as an informed addition (and correction) to the many different ways composers worldwide notate SWMP techniques.

While examining conventionally accepted notational practices for wind instruments, it becomes apparent that many different symbols have historically been used to represent the same sonic phenomena. This fact complicates the relationship between performer, composer, and score. For example, long-established practices in the flute world use diamonds to represent air-specific sounds or triangles to represent tongue rams. This is the case for Salvatore Sciarrino's *Como Vengono Prodotti Gli Incantesimi?* (1985), Brian Ferneyhough's *Unity Capsule* (1976), or more recently Helmut Lachenmann's *My Melodies* (2016-2018) for 8 horns and orchestra.[43] Typical trumpet playing is notated with regular round noteheads. In the following sections, I preserve these long-practiced traditions by modelling my preferred notation for air pitch, tongue rams, and trumpet sounds from these notational practices borrowed from flute and trumpet playing. However, how to notate saxo-flute hybridity? A standard round notehead or a diamond notehead, accompanied by a textual designation above the stave indicating saxo-flute hybridity would perhaps suffice. However, I find this solution unsatisfactory, as it is less elegant and can potentially cause confusion when a mixture of techniques is employed in rapid succession. Instead, I choose to notate saxo-flute hybridity by using boxes. In traditionally accepted string and wind writing, boxes are used to represent airy sounds. As saxo-flute hybridity is an evolved form of the air pitch technique it makes sense to notate this technique with square boxes too.[44]

When homonymous techniques are used with and without the mouthpiece integrated within the same piece, I encourage composers to adapt their notational language in order to be as clear and transparent as possible. For example, one can use a triangle to notate tongue rams and the traditionally accepted "X" to notate slap tongue. Many possibilities

[43] In Lachenmann's work air sounds are represented by diamond noteheads. However, the tongue ram does not conform to traditionally accepted notational practices. Therefore, he chose to notate them with a square box notehead with a line extending from the bottom right-side corner of the box.

[44] The choice of notation software and their respective positive and negative benefits to notational practices is outside the immediate scope of this thesis since it pertains little to SWMP generally. The multitudes of software that can be employed show how rich the possibilities are. However, limitations are inherent, especially when a very specific, unprogrammed or nonexistent design is required. Software usage in general also brings up concerns about access as it is often expensive and it usually involves years of experimentation to become useful and convenient. Nonetheless, at the time of publication of this thesis there are several options available: Dorico, Sibelius, LilyPond, MuseScore, Finale (despite the recent dissolvement of the Finale business), etc. Furthermore, many composers are using InDesign and other graphic design programs to elaborate their notation. For my own notehead preferences, outlined in subsequent sections of this thesis, I have used Finale.

are conceivable; however, it is essential to notate these techniques logically and include clear explanations of all notational symbols in the foreword of the score.

For each technique, I will list basic guidelines to follow when notating them. Then, I will show the basic symbol and notation used and follow up with a few practical examples.

6.7 - General Notational Guidelines for SWMP Techniques

1. The selection of noteheads must be clear, particularly in contexts where both saxophone with and without mouthpiece are employed within the same composition. It is crucial that rhythmic durations are readily discernible through appropriate notehead choices. For instance, a simplistic "X" shape fails to convey duration effectively, thus proving unsuitable for techniques such as air pitch, trumpet sounds, or saxo-flute hybridity, all of which may require extended durations.
2. Specify instances where the saxophonist is required to remove or replace the mouthpiece.
3. Upon the initial introduction of a technique within the score, provide textual descriptions or abbreviations (e.g., AP for air pitch, TS for trumpet sounds, SFH for saxo-flute hybridity, and TR for tongue rams).
4. Minimize the utilization of multiple staves, employing them only when indispensable, such as for simultaneous playing and singing or intricate and densely layered trumpet sounds or saxo-flute hybridity techniques.
5. Avoid transcribing techniques in concert pitch; all notated pitches should indicate the specific saxophone fingering, thereby ensuring proper transposition.
6. Include a comprehensive index of symbols denoting all instrumental techniques utilized throughout the composition.
7. When working with electronics, include a staff with relevant auditory cues. If the sounds are more rhythmically free or action-based, include textual descriptions of what the saxophonist will hear. Clearly mark where pedal changes must be executed above the notated saxophone staff.

6.7.1 - Air Pitch

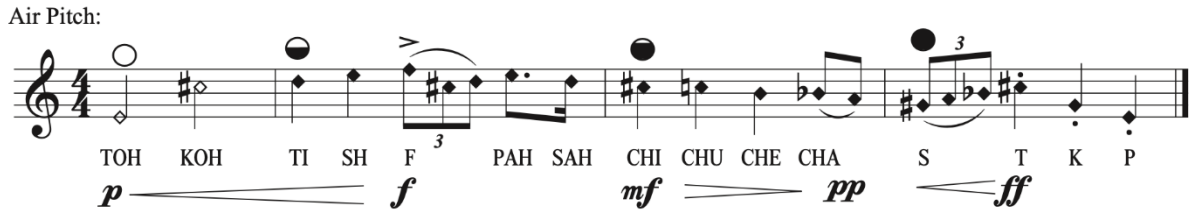
From a performer’s perspective, the notation of air pitch techniques can pose inadvertent challenges, often stemming from ambiguities in producing phonetic syllables through the instrument. Saxophonists must make compositional decisions when these instructions are not explicitly defined by the composer; the performer thereby becomes a co-composer of the piece. When there is insufficient information, the performer is compelled to make their own artistic decisions, thereby shaping both their performance and the work itself. The following guidelines are proposed to ensure clarity in notating the air pitch technique:

1. Employ a diamond notehead.

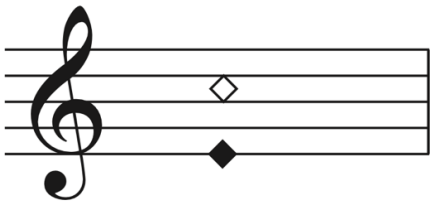
2. Specify the phonetic syllables or vowels intended to shape the sound below the staff. In the performance notes section of the score, provide examples of phonetic spellings along with sample words, and denote their linguistic origins when necessary.
3. In cases where no specific syllable or vowel is designated, indicate that the saxophonist can select a neutral vowel at their discretion.
4. Since the sound of the air pitch is influenced by mouthpiece placement on the neck, detail how much of the mouthpiece should be covered by the mouth. This can be visually represented by an open circle gradually filled to indicate coverage levels (e.g., 0%, 25%, 50%, 75%, and 100%), specifying the direction from which the saxophonist should approach the neckpiece (left or right, top, or bottom).
5. If no particular mouth placement is specified, note that the saxophonist can determine this based on the contour of the musical line and dynamics.
6. For transitions between phonetic syllables, denote the desired evolution using an arrow connecting the two phonemes.

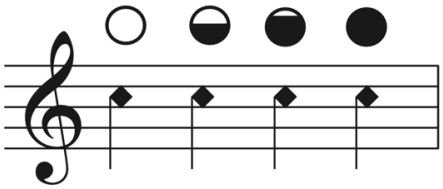
These guidelines aim to mitigate potential confusion in air pitch notation, ensuring a clearer and more consistent interpretation.

Notation example using air pitch technique:



Click the link below to listen and watch my demonstration of this excerpt:
https://youtu.be/SqLUFsjgeRA

Notehead preference:		The diamond notehead serves as a precise and clear indicator of rhythmic duration.

<table>
<tr>
<td>Mouth placement symbol preference:</td>
<td>

<table>
<tr><td></td><td>Tube is 100% open.</td></tr>
<tr><td></td><td>Tube is 50% open and 50% closed.</td></tr>
<tr><td></td><td>Tube is 75% closed and 25% open.</td></tr>
<tr><td></td><td>Tube is 100% closed.</td></tr>
</table>
</td>
<td>Symbols such as these enable composers to impart diverse tonal qualities to the sound. These symbols are clear, visually representing the positioning of the mouthpiece, and facilitating rapid sequential use. While additional gradations like 10%/90% or 30%/70% are feasible, the perceptible auditory effect diminishes, and achieving precise accuracy at these specific percentages proves challenging. Consequently, the potential for notational ambiguity between these symbols can swiftly lead to confusion.</td>
</tr>
</table>

6.7.2 - Tongue Ram

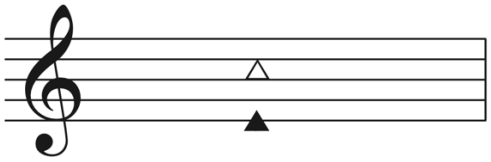
Although straightforward, the notation of the tongue ram technique can be mistakenly associated with both traditional tongue ram and slap tongue techniques used in playing with a mouthpiece. Therefore, it is crucial to differentiate between these techniques in musical scores, for example by adding text that states when the mouthpiece is intended to be removed and when the mouthpiece is supposed to be added again. This simple solution avoids confusion when homonym techniques are employed in compositions. The following guideline aims to clarify the notation of the tongue ram technique:

1. Employ a triangle notehead to signify the tongue ram technique. It is common for composers to use an “X”-shaped notehead to denote slap tongue, but this can lead to confusion, particularly in compositions that incorporate both mouthpiece and SWMP playing.

Notation example using the tongue ram technique:

Click the link below to listen and watch my demonstration of this excerpt:
https://youtu.be/KtNSFSf2qTY

Example of notehead preference for the tongue ram technique:

Notehead preference:		The triangle notehead is a precise and effective choice for notating tongue rams. Because this technique involves a quick articulation rather than sustaining a note for a long duration, using this notehead ensures rhythmic clarity. This is particularly important in distinguishing the silence between articulations, which can be accurately executed with the triangle shape compared to an “X” notehead, typically associated with slap tongue techniques.

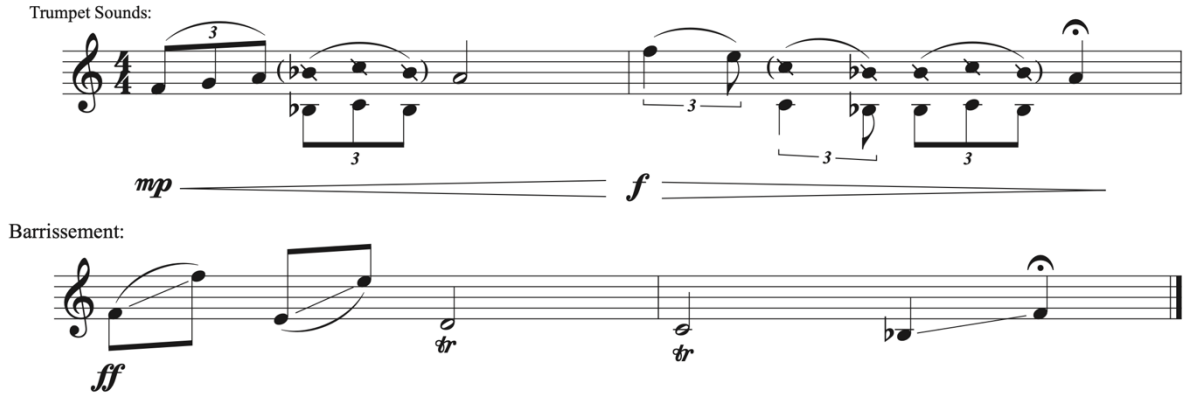
6.7.3 - Trumpet Sounds

Here are several guidelines for composers from a performer's perspective when composing for the trumpet sounds technique:

1. Employ the standard round notehead.
2. When a passage necessitates the saxophonist to execute an unconventional leap within a fingering pattern, clarify the transposed desired notes with a round notehead containing a slash. Additionally, enclosing these notes in parentheses can further differentiate which notations correspond to the intended fingering and which represent the desired sonic outcome of that fingering.
3. Utilize double staves sparingly, reserving them for instances where the saxophonist is required to sing exact pitches while playing simultaneously.
4. When incorporating the barrissement technique, clearly delineate the starting and ending points of both normal trumpet sounds and barrissement sounds.

These guidelines aim to enhance clarity and facilitate the performance of trumpet sounds, ensuring both the accuracy of fingering transitions and the distinct articulation of desired sonic effects.

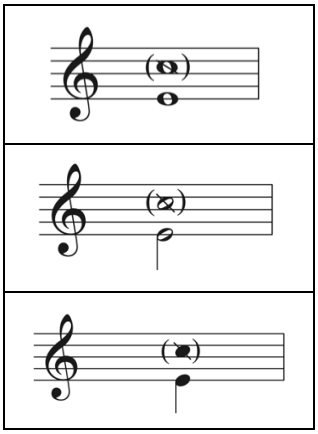
Notation example using trumpet sounds and barrissement techniques:



Click the link below to listen and watch my demonstration of this excerpt:
https://youtu.be/NRNPo13XHvA

In the provided excerpt, fingering indications are represented by notes with standard round noteheads. When a fingering does not produce the expected sound, notes with a round notehead slashed through and enclosed in parentheses guide the performer in executing the melodic phrase as intended. The second line of the figure prominently displays instructions for employing the barrissement technique. Given its inherently ambiguous pitch center and its primary role in textural creation rather than precise pitch control, parentheses are not essential for indicating this technique. However, composers seeking greater control over the barrissement effect may specify such preferences in the performance notes.

Example of notehead preference for trumpet sounds technique:

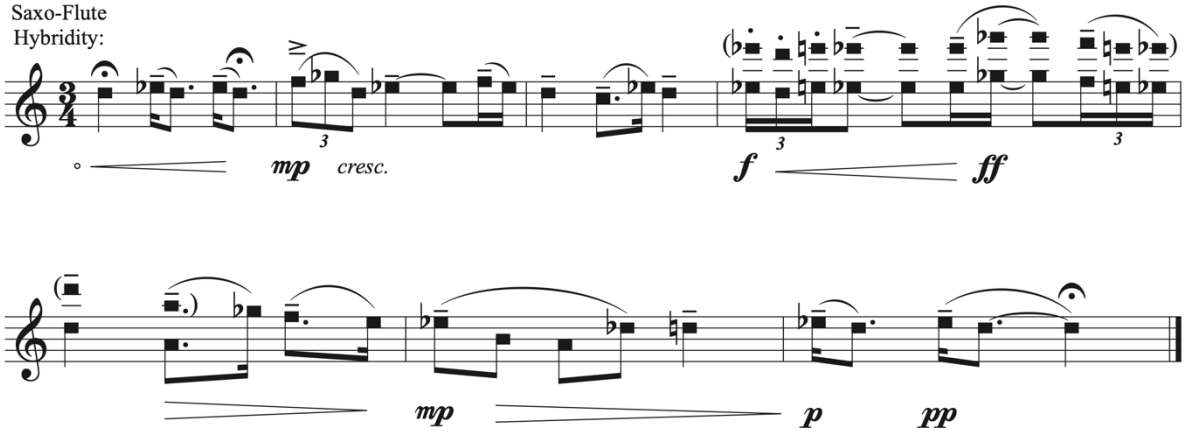
Notehead preference:		The standard round notehead is the preferred choice for notating trumpet sounds. This offers the broadest range of sonic possibilities among the various techniques used to notate trumpet sounds. The round noteheads with a slash through them indicate that saxophonists should finger the lower note but aim for the other octave indicated by the slashed notehead.

6.7.4 - Saxo-Flute Hybridity

Especially when juxtaposed with other SWMP techniques the following guidelines aim to clarify the notation of these sounds:

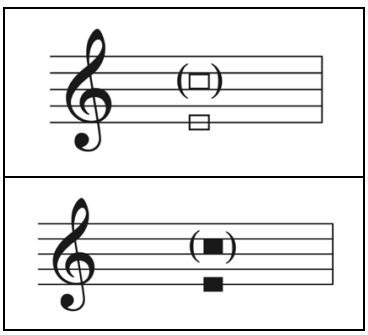
1. Use a square box notehead to denote saxo-flute hybridity.
2. In passages where the saxophonist must navigate an unconventional leap in fingering patterns, indicate the transposed desired notes with an additional square notehead but consider enclosing these notes in parentheses to clearly differentiate which notations correspond to the intended fingering and which represent the desired sonic outcome. Regarding the use of parentheses, the opposite approach could also be effective, where the parentheses enclose the fingering, and the desired pitches remain unenclosed. Both are clear notational solutions; however, it is crucial to provide a detailed explanation of these notations in the foreword of the score.

Notation example using the saxo-flute hybridity technique:



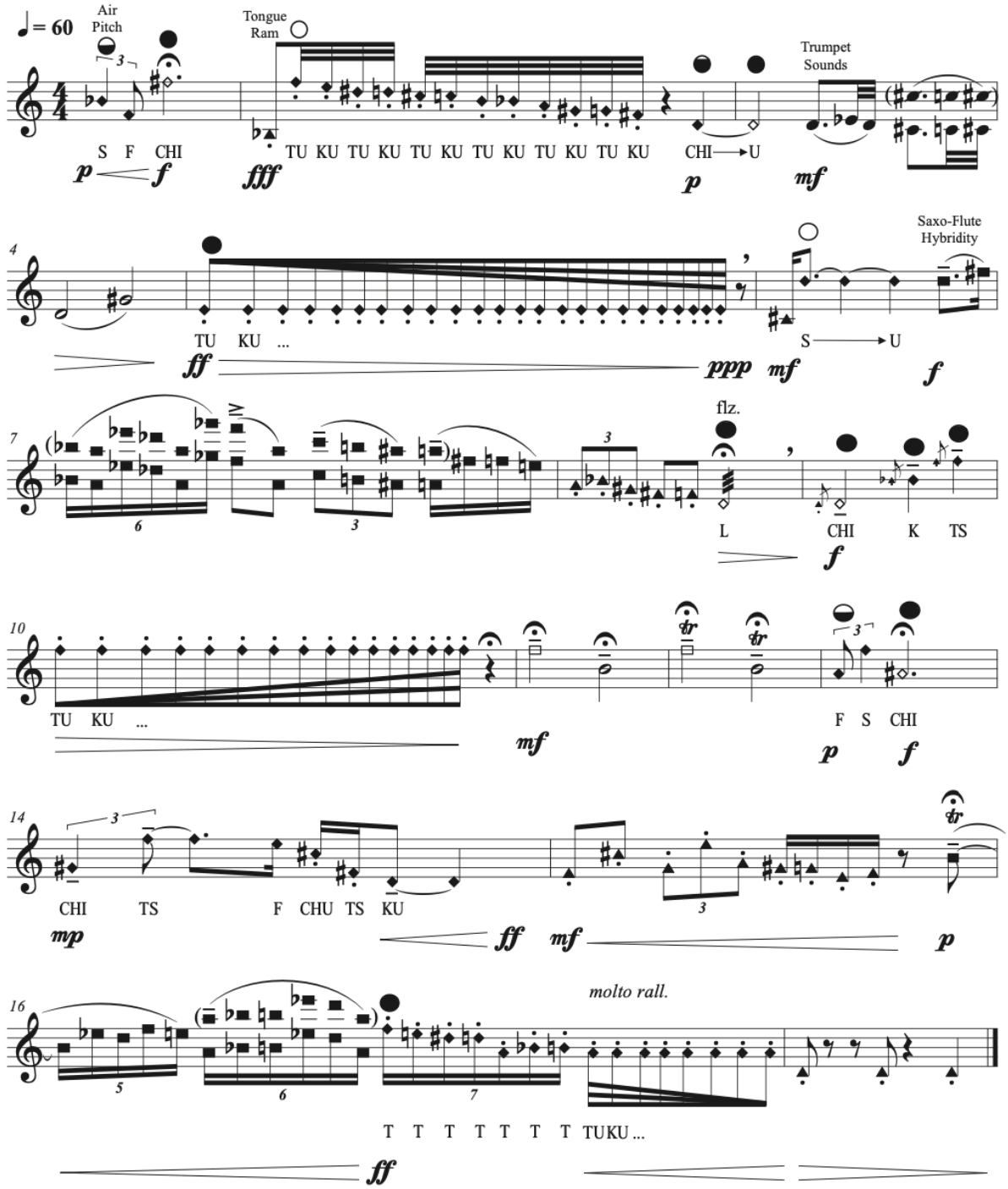
Click the link below to listen and watch my demonstration of this excerpt:
https://youtu.be/CxDjHK1wyP4

Example of notehead preference for saxo-flute hybridity technique:

Notehead preference:		The square box notehead is the recommended choice for notating saxo-flute hybridity due to its distinct visual representation. This notehead is also more conventionally used to represent airy sonic material in string and wind writing and is therefore a good replacement of the round or diamond noteheads.

6.8 - Notational Synthesis

The following excerpt, a simple composition that I created myself, combines all four techniques together using my notational suggestions and guidelines.



Click the link below to listen and watch my demonstration of this excerpt:
https://youtu.be/mvpcxO_zjJ0

As explored in this chapter, the possibilities of musical notation appear boundless. This extensively discussed and debated topic will persist as a focal point of scholarly and musical discourse, driven by the composers urge to innovate and the performers' desire to experiment and to expand the capabilities of their instruments and the range of sounds they produce. These advancements are (more and more) supported by technological progress. As software becomes more user-friendly, widely adopted, and refined, it will increasingly be integrated into the processes of music creation and notation. The evolution of symbols and signs used to represent sonic ideas is therefore inevitable. Guidelines and systems of standardization normalize new techniques, enhance artistic depth, and reduce confusion among performers and composers alike.

For the SWMP practice, a deliberately suggested format accompanied by various guidelines for notating these techniques can serve as a foundation for new compositions, auxiliary techniques, deeper comprehension of these techniques, and the dissemination of this contemporary saxophone repertoire. Composers will observe their works being performed with greater accuracy and fidelity, increasing the likelihood of these pieces being featured in festivals and programmed by cultural centers. Performers will become acclimated to these specific notations, developing proficiency that fosters better performances. Although no single notation system can be deemed superior to another, possessing an understanding and knowledge of notational possibilities – alongside those preferred from a practice-led approach – enables more precise execution of these techniques, allowing performers to better express themselves.

Additionally, I advocate for a more direct interaction between composer and performer in the creation of new works. Notation functions not simply as a directive for the creation of particular sounds; it is an element in a network of agents that make music making possible. This perspective, again, highlights a focus on the dynamic relationship between performer and score, where the endeavor to navigate the complexities of the notation constitutes a fundamental element of music making. This approach emphasizes a middle ground between strict standardization and interaction between performer and score.

A more standardized notational system will enable performers to swiftly transition from basic comprehension of techniques to achieving more control, granting them the freedom to deliver convincing interpretations. Although composers may never attain complete satisfaction in what Taruskin describes as their quest for "infinite musical evolution" (Taruskin 2010: 476), I have tried to establish a foundational basis, along with clearer guidelines, for notating SWMP techniques. These guidelines, coupled with a closer relationship between composer and performer, might offer a valuable framework for composers willing to incorporate these techniques into their works.

Conclusion

At the beginning of this practice-led research, I was driven by a desire to uncover the layers of meaning behind the techniques and practice of SWMP playing. I saw these techniques as a defining and infinite source of artistic inspiration and committed myself to developing them in a way that no other saxophonist had previously attempted. My artistic quest began with the question of how to most effectively transmit the artistic potential of these techniques to a broader audience, as well as to the specialists with whom I work closely, namely saxophonists, composers, and music researchers.

Through this deep investigation, I have begun to understand that these techniques are steeped in a myriad of issues that have hindered their more widespread adoption among saxophonists and composers. These problems include:

- Troublesome understandings of contextualization and historical legitimacy
- Disparate levels of inclusion in prominent saxophone guides
- Misconceptions concerning proper basic training and knowledge transmission among saxophonists and composers alike
- A repertoire that, while important, is not (yet) widely recognized as part of the contemporary saxophone repertoire
- A lack of notational guidelines for composers

Given these issues, I have investigated how to best solve such problems and bring a richer and deeper understanding of SWMP techniques to saxophonists, composers, researchers, and the general public. Through my research, I have aimed to provide clarity, context, and a robust framework that can support the wider acceptance and artistic exploration of these innovative techniques.

In this dissertation I have uncovered knowledge about these techniques, demystified them, placed them in a historical and aesthetic context, and codified the practicalities in response to the problems and questions which have surrounded them. In Chapter One, I have examined several musical developments which formed fertile grounds for SWMP to come into existence and to evolve. The emergence of SWMP did not happen in an isolated void: experimentation and an interest in novel sounds can be traced from the 1900s into the present day. In the 1920s-1930s, Vaudeville and dance band saxophonists would experiment heavily with tricks to amuse audiences (Levinsky 1997). Despite a clear and concrete lack of proof, it can be assumed that saxophonists continued to experiment with novel sounds between the 1930s and 1980s when composers started incorporating SWMP techniques in their work. Daniel Kientzy's foundational research on classifying all possible sonic phenomena on the instrument, serve as evidence of the evolution of extended techniques including SWMP. In 1980, the first known composition was written using SWMP techniques: In *Do-Mi-Si-La-Do-Ré* (1980/1981) Costin Miereanu used trumpet sounds on the saxophone marking an important entrance for these techniques into the contemporary performers tool kit. From this point onward, composers began to

write for SWMP in an exponentially increasing fashion. Currently, more than 250 works by notable contemporary composers incorporate SWMP techniques.

Prominent saxophonists have played a defining role in bringing legitimacy to contemporary saxophone techniques throughout the past decades. Without the staunch advocacy from Daniel Kientzy, Jean-Marie Londeix, Marcus Weiss, Marie-Bernadette Charrier, Claude Delangle, etc. the saxophone would not be the wind instrument as many contemporary composers see and use it today. Their commissions, performances, research, recordings, and influence have not only reshaped the conventional understanding of saxophone technique but also inspired a younger generation of saxophonists to explore similar and dissimilar innovations through their instrument. Despite the wealth of knowledge these trailblazers of the saxophone community have added to the collective knowledge of contemporary saxophone performance practice and education, SWMP techniques are still not fully understood. My observation is that this practice has not received the detailed study that it deserves. I hope that my practice-led artistic research has contributed something to close this knowledge gap.

Especially from the 20th century on, the landscape of music was continuously evolving, driven by a broader trend towards experimentation and innovation in both the tools and methods of music creation, including the use of instruments, computers, and extended techniques. It seems likely that this also influenced the saxophone community.[45] Luigi Russolo, a pivotal figure in this experimental milieu, articulated a radical reimagining of music in his 1913 manifesto *The Art of Noises*. Russolo contended that the advent of machinery in the 19th century had irrevocably altered the auditory environment, making traditional music, with its historical conventions and limited sonic range, inadequate for modern sensibilities. He advocated for the incorporation of mechanical and urban noises into music, envisioning *intonarumori* or noise instruments that could produce a more extensive array of sounds. I also mentioned the contributions of Edgard Varèse, who in his manifesto *The Liberation of Sound*, underscored the transformative potential of electronic music in expanding the timbral and expressive capacities of sound. Varèse posited that electronic music should complement rather than replace traditional instruments, suggesting a synergistic relationship between the two. The influence of Russolo and Varèse - which is echoed in both conventional and non-traditional saxophone techniques later on - continued after World War II, a period that witnessed a pronounced shift in musical focus towards the exploration of sound itself, leading to the development of new performance techniques and the establishment of symbiotic composer-performer relationships. This era saw figures such as John Cage and Luciano Berio, alongside saxophonists like Daniel Kientzy, championing modern and progressive techniques that significantly influenced contemporary compositional and pedagogical practices. The concept of *musique concrète instrumentale* provided another framework for understanding the innovative potential of saxophone techniques. Helmut Lachenmann's

[45] Proof of this can, for example, be found in (free) improvised music – see below.

ideas, which prioritize the physical act of sound production over the concrete sonic results, can also be recognized in the practice of SWMP. Also Lachenmann challenged certain aesthetic conventions, prompting a reevaluation of the artistic value of non-traditional sounds. Through the lens of *musique concrète instrumentale*, SWMP techniques acquire additional historical and aesthetic significance, emphasizing the dynamic interplay between tradition and innovation.

The impact that composers, performers, and improvising musicians have brought to the sonic evolution of the saxophone cannot be understated. Jazz and improvising musicians consistently adapted and created new techniques and sounds on the saxophone, often inventing techniques that composers and classical saxophonists adopted later. In their book *The Techniques of Saxophone Playing,* Weiss and Netti highlight improvisation and the explorations of the postwar avant-garde as major aesthetic contributions to modern saxophone sound and embouchure.

By briefly analyzing Marc Vilanova's *Saxophone Miniature II*, Christine Abdelnour's solo set from Paris, and Ben Eidson's *Solo Saxophone I,* I illustrated how the innovative uses of SWMP techniques were concretely adapted in improvisations. Both analyses also highlighted the artistic value of these techniques outside of the classical style of playing. Here, they served to enrich the sonic space of the sound worlds in which the two artists were performing.

Over 250 pieces now incorporate the SWMP techniques, with numerous composers contributing to this evolving repertoire. Performers and ensembles also played crucial roles in commissioning and presenting new works. Also, my own commissions have led to new works which have become part of the SWMP repertoire. Additionally, my saxophone quartet, The Ensemble du Bout du Monde, has specialized in performing demanding and difficult works, and challenges composers to include SWMP techniques to their fullest artistic possibilities. I also included two analyses of solo works that use these techniques, *For Felipe M.* by Stratis Minakakis, and *Go Within* by Eleni Ralli. The analyses were added in order to demonstrate the artistic and practical applications of these techniques. Through them, I aimed to underscore the dramatic and innovative potential of SWMP in contemporary music.

In Chapters Two to Five, I have discussed the more pragmatic, technical, and pedagogical ideas of SWMP techniques. Several years ago, before starting this practice-led research, studying these techniques and the repertoire utilizing them was a frustrating and confusing task due to the lack of knowledge on the subject as compared to other extended techniques. Running to search for basic information in Weiss and Netti's *The Techniques of Saxophone Playing* or Kientzy's *Saxologie* made it seem as though I was only just cracking the surface on the possibilities. Now, through my research, I have developed a more profound approach to the pedagogy of these techniques – something that has been lacking in all previous resources. Readers of my thesis can hear all the sonic possibilities,

mimic my fingerings, and attempt to produce similar results. The repertoire is available to be perused in a continually updatable format where new compositions can be added at any time. Composers have access to up-to-date knowledge on the SWMP techniques with transparent transposition guides, notational suggestions, and practiced-based knowledge on how to use them or what to potentially avoid in a composition. Through bespoke videos saxophonists and composers may now gain direct knowledge by seeing and hearing me perform these techniques and giving step by step instructions on their production. The thesis allows a wider audience to engage with this material, and, most importantly, shows the artistic potential of the SWMP techniques.

For the air pitch technique, I have offered essential information on how to approach various playing positions, detailing the different ways to shape vowel and consonant sounds, and demonstrating the unique transitions from this technique to others. Regarding the tongue ram technique, I have expanded the knowledge on its sonic outcomes and dynamic possibilities, while also linking it to other contemporary extended techniques for saxophone and flute. I have enhanced the understanding of the trumpet sounds technique by providing foundational advice on the distinctive buzzing embouchure, addressing common misconceptions about embouchure placement, and offering detailed demonstrations of different articulation structures that performers should master. The saxo-flute hybridity technique, which had been relatively unexplored by other scholars, allowed me to uncover a wealth of new information. Most notably, I discovered that this technique is feasible on all saxophones, regardless of their tube size.

I continue to practice these techniques with care and resilience, making myself a better musician. In the course of this research, I have performed music using SWMP techniques countless times all over the world, educated several colleagues and their students about the techniques and their proper usage, and have been invited to perform pieces using SWMP techniques at international festivals. I have also released several albums that prominently feature these techniques, and I continue to commission composers who write music for SWMP. Artistically, these techniques have made me a better and more inquisitive musician: I look for novel ways to approach music and techniques; I am more open to difficult or dense notational practices because I have encountered, analyzed, and performed many scores with many different notations; and I have become confident with these techniques so that I can inquire if a specific notation is serving a passage, gesture, technique, or entire parts of the score to the best, or to allow myself to suggest better ways of notating. The collaborative demands of these techniques – whether between composer and performer, performer and performer, or performer and notation – have opened doors to new and interesting dimensions of music-making. This has fostered in me and my collaborators a sense of exploration and openness to the unknown, encountering it with more precision, clarity, and musical intentionality. Through this research project, SWMP may gain renewed interest from performers and composers.

Tackling the problems associated with notation has been an important and necessary part of this research project. I saw from my first encounter with the SWMP techniques that the signs and symbols used to present them were disjointed and had little to nothing in common. Providing an understanding that notation is an important issue for both composers and performers was essential in my discussion in Chapter Six. I sought to bring more clarity and coherence to the proliferation of various notation systems in the SWMP repertoire. Analyzing the roots of contemporary notation highlighted its positives and negatives starting in the 1980s and moving closer to today. Distinctly important to my inquiry were three facets at play with each other: first, the idea that one of the objectives of notation is to eternalize a composer's sonic ideas as cogently as possible; second, the composer-performer-material-score-electronics relationship is a complex intertwined web where all these entities are interacting with one another; and third, that when working from any score there is a pivotal role the performer plays as co-author. With this in mind, I advocate for two things when it comes to notation for SWMP. First, a more standardized model for notating these techniques upon which composers can expand. After critically examining, practicing, and performing many scores using SWMP, I have come up with my own thoughts on such a notation model using guidelines that prioritize clarity and ease of dissemination. These guidelines are just that, a model for composers to use should they want to. Recognizing that notation is a highly individualized (artistic, aesthetic, technical, or practical) choice made by each composer, or sometimes the result of a certain ignorance regarding notation possibilities for SWMP techniques, I will never insist that composers accept my notational suggestions as absolute. Furthermore, standardized guidelines for notation do not result in standardized performances. Regardless of the notation – standardized or not – performers will always bring their unique perspectives, cultural backgrounds, and identities to their performances.

Many composers have told me that they do not know how to properly notate SWMP techniques. This brings me to my second point, the importance of a composer-performer relationship when working on new sonic landscapes, especially in the context of SWMP. Citing Barthes' "The Death of the Author," the meaning of a text is determined by both author and reader (the author usually also being the first reader). Barthes' claim is that the author (composer) cannot claim the exclusive right on knowing what a text (score) means; the reader (performer) can have their own ideas about the text (score) as that text (score) is by definition open to a multitude of interpretations impacted by many different factors. Barthes' idea can also be applied to emphasize the interplay between performers and composers. A score will be interpreted by a performer, who imbues meaning into the work. By working with a score that is by definition open to multiple interpretations, a performer has to make choices as to how it can be played. This could of course take place in close consultation with the composer. Therefore, I advocate for more discussion between saxophonists and composers on which notation works best to convey certain musical ideas, thus shedding light on the dual importance of the artistic intention and the clarity of notation.

Future of SWMP Techniques - https://youtu.be/3q0BmlC9_sc

In terms of the practice of SWMP, I believe I have provided a solid foundation upon which further research can be built. As such, this research presents the continuation or renaissance of this practice. My hope is that every saxophonist will be curious enough to explore the sonic possibilities of SWMP techniques; that composers will be inspired to incorporate them into their works; and that the field will continue to develop due to these advancements. Through such curiosity, future artists will continue to realize Luigi Russolo's vision of fostering "the comprehension, the taste, and the passion for noises" (Russolo 1913: 12). Any and every sound – some previously considered as noise, that is, as non-musical sounds – can be translated into music, and, in the hands of the right performer or composer, hold artistic value.

Had I possessed unlimited resources, primarily time and finances, I would, for example, have delved into the ultra-microtonal fluctuations that occur while working with these techniques. Distilling knowledge concerning microtonal sounds would unlock another artistic potential for composers and could provide new insights for performers. Additionally, I would have liked to explore auxiliary techniques as extensions of the four main techniques discussed here: for instance, the potential of jet whistle sounds with saxo-flute hybridity or the possibilities of glissandi with tongue rams. This additional work and exploration can be pursued separately from this dissertation, as the primary focus here was to establish a cogent and comprehensive understanding of the four main SWMP techniques.

The future of SWMP remains to be written. Will these techniques continue to be utilized and explored by composers, improvisers, and performers in the next 10, 25, 100, or more years? Will saxophonists maintain their curiosity about these methods of playing? In a world of ever-changing trends, contemporary playing techniques only remain relevant if their advocates present them compellingly. The future of these techniques depends on several factors: whether saxophonists embrace them in their practice, whether composers incorporate them in innovative ways, and whether these techniques can transcend and evolve further. Ultimately, their future starts by how we understand and treat them today.

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Personal Audio and Video Performance Repository

The recordings listed below constitute artistic output over the course of several years. This work also includes several of my colleagues across two professional ensembles, namely the Ensemble du Bout du Monde (with current members Noa Mick, Simona Castria, and Salvatore Castellano and former members Kay Zhang, Pablo de la Fuente, and Quentin Darricau) and Duo Entre-Nous (with Jackie Glazier). Commissioned works are marked as such. All recordings are publicly available and several, where applicable, are released on full-length albums.

Solo Works:
For Felipe M. (Commissioned Work) - Stratis Minakakis
Live Performance - https://youtu.be/LFlH1_ay-Ds?si=ZsA6B_GFKiR5aXOh
Video Recording - https://youtu.be/jpf7mYXNFo8?si=EtxGI5R8fam3GcTQ
Audio Recording - https://youtu.be/-OEXoe_Zhng?si=MwcoPd3qtexnGJAg

Go Within (Commissioned Work) - Eleni Ralli
Live Performance - https://youtu.be/GwaisJoHlbo?si=ZwgIQ9jV93B7xPqc
Score Follower - https://youtu.be/bBrJ3atAN_U?si=9ah3CI7XDldwg_B-
Audio Recording - https://youtu.be/dyReFcxa1jo?si=UnzAftOsOERihft7

el gran cabrón - Germán Alonso
Live Performance - https://youtu.be/n20__dNZ6dI?si=ckqx1e2Gf3NbyvrU

Vision (Urban Music II) - Rainer Rubbert
Live Performance - https://youtu.be/4kGjvI3jPeo?si=vMOqjbR_8ABeut-2

Sikuri I - Juan Arroyo
Live Performance - https://on.soundcloud.com/q8u7EUn5yBYHCbJTA

Saxophone and Clarinet Duo Works:
Anemoi Dances (Commissioned Work) - Max Grafe
Live Performance - https://youtu.be/3NCnuS-bpQI?si=Ybk7rO3oT3IwGo-G
Audio Recording - https://youtu.be/6KkkXokRcQM?si=Vczq3wapcqjqO48Q

Air Mirrors (Commissioned Work) - María Eugenia Luc
Live Performance - https://youtu.be/tb-L-iCNHP8?si=ZYGnpXNa8Hr2H_KU
Audio Recording - https://youtu.be/LEKmaGyb1uk?si=har1eikd0RaWYirx

Saxophone Quartet Works:
Irrational (Commissioned Work) - Chaya Czernowin
Live Performance - https://youtu.be/Wu-_YuG71lU?si=jwsdXrGcmoV2vxpY

Zeruan (Commissioned Work) - María Eugenia Luc
Video Recording - https://youtu.be/2iLGqOVbDKo?si=2_TjfIiE-UlHEoVq

Live Performance - https://youtu.be/QTkZtkTPk9A?si=0YVVxd1DC6AdTyFU
Audio Recording -
https://open.spotify.com/track/3IvkXj2EXZNM8UMC8gVIYF?si=a970f2b407424fc9

Thalassografia A (Commissioned Work) - Stratis Minakakis
Live Performance - https://youtu.be/HGuD4farJV8?si=u-3lxy9T6FFT1hrr

Jalkin - Ramon Lazkano
Video Performance - https://youtu.be/hWIIwCkqyOQ?si=920iEjxkPWXeDtlW
Live Performance - https://youtu.be/KT1DNvbHwQA?si=AS4xItF-0lHLmB3w

Der Blutige Schaffner - Robin Hoffmann
Video Performance - https://youtu.be/SNG8IsSWeiI?si=mrGQhvPFkFAred4O
Live Performance - https://youtu.be/CAdLtBwiEUc?si=8mPoUQrd5olhrzFc

YUN - María Eugenia Luc
Video Performance - https://youtu.be/Wr8ddjdxkIE?si=g0-JTBLOdSY_0cTS

Albums Released with SWMP Techniques:
Go Within - Don-Paul Kahl -
https://open.spotify.com/album/1OVot3tfdTYGGNsV59MgqN?si=SDh0mD1cTKyEcfSSUaabYg

Fresh Ink - Duo Entre-Nous -
https://open.spotify.com/album/0eK1Er9KC6q7iWFzUOwE4r?si=iKxx1LgmRRSh5xiqw7I9iA

María Eugenia Luc - Solo & Chamber Music -
https://open.spotify.com/album/7zmKxJmpUuu42BBdkd0Sel?si=x46CewXpTD6vWo42NxgR4A

Pitch Manual

Recording Method

All recordings that are part of this manual were made on the 10th of March 2022 in the recording studios at the Koninklijk Conservatorium Den Haag with sound engineer Pablo Gastaldello. Recordings can be accessed at the following webpages:

Air Pitch:
https://www.saxowithoutmouthpiece.com/pitch-manual/air-pitch/

Tongue Ram:
https://www.saxowithoutmouthpiece.com/pitch-manual/tongue-ram/

Trumpet Sounds:
https://www.saxowithoutmouthpiece.com/pitch-manual/trumpet-sounds/

Saxo-Flute Hybridity:
https://saxowithoutmouthpiece.com/pitch-manual/saxo-flute-hybridity/

Materials:

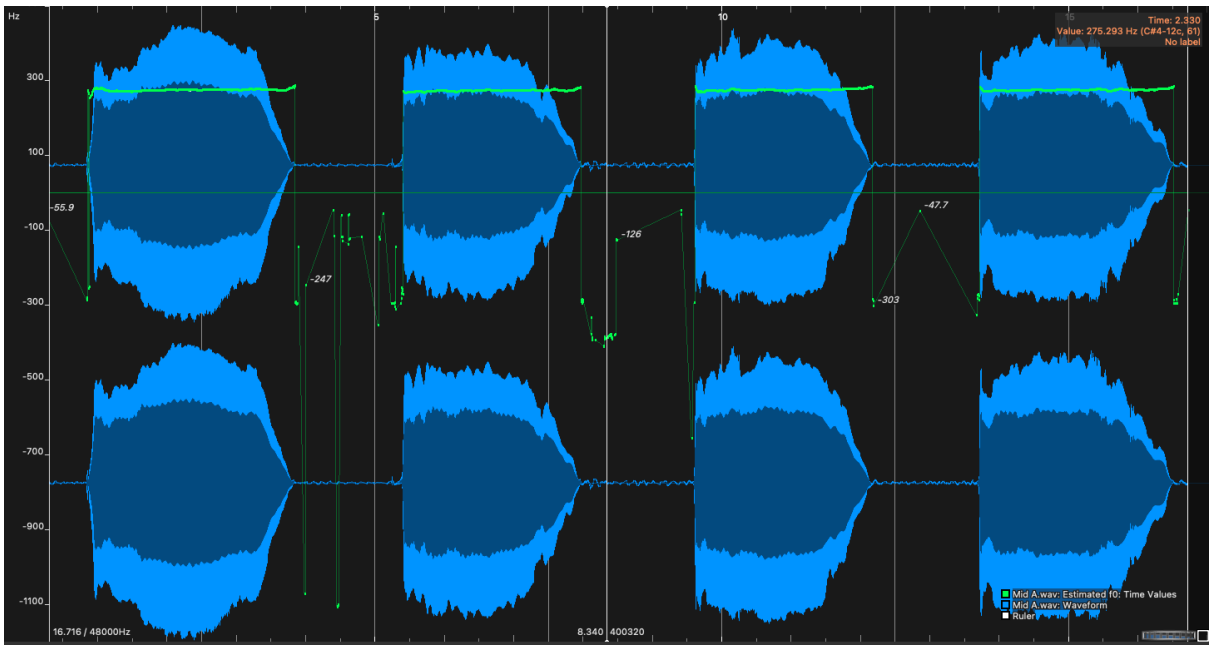
- Two Neumann KM184 paired microphones were placed about 2 meters from the saxophone.
- One Neumann U87 microphone was placed about 1.5 meters from the saxophone.
- Focusrite RedNet2 with a Solid State Logic (SSL) XLogic VHD Pre preamp was used for audio recording.
- Reaper recording software was used to record raw material.
- Sonic Visualizer with the YIN plugin. YIN is a vamp implementation of the Yin algorithm for monophonic frequency estimation. It is used to analyze the fundamental frequencies of single monophonic pitches and was developed by Matthias Mauch and Simon Dixon.

Saxophone Models Used in this Study:

- Soprano Saxophone - Henri Selmer Paris - Super Action 80 Series III - Solid Silver Neck
- Alto Saxophone - Henri Selmer Paris - Supreme - Lacquered Neck
- Tenor Saxophone - Henri Selmer Paris - Super Action 80 Series III - Solid Silver Neck
- Baritone Saxophone - Henri Selmer Paris - Super Action 80 Series II - Lacquered Neck

Methodological Steps:

1. Recordings were made of each individual note produced by the four saxophones without mouthpiece. For the sake of this study only the standard fingerings were used. No alternate, eighth-tone, quarter-tone, or multiphonic fingerings were used. (However, these can be integrated through a future study).
2. Four to six test recordings were made to ensure accuracy of the material.
3. Each note was examined in Sonic Visualizer using the YIN plugin. Below you can see a screenshot from Sonic Visualizer with its pitch analyses.



4. This material was analyzed and a hertz value was extracted for each of the four test pitches.
5. This value was confirmed by ear with a pure sine wave of the same value to ensure accuracy. This step was important: despite being powerful software, it is not infallible and it is only a tool to aid in analysis. Everything had to be tested through the software and then confirmed aurally.
6. The recorded hertz values of all four tests were combined to create an average hertz value. The standard deviation was also calculated in order to understand the variability between the individual tests. This statistic shows how unstable the pitch result for a specific fingering might be.
7. The average hertz value was tested by ear with a pure sine wave of the same hertz value.
8. The average hertz value was converted to the precise musical pitch using the following formula:

$$m_p = 12 * \log_2\left(\frac{f_0}{440\text{Hz}}\right) + 69$$

   where m_p is the musical pitch and f_0 is the frequency of the individual averaged pitch.
9. This formula gives the MIDI number which represents the closest tempered semitone, plus how far out of tune this pitch is from that semitone.
10. I converted this pitch value to the nearest eighth-tone.
11. From the nearest eighth-tone value, I converted this to musical notation.

Accidentals

Below are the eighth-tone and quarter-tone accidental signs used in this study.

sharpened by an eighth-tone	
sharpened by a quarter-tone	
sharpened by three quarter-tones	
lowered by an eighth-tone	
lowered by a quarter-tone	
lowered by three quarter-tones	

Pitch Manual for Air Pitch:

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**Std Dev (Hz)**	**Musical Notation**
A#3 / B♭3	255.95	254.347	256.79	254.45	**255.38425**	1.19	**C4 minus 42 cents**
B3	263.9	266.47	261.6	259.22	**262.7975**	3.11	**C4 plus 8 cents**
C4	288.4	287.84	296.86	288.21	**290.3275**	4.36	**D4 minus 20 cents**
C#4 / D♭4	323.32	326.76	326.9	326.14	**325.78**	1.67	**E4 minus 20 cents**
D4	348	338.22	330.04	345.31	**340.3925**	8.04	**F4 minus 44 cents**
D#4 / E♭4	355.59	358.52	357.04	357.95	**357.275**	1.28	**F4 plus 39 cents**
E4	388.46	401.98	404.39	400.44	**398.8175**	7.09	**G4 plus 30 cents**
F4	432.61	433.08	432.07	433.47	**432.8075**	0.60	**A4 minus 29 cents**
F#4 / G♭4	458.41	457.42	458.64	461.97	**459.11**	1.98	**A#4 minus 26 cents**
G4	501.38	503.65	508.82	503.67	**504.38**	3.15	**B4 plus 36 cents**
G#4 / A♭4	555.67	547.41	534.45	543.24	**545.1925**	8.83	**C#5 minus 29 cents**
A4	583.11	593.51	597.32	601.65	**593.8975**	7.92	**D5 plus 19 cents**
A#4 / B♭4	641.94	640.94	635.21	640.46	**639.6375**	3.02	**D#5 plus 48 cents**
B4	684.08	693.18	683.77	685.49	**686.63**	4.43	**F5 minus 30 cents**
C5	738.45	727.86	746.1	700.19	**728.15**	20.08	**F#5 minus 28 cents**
C#5 / D♭5	811.58	817.63	813.01	815.47	**814.4225**	2.67	**G#5 minus 34 cents**
D5 (with palm keys)	846.19	844.32	846.53	850.27	**846.8275**	2.49	**G#5 plus 33 cents**
D#5 / E♭5 (with palm keys)	932.5	936.31	937.87	939.72	**936.6**	3.07	**A#5 plus 8 cents**
E5 (with palm keys)	992.2	973.01	934.33	1054.45	**988.4975**	50.12	**B5 plus 1 cent**
F5 (with palm keys)	1064.39	1094.39	1118.2	1099	**1093.995**	22.27	**C#6 minus 23 cents**
F#5 / G♭5 (with palm keys)	1127.5	1119.84	1108.34	1160.52	**1129.05**	22.41	**C#6 plus 31 cents**
G5 (with palm keys)	1224.49	1316.4	1338.24	1234.2	**1278.3325**	57.40	**D#6 plus 46 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	164.4	165.11	164.93	164.02	**164.615**	0.50	**E3 minus 2 cents**
B3	186.94	187.82	191.03	182.47	**187.065**	3.53	**F#3 plus 19 cents**
C4	197.64	201.5	199.12	193.69	**197.9875**	3.28	**G3 plus 17 cents**
C#4 / D♭4	210.37	211.82	209.11	212.71	**211.0025**	1.59	**G#3 plus 28 cents**
D4	220.55	232	229.54	228.76	**227.7125**	4.97	**A#3 minus 40 cents**
D#4 / E♭4	231.01	246.72	247.71	248.57	**243.5025**	8.36	**B3 minus 24 cents**
E4	262.41	262.81	263.33	259.28	**261.9575**	1.82	**C4 plus 2 cents**
F4	272.82	280.57	274.89	282.06	**277.585**	4.43	**C#4 plus 3 cents**
F#4 / G♭4	309.58	287.88	309.17	309.53	**304.04**	10.77	**D#4 minus 40 cents**
G4	318.18	320.3	320.8	323.98	**320.815**	2.40	**E4 minus 47 cents**
G#4 / A♭4	356.49	351.32	353.45	353.67	**353.7325**	2.12	**F4 plus 22 cents**
A4	392.93	392.42	388.25	391.68	**391.32**	2.11	**G4 minus 3 cents**
A#4 / B♭4	416.14	419.22	417.37	415.3	**417.0075**	1.70	**G#4 plus 7 cents**
B4	443.64	442.04	443.25	444.16	**443.2725**	0.90	**A4 plus 13 cents**
C5	496.71	493.31	497.46	496.74	**496.055**	1.86	**B4 plus 8 cents**
C#5 / D♭5	539.72	532.75	534.05	535.93	**535.6125**	3.03	**C5 plus 40 cents**
D5 (with palm keys)	559.09	571.61	578.76	562.34	**567.95**	8.95	**C#5 plus 42 cents**
D#5 / E♭5 (with palm keys)	613.47	613.3	614.02	613.78	**613.6425**	0.32	**D#5 minus 24 cents**
E5 (with palm keys)	630.95	628.68	630	630.54	**630.0425**	0.99	**D#5 plus 22 cents**
F5 (with palm keys)	690.89	684.48	692.9	692.21	**690.12**	3.85	**F5 minus 21 cents**
F#5 / G♭5 (with palm keys)	746.54	742.82	742.61	743.17	**743.785**	1.85	**F#5 plus 9 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	121.73	123.03	122.16	122.31	**122.3075**	0.54	**B2 minus 16 cents**
B3	131.12	131.92	133.37	131.13	**131.885**	1.06	**C3 plus 14 cents**
C4	137.78	137.82	136.83	139.36	**137.9475**	1.05	**C#3 minus 8 cents**
C#4 / D♭4	154.12	152.07	153.09	153.04	**153.08**	0.84	**D#3 minus 28 cents**
D4	166.55	167.75	166.27	164.3	**166.2175**	1.43	**E3 plus 15 cents**
D#4 / E♭4	172.59	172.64	172.45	173.42	**172.775**	0.44	**F3 minus 18 cents**
E4	180.21	181.53	181.11	180.44	**180.8225**	0.61	**F#3 minus 40 cents**
F4	205.14	204.98	203.59	202.6	**204.0775**	1.21	**G#3 minus 30 cents**
F#4 / G♭4	220.28	224.18	224.66	223.26	**223.095**	1.96	**A3 plus 24 cents**
G4	232.58	232.51	233.33	231.98	**232.6**	0.56	**A#3 minus 4 cents**
G#4 / A♭4	255	254.13	254.08	254.12	**254.3325**	0.45	**C4 minus 49 cents**
A4	273.65	273.75	273.39	272.79	**273.395**	0.43	**C#4 minus 24 cents**
A#4 / B♭4	295.75	295.63	294.6	295.09	**295.2675**	0.53	**D4 plus 9 cents**
B4	317.25	316.38	317.78	318.24	**317.4125**	0.80	**D#4 plus 35 cents**
C5	358.56	355.99	357.17	360.98	**358.175**	2.14	**F4 plus 44 cents**
C#5 / D♭5	375.12	375.12	374.81	375.45	**375.125**	0.26	**F#4 plus 24 cents**
D5 (with palm keys)	414.23	414.99	414.33	414.31	**414.465**	0.35	**G#4 minus 4 cents**
D#5 / E♭5 (with palm keys)	439.87	440.55	440.73	441.13	**440.57**	0.53	**A4 plus 2 cents**
E5 (with palm keys)	473.93	474.85	475.28	473.53	**474.3975**	0.81	**A#4 plus 30 cents**
F5 (with palm keys)	523.59	523.66	523.28	524.01	**523.635**	0.30	**C5 plus 1 cent**
F#5 / G♭5 (with palm keys)	557.53	558.3	554.72	554.86	**556.3525**	1.83	**C#5 plus 6 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3	74.6	74.95	74.7	74.87	**74.78**	0.16	**D2 plus 32 cents**
A#3 / B♭3	82.47	80.09	80.5	80.55	**80.9025**	1.07	**E2 minus 32 cents**
B3	85.9	86.14	86.03	86.24	**86.0775**	0.15	**F2 minus 25 cents**
C4	91.61	90.93	91.35	92.68	**91.6425**	0.75	**F#2 minus 16 cents**
C#4 / D♭4	101.36	101.83	101.97	100.74	**101.475**	0.56	**G#2 minus 40 cents**
D4	111.22	112.29	111.37	111.46	**111.585**	0.48	**A2 plus 25 cents**
D#4 / E♭4	117.89	117.12	117.68	116.58	**117.3175**	0.59	**A#2 plus 11 cents**
E4	124.41	127.2	123.37	122.33	**124.3275**	2.09	**B2 plus 12 cents**
F4	131.75	130.16	130.81	130.57	**130.8225**	0.67	**C3 plus 0 cents**
F#4 / G♭4	143.71	143.91	144.86	143.65	**144.0325**	0.56	**D3 minus 33 cents**
G4	153.72	155.02	153.6	153.52	**153.965**	0.71	**D#3 minus 18 cents**
G#4 / A♭4	165.06	166.12	165.06	167.37	**165.9025**	1.10	**E3 plus 11 cents**
A4	183.54	181.89	183.36	183.49	**183.07**	0.79	**F#3 minus 18 cents**
A#4 / B♭4	190.29	190.75	192.15	191.76	**191.2375**	0.86	**G3 minus 43 cents**
B4	211.42	207.71	210.24	211.15	**210.13**	1.69	**G#3 plus 21 cents**
C5	227.33	226.4	228.54	224.78	**226.7625**	1.59	**A#3 minus 48 cents**
C#5 / D♭5	247.12	247.75	248.39	248.49	**247.9375**	0.64	**B3 plus 7 cents**
D5 (with palm keys)	260.15	258.68	259.02	258.8	**259.1625**	0.67	**C4 minus 16 cents**
D#5 / E♭5 (with palm keys)	276.21	278.22	276.84	277.45	**277.18**	0.86	**C#4 plus 0 cents**
E5 (with palm keys)	299.49	298.62	298.52	299.69	**299.08**	0.60	**D4 plus 32 cents**
F5 (with palm keys)	320.03	320.29	320.44	320.09	**320.2125**	0.19	**D#4 plus 50 cents**
F#5 / G♭5 (with palm keys)	349.98	348.86	349.73	349.54	**349.5275**	0.48	**F4 plus 1 cent**

Pitch Manual for Tongue Ram:

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	222.63	221.28	222.63	222.42	**222.24**	0.65	**A3 plus 18 cents**
B3	232.41	232.33	231.37	233.08	**232.2975**	0.70	**A#3 minus 6 cents**
C4	245.31	245.18	245.95	245.38	**245.455**	0.34	**B3 minus 10 cents**
C#4 / D♭4	260.92	265.15	262.49	266.29	**263.7125**	2.45	**C4 plus 14 cents**
D4	290.29	286.69	286.44	283.28	**286.675**	2.87	**D4 minus 42 cents**
D#4 / E♭4	304.31	303.35	305	306.17	**304.7075**	1.19	**D#4 minus 36 cents**
E4	329.13	325.08	330.37	330.6	**328.795**	2.56	**E4 minus 4 cents**
F4	357.24	358.42	359.61	355.49	**357.69**	1.76	**F4 plus 41 cents**
F#4 / G♭4	367.82	365.16	365.64	365.16	**365.945**	1.27	**F#4 minus 19 cents**
G4	429.99	426.94	427.03	413.22	**424.295**	7.52	**G#4 plus 37 cents**
G#4 / A♭4	436.77	435.07	433.21	431.08	**434.0325**	2.45	**A4 minus 24 cents**
A4	460.19	465.29	459.16	458.4	**460.76**	3.11	**A#4 minus 20 cents**
A#4 / B♭4	487.13	500.96	514.48	484.13	**496.675**	13.95	**B4 plus 10 cents**
B4	545.71	537.08	536.76	550.4	**542.4875**	6.71	**C#5 minus 37 cents**
C5	565.36	573.38	568.3	565.45	**568.1225**	3.76	**C#5 plus 42 cents**
C#5 / D♭5	651.54	639.7	636.25	655.93	**645.855**	9.38	**E5 minus 36 cents**
D5 (with palm keys)	663.95	663.73	662.78	663.55	**663.5025**	0.51	**E5 plus 11 cents**
D#5 / E♭5 (with palm keys)	677.83	674.51	678.24	687.5	**679.52**	5.58	**F5 minus 48 cents**
E5 (with palm keys)	727.61	715.72	716.16	727.29	**721.695**	6.65	**F#5 plus 43 cents**
F5 (with palm keys)	788.25	784.01	785.25	777.4	**783.7275**	4.58	**G5 minus 1 cent**
F#5 / G♭5 (with palm keys)	803.56	X	809.44	801.56	**804.8533333**	4.10	**G5 plus 45 cents**
G5 (with palm keys)	844.67	848.4	857.41	X	**850.16**	6.55	**G#5 plus 40 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	146.79	144.44	146.24	145.23	**145.675**	1.05	**D3 minus 14 cents**
B3	154.74	154.87	154.3	154.65	**154.64**	0.24	**D#3 minus 10 cents**
C4	163.83	163.89	163.19	163.15	**163.515**	0.40	**E3 minus 14 cents**
C#4 / D♭4	175.57	175.4	175.07	174.92	**175.24**	0.30	**F3 plus 6 cents**
D4	187.78	186.45	186.24	185.16	**186.4075**	1.08	**F#3 plus 13 cents**
D#4 / E♭4	192.38	193.27	193.78	193.63	**193.265**	0.63	**G3 minus 24 cents**
E4	204.6	204.36	204.17	205.05	**204.545**	0.38	**G#3 minus 26 cents**
F4	226.98	223.33	223.83	224.54	**224.67**	1.62	**A3 plus 36 cents**
F#4 / G♭4	243.65	242.5	242.38	242.78	**242.8275**	0.57	**B3 minus 29 cents**
G4	251.31	251.67	250.61	250.23	**250.955**	0.65	**B3 plus 28 cents**
G#4 / A♭4	273.35	269.18	272.72	273.2	**272.1125**	1.97	**C#4 minus 32 cents**
A4	297.96	297.51	297.98	296.22	**297.4175**	0.83	**D4 plus 22 cents**
A#4 / B♭4	316.57	313.47	312.24	312.78	**313.765**	1.94	**D#4 plus 15 cents**
B4	347	340.72	339.23	337.61	**341.14**	4.11	**F4 minus 41 cents**
C5	368.52	365.73	363.48	364.7	**365.6075**	2.15	**F#4 minus 21 cents**
C#5 / D♭5	397.84	394.17	394.23	393.88	**395.03**	1.88	**G4 plus 13 cents**
D5 (with palm keys)	425.34	410.53	422.02	413.35	**417.81**	7.01	**G#4 plus 10 cents**
D#5 / E♭5 (with palm keys)	434.19	439.3	430.54	430.6	**433.6575**	4.13	**A4 minus 25 cents**
E5 (with palm keys)	462.16	464.7	465.84	461.6	**463.575**	2.02	**A#4 minus 10 cents**
F5 (with palm keys)	494.9	495.02	492.9	494.14	**494.24**	0.97	**B4 plus 1 cent**
F#5 / G♭5 (with palm keys)	521.48	521.88	523.57	520.49	**521.855**	1.28	**C5 minus 5 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	110.4	110.55	110.49	110.56	**110.5**	0.07	**A2 plus 8 cents**
B3	117.38	117.84	117.88	117.81	**117.7275**	0.23	**A#2 plus 18 cents**
C4	124.57	125.86	124.21	124.94	**124.895**	0.71	**B2 plus 20 cents**
C#4 / D♭4	129.41	130.84	129.77	133	**130.755**	1.62	**C3 minus 1 cent**
D4	140.59	139.32	140.24	139.16	**139.8275**	0.70	**C#3 plus 15 cents**
D#4 / E♭4	144.24	148.64	144.7	145.19	**145.6925**	2.00	**D3 minus 13 cents**
E4	155.91	155.37	155.9	155.77	**155.7375**	0.25	**D#3 plus 2 cents**
F4	165.75	165.33	165.91	165.43	**165.605**	0.27	**E3 plus 8 cents**
F#4 / G♭4	174.58	176.21	175.11	175.03	**175.2325**	0.69	**F3 plus 6 cents**
G4	186.89	186.85	186.3	186.58	**186.655**	0.27	**F#3 plus 15 cents**
G#4 / A♭4	198.93	198.66	198.91	198.29	**198.6975**	0.30	**G3 plus 24 cents**
A4	220.47	221.24	221.19	222.46	**221.34**	0.83	**A3 plus 11 cents**
A#4 / B♭4	232.88	231.08	233.12	232.1	**232.295**	0.92	**A#3 minus 6 cents**
B4	246.57	246.2	246.86	246.21	**246.46**	0.32	**B3 minus 3 cents**
C5	269.89	269.11	267.53	267.15	**268.42**	1.30	**C4 plus 44 cents**
C#5 / D♭5	289.92	288.48	288.56	287.82	**288.695**	0.88	**D4 minus 30 cents**
D5 (with palm keys)	307.66	307.2	305.3	305.58	**306.435**	1.17	**D#4 minus 26 cents**
D#5 / E♭5 (with palm keys)	333.5	328.99	328.44	326.5	**329.3575**	2.96	**E4 minus 1 cent**
E5 (with palm keys)	363.49	364.5	362.8	361.62	**363.1025**	1.21	**F#4 minus 33 cents**
F5 (with palm keys)	379.03	379.77	382.4	379.4	**380.15**	1.53	**F#4 plus 47 cents**
F#5 / G♭5 (with palm keys)	403.17	405.98	401.41	403.17	**403.4325**	1.89	**G4 plus 50 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3	68.77	68.42	68.3	68.51	**68.5**	0.20	**C#2 minus 20 cents**
A#3 / B♭3	73.57	73.77	73.7	73.4	**73.61**	0.16	**D2 plus 5 cents**
B3	76.36	77.32	76.54	76.86	**76.77**	0.42	**D#2 minus 23 cents**
C4	84.04	84.15	84.49	84.32	**84.25**	0.20	**E2 plus 38 cents**
C#4 / D♭4	88.87	87.17	87.44	88.41	**87.9725**	0.80	**F2 plus 13 cents**
D4	92.63	92.66	92.65	92.55	**92.6225**	0.05	**F#2 plus 2 cents**
D#4 / E♭4	100.06	98.68	100.58	99.31	**99.6575**	0.83	**G2 plus 29 cents**
E4	106.18	106.39	106.3	106.57	**106.36**	0.16	**G#2 plus 42 cents**
F4	114.54	114.45	113.12	113.98	**114.0225**	0.65	**A#2 minus 38 cents**
F#4 / G♭4	116.62	115.42	116	115.57	**115.9025**	0.54	**A#2 minus 10 cents**
G4	129.07	128.31	126.6	127.92	**127.975**	1.03	**C3 minus 38 cents**
G#4 / A♭4	136.34	135.33	135.08	135.26	**135.5025**	0.57	**C#3 minus 39 cents**
A4	146.73	145.75	144.55	144.67	**145.425**	1.02	**D3 minus 17 cents**
A#4 / B♭4	150.74	151.14	150.94	150.01	**150.7075**	0.49	**D3 plus 45 cents**
B4	162.69	162.9	163.12	162.56	**162.8175**	0.25	**E3 minus 21 cents**
C5	176.21	175.31	176.6	176.13	**176.0625**	0.54	**F3 plus 14 cents**
C#5 / D♭5	188.52	186.45	185.23	185.85	**186.5125**	1.43	**F#3 plus 14 cents**
D5 (with palm keys)	197.21	198.71	199.54	196.14	**197.9**	1.52	**G3 plus 17 cents**
D#5 / E♭5 (with palm keys)	206.3	206.75	205.81	206.21	**206.2675**	0.39	**G#3 minus 12 cents**
E5 (with palm keys)	221.68	220.3	221.22	221.54	**221.185**	0.62	**A3 plus 9 cents**
F5 (with palm keys)	233.84	233.44	233.85	233.02	**233.5375**	0.39	**A#3 plus 3 cents**
F#5 / G♭5 (with palm keys)	248.08	248.07	247.45	247.02	**247.655**	0.52	**B3 plus 5 cents**

Pitch Manual for Trumpet Sounds:

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	209.63	210.7	211.15	215.03	**211.6275**	2.36	**G#3 plus 33 cents**
B3	220.65	224.63	226.65	227.06	**224.7475**	2.93	**A3 plus 37 cents**
C4	240.08	241.63	242.34	244.92	**242.2425**	2.02	**B3 minus 33 cents**
C#4 / D♭4	259.14	259.37	259.26	259.68	**259.3625**	0.23	**C4 minus 15 cents**
D4	272.31	273.13	275.99	273.88	**273.8275**	1.58	**C#4 minus 21 cents**
D#4 / E♭4	293.68	291.58	292.52	289.72	**291.875**	1.67	**D4 minus 11 cents**
E4	310.4	313.92	313.76	313.78	**312.965**	1.71	**D#4 plus 10 cents**
F4	328.69	331.35	330.21	329.45	**329.925**	1.13	**E4 plus 2 cents**
F#4 / G♭4	347.43	355.52	354.67	354.26	**352.97**	3.73	**F4 plus 18 cents**
G4	369.88	368.01	371.34	371.64	**370.2175**	1.66	**F#4 plus 1 cent**
G#4 / A♭4	400.82	393.59	396.77	399.67	**397.7125**	3.23	**G4 plus 25 cents**
A4	427.23	432.16	434.5	432.47	**431.59**	3.09	**A4 minus 33 cents**
A#4 / B♭4	456.24	462.08	463.66	466.05	**462.0075**	4.18	**A#4 minus 16 cents**
B4	502.54	504.6	500.22	501.23	**502.1475**	1.89	**B4 plus 29 cents**
C5	519.34	530.96	524.49	523.56	**524.5875**	4.80	**C5 plus 4 cents**
C#5 / D♭5	564.11	569.28	560.66	565.02	**564.7675**	3.55	**C#5 plus 32 cents**
D5	576	577.77	579.76	576.99	**577.63**	1.59	**D5 minus 29 cents**
D#5 / E♭5	599.86	606.22	606.52	608.23	**605.2075**	3.67	**D#5 minus 48 cents**
E5	658.69	659.9	651.89	657.87	**657.0875**	3.56	**E5 minus 6 cents**
F5	694.21	698.1	700.28	703.63	**699.055**	3.95	**F5 plus 1 cent**
F#5 / G♭5	753.18	754.69	754.65	753.16	**753.92**	0.87	**F#5 plus 32 cents**
G5	824.28	826.58	810.24	807.19	**817.0725**	9.78	**G#5 minus 28 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	143.19	145.08	144.93	144.33	**144.3825**	0.86	**D3 minus 29 cents**
B3	154.08	154.06	154.52	154.04	**154.175**	0.23	**D#3 minus 16 cents**
C4	161.42	161.56	162.19	161.08	**161.5625**	0.46	**E3 minus 34 cents**
C#4 / D♭4	169.43	170.9	170.75	169.72	**170.2**	0.73	**F3 minus 44 cents**
D4	178.65	179.38	179.26	181.45	**179.685**	1.22	**F3 plus 50 cents**
D#4 / E♭4	186.9	188.9	190.25	190.42	**189.1175**	1.63	**F#3 plus 38 cents**
E4	198.57	200.41	200.36	200.56	**199.975**	0.94	**G3 plus 35 cents**
F4	210.39	209.36	211.68	212.52	**210.9875**	1.39	**G#3 plus 28 cents**
F#4 / G♭4	223.71	224.38	225	225.82	**224.7275**	0.90	**A3 plus 37 cents**
G4	239.22	240.84	241.5	243.76	**241.33**	1.88	**B3 minus 40 cents**
G#4 / A♭4	257.89	252.47	254.96	257.86	**255.795**	2.61	**C4 minus 39 cents**
A4	275.29	273.37	275.95	277.74	**275.5875**	1.80	**C#4 minus 10 cents**
A#4 / B♭4	292.63	291.18	291.73	294.15	**292.4225**	1.30	**D4 minus 7 cents**
B4	313.26	314.9	316.75	313.83	**314.685**	1.54	**D#4 plus 20 cents**
C5	326.61	324.04	335.96	336.72	**330.8325**	6.45	**E4 plus 6 cents**
C#5 / D♭5	353.06	348.5	350.41	347.84	**349.9525**	2.34	**F4 plus 4 cents**
D5	370.32	371.71	371.98	372.56	**371.6425**	0.95	**F#4 plus 8 cents**
D#5 / E♭5	393.2	394.13	395.34	391.74	**393.6025**	1.52	**G4 plus 7 cents**
E5	415.55	420.18	422.24	422.24	**420.0525**	3.15	**G#4 plus 20 cents**
F5	442.02	455.05	459.12	459.28	**453.8675**	8.14	**A#4 minus 46 cents**
F#5 / G♭5	487.75	487.22	489.48	490.82	**488.8175**	1.65	**B4 minus 18 cents**
G5	522.07	526.75	525.91	527.71	**525.61**	2.47	**C5 plus 8 cents**
G#5 / A♭5	571.86	566.98	567.47	567.78	**568.5225**	2.25	**C#5 plus 44 cents**
A5	606.01	612.96	608.07	612.23	**609.8175**	3.33	**D#5 minus 35 cents**
A#5 / B♭5	644.57	644.55	640.9	648.21	**644.5575**	2.98	**E5 minus 39 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	107.73	107.45	108.72	108.8	**108.175**	0.69	**A2 minus 29 cents**
B3	115.19	114.37	117.88	114.71	**115.5375**	1.60	**A#2 minus 15 cents**
C4	122.18	122.48	122.94	122.17	**122.4425**	0.36	**B2 minus 14 cents**
C#4 / D♭4	130.01	129.45	129.13	128.4	**129.2475**	0.67	**C3 minus 21 cents**
D4	137.93	137.89	136.59	138.12	**137.6325**	0.70	**C#3 minus 12 cents**
D#4 / E♭4	147.28	143.76	145.79	145.33	**145.54**	1.45	**D3 minus 15 cents**
E4	156.43	158.72	158.36	158.74	**158.0625**	1.10	**D#3 plus 28 cents**
F4	164.62	163.6	165.76	166.87	**165.2125**	1.41	**E3 plus 4 cents**
F#4 / G♭4	174.07	176.12	176.7	178.35	**176.31**	1.77	**F3 plus 17 cents**
G4	185.41	187.66	185.83	185.78	**186.17**	1.01	**F#3 plus 11 cents**
G#4 / A♭4	195.72	198.19	199.56	200.29	**198.44**	2.01	**G3 plus 21 cents**
A4	212.37	213.13	210.79	213.08	**212.3425**	1.09	**G#3 plus 39 cents**
A#4 / B♭4	224.2	223.91	225.91	226.02	**225.01**	1.11	**A3 plus 39 cents**
B4	237.44	237.94	236.52	238.89	**237.6975**	0.99	**A#3 plus 34 cents**
C5	254.16	255.08	255.13	258.68	**255.7625**	2.00	**C4 minus 39 cents**
C#5 / D♭5	272.43	272.43	272.33	273.49	**272.67**	0.55	**C#4 minus 28 cents**
D5	282.66	283.67	284.78	284.36	**283.8675**	0.93	**C#4 plus 41 cents**
D#5 / E♭5	298.81	300	300.25	300.48	**299.885**	0.74	**D4 plus 36 cents**
E5	321.74	322.4	319.14	322.12	**321.35**	1.50	**E4 minus 44 cents**
F5	341.16	341.63	340.37	342.61	**341.4425**	0.94	**F4 minus 39 cents**
F#5 / G♭5	370.78	369.77	366.95	366.55	**368.5125**	2.08	**F#4 minus 7 cents**
G5	396.3	398.31	400.36	397.34	**398.0775**	1.73	**G4 plus 27 cents**
G#5 / A♭5	424.43	422.36	424	423.32	**423.5275**	0.90	**G#4 plus 34 cents**
A5	457.18	454.68	453.71	455.56	**455.2825**	1.47	**A#4 minus 41 cents**

A#5 / B♭5	483.4	494.09	494.53	495.37	**491.8475**	5.66	**B4 minus 7 cents**
B5	532.17	530.43	528.48	554.35	**536.3575**	12.09	**C5 plus 43 cents**
C6	583.5	581.8	581.98	580.68	**581.99**	1.16	**D5 minus 16 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3 - 1°	133.45	132.7	135.2	136.47	**134.455**	1.70	**C3 plus 48 cents**
A#3 / B♭3 - 1°	147.75	147.13	146.79	142.48	**146.0375**	2.40	**D3 minus 9 cents**
B3- 1°	153.06	153.51	151.98	155.88	**153.6075**	1.65	**D#3 minus 22 cents**
C4 - 1°	162.01	162.67	162.4	162.66	**162.435**	0.31	**E3 minus 25 cents**
C#4 / D♭4 - 1°	174.78	173.31	174.52	174.97	**174.395**	0.75	**F3 minus 2 cents**
D4 - 1°	183.41	185.08	185.15	185.82	**184.865**	1.03	**F#3 minus 1 cent**
D#4 / E♭4 - 1°	194.83	194.84	196.26	194.84	**195.1925**	0.71	**G3 minus 7 cents**
E4 - 1°	205.35	203.27	209.34	209.05	**206.7525**	2.95	**G#3 minus 8 cents**
F4 - 1°	218.31	221.67	222.25	223.17	**221.35**	2.12	**A3 plus 11 cents**
F#4 / G♭4 - 1°	236.35	238.69	238.18	240.15	**238.3425**	1.57	**A#3 plus 39 cents**
G4 - 1°	251.44	252.89	253.6	252.22	**252.5375**	0.92	**B3 plus 39 cents**
G#4 / A♭4 - 1°	268	270.46	270.79	271.96	**270.3025**	1.66	**C#4 minus 44 cents**
A4 - 1°	288.87	287.92	290.03	292.59	**289.8525**	2.02	**D4 minus 23 cents**
A#4 / B♭4 - 1°	306.97	309.44	309.62	312.33	**309.59**	2.19	**D#4 minus 9 cents**
B4 - 1°	336.54	335.76	336.7	335.04	**336.01**	0.77	**E4 plus 33 cents**
C5 - 1°	355.31	357.36	358.31	361.71	**358.1725**	2.67	**F4 plus 44 cents**
C#5 / D♭5 - 1°	390.35	390.27	393.6	393.98	**392.05**	2.02	**G4 plus 0 cents**
D5 - 1°	416.46	414.05	413.81	415.43	**414.9375**	1.24	**G#4 minus 2 cents**
D#5 / E♭5 - 1°	418.04	418.66	421.94	421.69	**420.0825**	2.02	**G#4 plus 20 cents**
E5 - 1°	441.15	442.53	437.79	442.35	**440.955**	2.20	**A4 plus 4 cents**
F5 - 1°	477.46	477.43	477.07	478.17	**477.5325**	0.46	**A#4 plus 42 cents**

F#5 / G♭5 - 1°	495.52	497.72	496.86	494.92	**496.255**	1.27	**B4 plus 8 cents**
G5 - 1°	537.64	537.84	538.91	540.67	**538.765**	1.39	**C#5 minus 49 cents**
G#5 / A♭5 - 1°	586.37	586.65	589.99	588.65	**587.915**	1.72	**D5 plus 2 cents**
A5 - 1°	597.98	590.98	598.06	598.36	**596.345**	3.58	**D5 plus 26 cents**
D5 - 2°	278.57	279.92	281	281.21	**280.175**	1.21	**C#4 plus 19 cents**
D#5 / E♭5 - 2°	292.22	298.25	298.78	298.82	**297.0175**	3.21	**D4 plus 20 cents**
E5 - 2°	317.48	319.31	319.54	320.85	**319.295**	1.39	**D#4 plus 45 cents**
F5 - 2°	337.88	341.62	342.25	343.54	**341.3225**	2.43	**F4 minus 40 cents**
F#5 / G♭5 - 2°	367.36	366.7	368.75	371.8	**368.6525**	2.27	**F#4 minus 6 cents**
G5 - 2°	393.76	397.65	398.16	398.54	**397.0275**	2.21	**G4 plus 22 cents**
G#5 / A♭5 - 2°	428.87	429.08	429.55	429.18	**429.17**	0.28	**A4 minus 43 cents**
A5 - 2°	459.76	456.67	457.03	456.85	**457.5775**	1.46	**A#4 minus 32 cents**
A#/B♭ 5 - 2°	501.15	501.2	493.18	497.25	**498.195**	3.82	**B4 plus 15 cents**

Pitch Manual for Saxo-Flute Hybridity:

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
F#4 / G♭4	436.11	437.19	436.24	438.39	**436.9825**	1.05	**A4 minus 12 cents**
G4	X	482.69	496	485.63	**488.1066667**	6.99	**B4 minus 20 cents**
G#4 / A♭4	510.14	512.96	508.33	513.97	**511.35**	2.58	**C5 minus 40 cents**
A4	550.4	550.8	550.77	551.2	**550.7925**	0.33	**C#5 minus 11 cents**
A#4 / B♭4	586.74	592.53	589.81	583.74	**588.205**	3.80	**D5 plus 3 cents**
B4	654.23	655.3	653.02	654.33	**654.22**	0.93	**E5 minus 13 cents**
C5	730.15	722.74	721.38	720.99	**723.815**	4.29	**F#5 minus 38 cents**
C#5 / D♭5	780.34	781.32	780.49	780.46	**780.6525**	0.45	**G5 minus 7 cents**
D5 (with palm keys)	811.94	827.51	826.87	828.38	**823.675**	7.85	**G#5 minus 15 cents**

D#5 / E♭5 (with palm keys)	873.01	869.77	870.96	879.56	**873.325**	4.37	**A5 minus 13 cents**
E5 (with palm keys)	926.99	937.65	929.43	926.18	**930.0625**	5.24	**A#5 minus 4 cents**
F5 (with palm keys)	985.14	985.4	987.43	994.01	**987.995**	4.14	**B5 plus 0 cents**
F#5 / G♭5 (with palm keys)	1035.97	1043.18	1040.27	1049.26	**1042.17**	5.58	**C6 minus 7 cents**
G5 (with palm keys)	1093.91	1108.74	1096.14	1109.11	**1101.975**	8.08	**C#6 minus 11 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#4 / B♭4 - Low Octave	402.44	401.79	401.06	398.47	**400.94**	1.74	**G4 plus 39 cents**
B4 - Low Octave	438.62	435.99	435.54	437.99	**437.035**	1.50	**A4 minus 12 cents**
C5 - Low Octave	476.25	476.27	473.9	475.88	**475.575**	1.13	**A#4 plus 35 cents**
C#5 / D♭5 - Low Octave	519.66	519.03	514.73	520.65	**518.5175**	2.61	**C5 minus 16 cents**
D5 (with palm keys) - Low Octave	547.13	545.22	547.64	548.09	**547.02**	1.26	**C#5 minus 23 cents**
D#5 / E♭5 (with palm keys) - Low Octave	587.95	588.63	589.66	589.05	**588.8225**	0.72	**D5 plus 4 cents**
E5 (with palm keys) - Low Octave	621.06	622.94	627.5	632.18	**625.92**	4.97	**D#5 plus 10 cents**
F5 (with palm keys) - Low Octave	667.21	664.22	665.21	664.45	**665.2725**	1.36	**E5 plus 16 cents**
F#5 / G♭5 (with palm keys) - Low Octave	700.15	710.73	704.31	710.24	**706.3575**	5.06	**F5 plus 19 cents**
D#4 / E♭4 - Mid Octave	466.59	466.65	464.69	463.01	**465.235**	1.74	**A#4 minus 3 cents**
E4 - Mid Octave	493.77	487.97	492.06	488.99	**490.6975**	2.69	**B4 minus 11 cents**
F4 - Mid Octave	528.14	525.99	529.7	528.12	**527.9875**	1.52	**C5 plus 16 cents**
F#4 / G♭4 - Mid Octave	560.85	561.29	556.86	556.52	**558.88**	2.54	**C#5 plus 14 cents**
G4 - Mid Octave	632.77	632.94	632.98	633.86	**633.1375**	0.49	**D#5 plus 30 cents**
G#4 / A♭4 - Mid Octave	675.13	681.5	683.01	675.24	**678.72**	4.13	**E5 plus 50 cents**
A4 - Mid Octave	730.25	732.26	724.36	729.32	**729.0475**	3.36	**F#5 minus 26 cents**
A#4 / B♭4 - Mid Octave	767.29	780.93	778.35	779.75	**776.58**	6.28	**G5 minus 16 cents**
B4 - Mid Octave	829.54	827.76	829.27	830.66	**829.3075**	1.19	**G#5 minus 3 cents**

C5 - Mid Octave	871.73	871.49	876.13	862.15	**870.375**	5.88	**A5 minus 19 cents**
C#5 / D♭5 - Mid Octave	952.58	951.62	950.44	942.51	**949.2875**	4.60	**A#5 plus 31 cents**
D5 (with palm keys) - Mid Octave	1017.1	1020.09	1015.66	1022.94	**1018.9475**	3.24	**C6 minus 46 cents**
D#5 / E♭5 (with palm keys) - Mid Octave	1078.89	1082.02	1089.15	1097.42	**1086.87**	8.24	**C#6 minus 34 cents**
E5 (with palm keys) - Mid Octave	1157.28	1165.98	1160.97	1167.53	**1162.94**	4.70	**D6 minus 17 cents**
F5 (with palm keys) - Mid Octave	1226.2	1223.29	1229.68	1232.34	**1227.8775**	3.96	**D#6 minus 23 cents**
F#5 / G♭5 (with palm keys) - Mid Octave	1310.78	1315.21	1309.93	1322.08	**1314.5**	5.56	**E6 minus 5 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
E4 - Mid Octave	182.47	186.43	183.43	183.28	**183.9025**	1.74	**F#3 minus 10 cents**
F4 - Mid Octave	195.56	194.58	195	195.66	**195.2**	0.51	**G3 minus 7 cents**
F#4 / G♭4 - Mid Octave	212.56	209.39	210.57	210.39	**210.7275**	1.33	**G#3 plus 25 cents**
G4 - Mid Octave	229.54	226.46	227.47	226.61	**227.52**	1.42	**A#3 minus 42 cents**
G#4 / A♭4 - Mid Octave	241.13	241.81	242.37	242	**241.8275**	0.52	**B3 minus 36 cents**
A4 - Mid Octave	267.26	260.64	263.57	261.82	**263.3225**	2.89	**C4 plus 11 cents**
A#4 / B♭4 - Mid Octave	283.73	282.1	279.57	280.19	**281.3975**	1.89	**C#4 plus 26 cents**
B4 - Mid Octave	304.05	307.8	306.17	308.4	**306.605**	1.95	**D#4 minus 25 cents**
C5 - Mid Octave	331.93	333	330.91	334.02	**332.465**	1.34	**E4 plus 15 cents**
C#5 / D♭5 - Mid Octave	360.29	358.68	360.46	357.18	**359.1525**	1.54	**F4 plus 49 cents**
D5 (with palm keys) - Mid Octave	387.56	389.09	386.75	383.47	**386.7175**	2.37	**G4 minus 23 cents**
D#5 / E♭5 (with palm keys) - Mid Octave	414.77	416.73	416.97	419.54	**417.0025**	1.96	**G#4 plus 7 cents**
E5 (with palm keys) - Mid Octave	447.27	448.04	449.02	448.01	**448.085**	0.72	**A4 plus 32 cents**
F5 (with palm keys) - Mid Octave	476.89	481.66	489.55	480.53	**482.1575**	5.33	**B4 minus 42 cents**
F#5 / G♭5 (with palm keys) - Mid Octave	509.68	510.12	515.03	512.55	**511.845**	2.47	**C5 minus 38 cents**
G4 - High Octave	448.03	458.27	453.55	451.21	**452.765**	4.31	**A4 plus 50 cents**

G#4 / A♭4 - High Octave	483.12	486.91	485.91	485.48	**485.355**	1.61	**B4 minus 30 cents**
A4 - High Octave	525.41	519.03	520.72	515.27	**520.1075**	4.21	**C5 minus 10 cents**
A#4 / B♭4 - High Octave	556.63	567.63	565.72	564.65	**563.6575**	4.84	**C#5 plus 29 cents**
B4 - High Octave	602.01	601.77	600.13	602.18	**601.5225**	0.94	**D5 plus 41 cents**
C5 - High Octave	X	633.8	631.65	630.41	**631.9533333**	1.72	**D#5 plus 27 cents**
C#5 / D♭5 - High Octave	720.35	724.66	719.24	724.31	**722.14**	2.75	**F#5 minus 42 cents**
D5 (with palm keys) - High Octave	775.56	774.44	771.93	772.74	**773.6675**	1.64	**G5 minus 23 cents**
D#5 / E♭5 (with palm keys) - High Octave	824.44	825.33	826.2	829.73	**826.425**	2.32	**G#5 minus 9 cents**
E5 (with palm keys) - High Octave	890.88	897.76	898.29	902.43	**897.34**	4.79	**A5 plus 34 cents**
F5 (with palm keys) - High Octave	968.93	968.32	971.38	974.26	**970.7225**	2.70	**B5 minus 30 cents**
F#5 / G♭5 (with palm keys) - High Octave	1041.27	1042.13	1044.57	1041.83	**1042.45**	1.46	**C6 minus 7 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
B4 - Low Octave	208.76	206.18	205.67	205.92	**206.6325**	1.43	**G#3 minus 9 cents**
C5 - Low Octave	221.7	220.88	223.59	223.99	**222.54**	1.49	**A3 plus 20 cents**
C#5 / D♭5 - Low Octave	237.22	236.8	238.79	236.31	**237.28**	1.07	**A#3 plus 31 cents**
D5 (with palm keys) - Low Octave	252.19	253.15	252.16	254.84	**253.085**	1.26	**B3 plus 43 cents**
D#5 / E♭5 (with palm keys) - Low Octave	272.18	273.72	272.1	273.92	**272.98**	0.97	**C#4 minus 26 cents**
E5 (with palm keys) - Low Octave	292.49	294.17	291.2	292.2	**292.515**	1.23	**D4 minus 7 cents**
F5 (with palm keys) - Low Octave	311.79	314.24	312.69	313.29	**313.0025**	1.03	**D#4 plus 10 cents**
F#5 / G♭5 (with palm keys) - Low Octave	337.45	338.19	339.39	338.18	**338.3025**	0.80	**E4 plus 45 cents**
C5 - Mid Octave	431.73	431.16	428.9	427.54	**429.8325**	1.96	**A4 minus 40 cents**
C#5 / D♭5 - Mid Octave	469.31	472.51	469.84	466.06	**469.43**	2.65	**A#4 plus 12 cents**
D5 (with palm keys) - Mid Octave	501.92	499.23	500.25	501.16	**500.64**	1.16	**B4 plus 24 cents**

D#5 / E♭5 (with palm keys) - Mid Octave	530.94	531.75	535.01	537.63	**533.8325**	3.08	**C5 plus 35 cents**
E5 (with palm keys) - Mid Octave	574.19	574.26	578.79	579.24	**576.62**	2.77	**D5 minus 32 cents**
F5 (with palm keys) - Mid Octave	608.65	611.5	613.1	611.17	**611.105**	1.84	**D#5 minus 31 cents**
F#5 / G♭5 (with palm keys) - Mid Octave	661.23	671.01	672.91	671.04	**669.0475**	5.29	**E5 plus 26 cents**
C5 - High Octave	635.43	631.9	629.46	631.98	**632.1925**	2.45	**D#5 plus 27 cents**
C#5 / D♭5 - High Octave	688.4	693.95	694.96	692.48	**692.4475**	2.88	**F5 minus 15 cents**
D5 (with palm keys) - High Octave	743.2	738.14	739.37	745.88	**741.6475**	3.55	**F#5 plus 4 cents**
D#5 / E♭5 (with palm keys) - High Octave	790.86	783.07	792.1	796.26	**790.5725**	5.51	**G5 plus 14 cents**
E5 (with palm keys) - High Octave	840.19	840.58	838.92	838.92	**839.6525**	0.86	**G#5 plus 19 cents**
F5 (with palm keys) - High Octave	895.75	892.29	895.24	892.2	**893.87**	1.89	**A5 plus 27 cents**
F#5 / G♭5 (with palm keys) - High Octave	947.57	959.62	953.25	961.43	**955.4675**	6.33	**A#5 plus 42 cents**
D5 (with palm keys) - Altissimo Octave	1008.32	1005.88	1007.49	1010.15	**1007.96**	1.78	**B5 plus 35 cents**
D#5 / E♭5 (with palm keys) - Altissimo Octave	1059.27	1063.31	1068.6	1059.56	**1062.685**	4.35	**C6 plus 27 cents**

Repertoire

The following repertoire list includes pieces that use SWMP in any form. It includes the name of the composition, typical composer information, the year(s) of composition, instrumentation, publisher (if relevant), and for whom the work was written (if known). Additionally, on the website, further information concerning which SWMP techniques are featured in the work, a link to purchase or download the work (if available), and a link to the composers' website are included. Where applicable, I have included a link to a video or audio performance of the work, either by me or by other artists.

The repertoire list below has been updated as of October 2024. For a complete version of this list, please refer to the following webpage: https://www.saxowithoutmouthpiece.com/repertoire/

Repertoire for Saxophone Without Mouthpiece (updated October 2024)						
Last Name	**First Name**	**Title of Composition**	**Year**	**Instrumentation**	**Publisher**	**Written For?**
Alonso	Germán	*el gran cabrón*	2012	Baritone Sax + Electronics	BabelScores	Patrick Stadler
Alonso	Germán	*In Heaven Everything is Fine*	2011	Sax Quartet	BabelScores	
Aperghis	Georges	*Crosswind*	1997	Sax Quartet + Viola	Durand	XASAX
Aperghis	Georges	*Trio Funambule*	2014	Alto Sax + PIano + Percussion	Composer	
Arias	Helga	*Milk spilt on a stone*	2017	Sax Quartet	BabelScores	Sigma Project
Arroyo	Juan	*SAMA*	2013	Sax + Flute + Percussion + Piano + Electronics	Temperaments	Proxima Centauri
Arroyo	Juan	*Séliox*	2018	Baritone Saxophone + Cello	Tempéraments	Carl-Emmanuel Fisbach
Arroyo	Juan	*Sikuri I*	2012	Tenor Sax + Electronics	Tempéraments	Hiroe Yasui
Arroyo	Juan	*Sikuri II*	2023	Sax + Percussion + Electronics	Tempéraments	Marie-Bernadette Charrier
Arroyo	Juan	*Sikuri IV*	2013	Sax Quartet + Electronics	Tempéraments	
Arroyo	Juan	*Sikuri X*	2015	Sax Ensemble (10)	Tempéraments	
Arroyo	Juan	*Sismo*	2014	Baritone Sax + Accordion + Piano + Violin + Cello + Electronics	Tempéraments	Ensemble l'Itinéraire
Azguime	Miguel	*Mes ententes pour quatre personnages*	2012	Sax Quartet	Portuguese Music Research & Information Centre	Quasar
Bacon	Alexis	*Ötzi*	2017	Tenor Sax + Electronics	Caramuru Music	Wilson Poffenberger
Bång	Malin	*delta waves*	2007	Tenor Sax	Composer	Jörgen Peterson

Besingrand	Jean-Patrick	*23*	2019	Sax Sextet	Composer	Nitchan Pitayathorn
Besingrand	Jean-Patrick	*Brouillard d'hiver*	2019	Tenor Sax	Composer	Erin Rogers
Besingrand	Jean-Patrick	*Cinq regards sur l'horizon*	2014	Tenor Sax	Composer	Christopher De Louis
Besingrand	Jean-Patrick	*Derive en rouge*	2012	Sax Ensemble	Composer	
Besingrand	Jean-Patrick	*Des papillons...muets aussi*	2019	Sopranino Sax	Composer	Marie Kikuchi
Besingrand	Jean-Patrick	*Désirs inassouvis*	2018	Sax Duo	Composer	Nitchan Pitayathorn
Besingrand	Jean-Patrick	*Instants Éphémères*	2014	Sax Quartet	BabelScores	SaxOpen
Besingrand	Jean-Patrick	*Konohana*	2017	Ensemble (sax in ensemble)	Composer	
Besingrand	Jean-Patrick	*La lutte pour la lumière*	2019	Baritone Sax + Electronics	Composer	Pisol Manatchinapisit
Besingrand	Jean-Patrick	*Réminiscence*	2017	Sax + Piano + Percussion	Composer	Contemporaneous
Besingrand	Jean-Patrick	*Sous les cheveux, la rage*	2021	Soprano Sax	Composer	Gerald Preinfalk
Besingrand	Jean-Patrick	*Un rêve éveillé*	2015	Sax Quartet	Composer	Quatuor Avena
Black	Annesley	*Miniature*	2005	Sax Quartet	Juliane Klein	Con Calore Quartet
Cano Valiño	Rocío	*Antanáklasi II*	2019	Bass Sax + Electronics	Composer	
Carloséma	Bernard	*Clepsydre*	1998	Bass, Tenor, & Soprano Sax + Electronics	Fuzeau	Jean-Michel Goury
Cella	Carmine-Emanuele	*Improvviso Statico II*	2014	Tenor Sax + Electronics	Suvini Zerboni	Mario Marzi
Corajod	Mathieu	*Axes*	2021	Soprano Sax + Flute	BabelScores	Duo Alto
Corajod	Mathieu	*Critical Control Points*	2020	Alto Sax + Piano + Percussion + E. Guitar	BabelScores	
Corajod	Mathieu	*Subspheres*	2021	Sax Duo	BabelScores	Duo Eventuell
Czernowin	Chaya	*Irrational*	2022	Sax Quartet	Schott	Ensemble du Bout du Monde
Dempster	Thomas	*the bunyip*	2014	Alto Sax + Electronics	Composer	
Dimou	Stylianos	*~Drops~*	2017	Sax Quartet	Composer	Quartet Iberosudamericano
Dimou	Stylianos	*Machine Learning*	2018	Baritone Sax + Electronics	Composer	Fred Lerdahl
Dimou	Stylianos	*sur les traces de la fissure*	2018	Baritone Sax + Violin + Percussion + Accordion	Composer	
Eckardt	Jason	*a fractured silence*	2004	Sax Quartet	Composer	PRISM Quartet
Fallahzadeh	Sina	*Nafir*	2016	Baritone Sax + Electronics	Composer	

Frigon	Michel	*Geyser Ghetto*	2005	Sax Quartet	Unpublished	Quasar
Gabriele	Claudio	*Arriflex 35*	2010	Tenor Sax + Electronics	Composer	Jeffrey Vickers
Gabriele	Claudio	*NEUMA 31*	2012	Sax	Composer	Denis Schaffer
Gabriele	Claudio	*SHIFT SHAF*	2009	Sax Quartet	Composer	
Geiss	Philippe	*Calderosaxo*	2012	Sax Ensemble	Composer	Jean Michel-Goury
Gimenez-Comas	Nuria	*Clarière quan même*	2024	Sax + Soprano Voice + Flute + Percussion + Piano + Electronics	Unpublished	Proxima Centauri
Girard-Charest	Émilie	*Bestiaire*	2017	Sax Quartet	Unpublished	Quasar
Grafe	Max	*Anemoi Dances*	2020	Alto Sax + B♭ Clarinet	American Composers Alliance	Duo Entre-Nous
Hamel	André	*À huit*	2001	Sax Octet	Unpublished	Quasar
Havel	Christophe	*Analog 21•12*	2021	Ensemble	Composer	
Havel	Christophe	*Eden*	2021	Ensemble	Composer	
Havran	Thomas	*Overcaffinated*	2021	Tenor Sax	Composer	Noa Even
Heyn	Volker	*Buon natale, fratello Fritz*	1985	Soprano + Tenor Sax	Breitkopf & Härtel	Daniel Kientzy
Hoffmann	Robin	*Der blutige Schaffner*	1996	Sax Quartet	P. J. Tonger	Ensemble Atmosphere
Ibarra	Victor	*Grande Équerre: ensayo sobre la negación*	2014	Sax Quartet	Composer	Sigma Project
Ibarra	Víctor	*Homenaje a Francisco Toledo*	2014	Sax + Ensemble	Composer	
Ibarra	Víctor	*Insight*	2023	Baritone Sax	Composer	Pablo Coello
Iberg	Helge	*Ut å stjæle hester*	2016	Tenor Sax + Viola + Piano	Composer	Trio Brax
Kasprzyk	Cory	*Split Tree (Wintergarden)*	2014	Sax Ensemble + Electronics	Composer	
Katzer	Georg	*Dialog Imaginär 6*	1995	Tenor Sax + Electronics	Verlag	Johannes Ernst
Krämer	Reiner	*Stück*	2016	Sax + Flute + Electronics	Composer	Jeffrey Kyle Hutchins
Lauba	Christian	*Les Sept Iles*	1988	Sax Ensemble + Piano	Composer	Jean-Marie Londeix
Lazkano	Ramon	*Jalkin*	2012	Sax Quartet	Chant du Monde	Sigma Project
Lee	Junghae	*Kyol*	2017	Saxophone Ensemble	Composer	Zurich Saxophone Collective
Lemay	Robert	*La rédemption...hommage à Martin Scorsese*	1994	Sax Quartet + 2 Percussion	Canadian Music Centre	
Lemay	Robert	*No Limits*	2003	Contrabass Sax	Canadian Music Centre	Serge Bertocchi

Lemay	Robert	*Noirs*	2023	Tenor Sax +Soprano Sax (1 player) + String Quartet	Note en Bulle	Don-Paul Kahl
Lemay	Robert	*Red Shift/Blue Shift*	2012	Baritone Sax + Cello	Note en Bulle	
Lemay	Robert	*Shadows of Bamian*	2001-2002	Sax Quartet	Canadian Music Centre	
Lemay	Robert	*Solitude Oubliée*	1995	Tenor Sax	Doberman-Yppan	
Lemay	Robert	*Triptyque écarlate*	1991	Saxophone + Harp + Percussion	Canadian Music Centre	Daniel Gauthier
Lemay	Robert	*Un ciel variable pour demain*	2003-2004	Sax Quartet	Canadian Music Centre	
Leroux	Philippe	*L'Unique trait de Pinceau*	2008	Soprano and Baritone Sax (one player) + Orchestra	Billaudot	Claude Delangle
Lillios	Elainie	*Veiled Resonance*	2008	Soprano Sax + Electronics	Composer	Steve Duke
Litwin	Nahuel	*The Reconstruction of Ouisconsin*	2022	Sax + Soprano Voice + Flute + Percussion + Piano + Electronics	Composer	Proxima Centauri
López-López	José Manuel	*Simog/Civitella*	2011	Sax Quartet	Lemoine	Sigma Project
Luc	María Eugenia	*Air Mirrors*	2018	Tenor Sax + B♭ Clarinet	Composer	Duo Entre-Nous
Luc	María Eugenia	*YUN*	2012	Sax Quartet	Composer	Sigma Project
Luc	María Eugenia	*Zeruan*	2020	Sax Quartet	Composer	Ensemble du Bout du Monde
Makan	Keeril	*Voice Within Voice*	2005	Baritone Sax	PSNY	Brian Sacawa
Manotskov	Alexander	*Seven Portraits*	2011	Alto Sax + Orchestra	Donemus	Ola Asdahl Rokkones
Martínez Hernández	Diego Alonso	*Soliloquio*	2022	Sax Duo	Composer	
Matitia	Jean	*Las Américas: I Samba do Diabo*	2019	Sax Ensemble	Composer	Jean-Marie Londeix
Miereanu	Costin	*DO-MI-SI-LA-DO-RE*	1980-1981	Saxophone + Electronics	Salabert	Daniel Kientzy
Minakakis	Stratis	*For Felipe M.*	2021	Baritoe Sax	Composer	Don-Paul Kahl
Minakakis	Stratis	*Thalassografia A*	2018	Sax Quartet	Composer	Ensemble du Bout du Monde
Momi	Marco	*Cinque Nudi*	2012	Tenor Sax + Stomp Boxes	Zerboni	David Brutti
Moore	Ted	*Hollow*	2018	Alto Sax + Electronics	Composer	Kyle Hutchins
Musikantow	Joshua	*Ashera*	2019	Sax Trio	Composer	Acute Trio
Nešić	Snežana	*Quatre graffitis pour le début du temps*	2022	Sax Quartet	Unpublished	Quasar
Núñez	Nuria	*Fake (f)or real*	2014	Sax Quartet	Composer	Sax Quartet

Oliveiro	Mark	*Bone - Crest - Frequency*	2018	Sax Quartet	Composer	Nexas Quartet
Oliver	Joan Jordi	*Breathe*	2017	Alto Sax + Electronics	Composer	Joan Jordi Oliver
Pape	Gérard	*Makbenach I, III (solo)*	1996	Baritone & Alto Sax + Orchestra + Electronics	Composer	Daniel Kientzy
Parra	Hèctor	*Sigma-Waves*	2015	Sax Quartet	Composer	Sigma Project
Pettersen	Agnes Ida	*KPUN*	2022	Tenor Sax + Mixed Ensemble (2 Musicians) + Tape	Composer	Zwei-Mann-Orchester
Pont Anglada	Bernat	*How to Bread*	2022	Sax + Flute + Percussion + Piano + Electronics		Proxima Centauri
Posadas	Alberto	*Senderos que se bifurcan*	2017	Sax Quartet	Durand	Sigma Project
Ralli	Eleni	*Go Within*	2020	Tenor Sax + Embedded Speaker	Composer	Don-Paul Kahl
Risset	Jean Claude	*Voilements*	1987	Tenor Sax + Electronics	Salabert	Daniel Kientzy
Roald	Helge	*UT OG STJÆLE HESTER*	2015	Tenor Sax + Viola + Piano	Composer	Trio Brax
Rokkones	Ola Asdahl	*Jeg lagde meg så silde*	2016	Alto Sax	Composer	Ola Asdahl Rokkones
Rolin	Etienne	*Partita Polyfolia*	1995	Tenor Sax	Robert Martin	
Rotella	Didier	*Mogari*	2021	Sax + Flute + Percussion + Piano + Electronics	Composer	Proxima Centauri
Rua	Vitor	*Saxopera II*	2001	Tenor Sax + Electronics	Portugese Music Research & Information Centre	
Rubbert	Rainer	*Vision (Urban Music II)*	1993	Bass or Baritone Sax	Verlag	Johannes Ernst
Rudel Rey	Demian	*Parálaksis*	2022	Sax + Flute + Percussion + Piano + Video + Electronics	Unpublished	Proxima Centauri
Sánchez-Verdú	José M.	*Khôra I*	2013	Sax Quartet	Breitkopf	Sigma Project
Sánchez-Verdú	José M.	*Khôra II*	2014	Sax Quartet	Breitkopf	Sigma Project
Shi	Pei Yu	*Gedicht vom wind des herbstes*	2007	Sax + Piano + Percussion + Electronics	Unpublished	
Skoglund	Lars	*Scener fra et nabolag*	2015	Tenor Sax + Mixed Ensemble (2 Musicians) + Tape	Composer	Zwei-Mann-Orchester
Stifjell	Erik	*Zwei-Mann Orchester*	2015	Tenor Sax + Mixed Ensemble (2 Musicians) + Tape	Composer	Zwei-Mann-Orchester
Stifjell	Erik	*Alo*	2018	Tenor Sax (also Baritone Sax) + Sinfonietta	Composer	Ola Asdahl Rokkonnes
Tarrés	Ariadna Alsina	*flickering sparks in connecting tunnels*	2022	Sax Quartet + Electronics	Composer	IBSUD
Tarrés	Ariadna Alsina	*Les Rêves Circulaires*	2018	Alto Sax + Electronics	BabelScores	Nahikari Oloriz
Teruggi	Daniel	*Xatys I*	1988	Sax + Electronics	Unpublished	Daniel Kientzy
Teruggi	Daniel	*Xatys III*	1988	Sax + Electronics	Unpublished	Daniel Kientzy
Tidrow	Thierry	*Entre Nous*	2022	Musical Theater	Unpublished	Quasar
Torres Maldonado	Javier	*Huayra Yana*	2019	Baritone Sax + Electronics	Zerboni	Stéphane Sordet
Torres Maldonado	Javier	*MASIH*	2012-2013	Sax Quartet	Zerboni	Sigma Project

Torstensson	Klas	*Solo*	1988	Bass Sax	Muziekgroup Nederland	
Tzortzis	Nicolas	*Member*	2020	Solo Baritone Sax	Composer	Don-Paul Kahl
Vaggione	Horacio	*Thema*	1985	Bass Sax + Electronics	Salabert	Daniel Kientzy
Wanamaker	Gregory	*Without*	2019	Sax Quartet	Composer	Ensemble du Bout du Monde
Williams	Amy	*Child's Play*	2014	Sop Sax + Percussion	Composer	Bent Frequency
Younge	Bethany	*I'll Bleed Your Lines*	2020	Ensemble	Composer	113 Composers Collective

Interviews

The interviews listed below offer valuable insights into the practices of composers who have incorporated SWMP techniques into their work. Although these discussions were largely informal, they aimed to explore the composers' specific works, their broader practices, and their general perspectives on SWMP techniques. Among others, the questions cover topics such as notation, challenges encountered by performers, and the future potential of these techniques.

Several of these interviews, conducted in 2017 before the widespread use of Zoom, are of low quality and are audio-only recordings. Despite these limitations, they provide enlightening discussions that reveal the composers' thoughts and approaches.

Additionally, I conducted an interview with Gail B. Levinsky, a saxophonist and researcher, focusing on early saxophone methods from the 1920s and 1930s. This conversation provides a historical context that complements the more contemporary discussions with the composers.

Eleni Ralli - 20 August 2024:
https://youtu.be/Mq4W04Xfdqw?si=Pe7QKFyKJDmauUEU

Stylianos Dimou - 19 August 2024:
https://youtu.be/goRFoXap-fM?si=9PPSbrIeSrIobjLs

Jean-Patrick Besingrand - 1 December 2023:
https://youtu.be/kVLTUopIdI8?si=s_u8DkdlFKFiHKBg

Robert Lemay - 15 November 2023:
https://youtu.be/8k3jNXSnY4s?si=Y76sDpFuFeOxGK_o

Javier Torres Maldonado - 13 December 2023:
https://youtu.be/O0WIesLY-30?si=gLlpSVpctoqLR474

Juan Arroyo - 3 November 2017:
https://youtu.be/wUJzyAoSU8c?si=ByJYUQSV4FlNAkIC

Robin Hoffmann - 5 November 2017:
https://youtu.be/7ydsaZKRMCM?si=D2kioeLZ8-Qdn6AJ

Gail B. Levinsky - 23 August 2024:
https://youtu.be/Kfwq1GHeZbg?si=tiNzUgj_RnR089oF

Summary

This thesis explores saxophone without mouthpiece (SWMP), an innovative approach to saxophone playing that challenges traditional performance practices. In SWMP playing, the instrument's mouthpiece – an essential component for producing its conventional sound – is removed. Instead, the player performs directly on the neckpiece of the saxophone. This absence of the mouthpiece creates new sonic possibilities, giving rise to a range of relatively new techniques such as air pitch, tongue ram, trumpet sounds, and saxo-flute hybridity. These techniques, which have yet to be fully explored in both performance and academic spheres, prompted my early interest through initial encounters with composers incorporating them into their works. From this curiosity emerged an artistic research project aimed at understanding and refining my own skills with these techniques, contextualizing their origins and aesthetic position within music history, exploring their role in the broader saxophone repertoire, and investigating their potential in such a way that other performers as well as composers could benefit from it.

Some of the research questions that I sought to answer were: What is SWMP? What is the artistic, technical, and sonic potential of SWMP techniques? What is the historical background and context of these techniques? How do SWMP techniques fit into the interactive network formed by performers, composers, material, instruments, and notation? Can a more standardized notational model be proposed for these techniques that allows for a basis upon which composers can potentially expand? How can the relationship between composer and performer be more closely aligned in the notation of SWMP techniques in works that are intended to be passed from one performer to another?

In this thesis, the techniques are mostly investigated and evaluated through a practical lens, highlighting their sonic potential and defining their technical parameters. Additionally, I examine notational practices associated with SWMP techniques, and I propose a more uniform notational framework which may facilitate greater acceptance of these techniques among composers and enhance performers' comprehension. Hence designed for saxophonists, composers, pedagogues, and researchers, this thesis offers a comprehensive analysis of SWMP, its contextual foundations, its technical execution, and the challenges of its notation.

In Chapter One, I contextualize SWMP by situating it within a broader historical and aesthetic framework and trace its evolution and integration into contemporary saxophone practices. Its roots can be found in the 1920s and 1930s, a period when saxophonists in vaudeville and dance bands experimented with various extended techniques. During this time, musicians invented saxophone "tricks," including the "bugle-effect," a technique akin to the modern trumpet sound technique. Some of these "tricks" have persisted through history, while others faded or merged with related techniques. SWMP techniques, as we know them today, were formally developed much later, particularly in the 1980s. Main contributors are saxophonists such as Daniel Kientzy,

Jean-Marie Londeix, Marie-Bernadette Charrier, and Marcus Weiss, among others, who were instrumental in formalizing the SWMP techniques.

In the same chapter, I relate SWMP to broader musical, aesthetic, and philosophical developments. The rise of experimental music and the "sonic turn" – a shift in emphasis from traditional musical elements like melody and harmony to sound itself – provided fertile ground for the development of new saxophone techniques, including SWMP. The chapter references key aesthetic movements, such as Luigi Russolo's *The Art of Noises* (1913), which advocated for incorporating everyday and industrial sounds into music. Similarly, Edgard Varèse's manifesto *The Liberation of Sound* (1966) championed a break from traditional musical constraints, promoting the use of new sounds, including those made possible through electronic instruments and extended techniques. Also, Helmut Lachenmann's concept of *musique concrète instrumentale* is relevant in this respect, as it merges traditional instrumental techniques with the aesthetics of *musique concrète* and focuses on the physicality of sound production. Russolo's introduction of non-traditional sounds into music, Varèse's emphasis on the materiality of sound, its timbres and textures, and Lachenmann's idea that the act of producing sound is often as significant as the sonic results, supports the idea that SWMP techniques are not merely technical curiosities but part of a broader historical, artistic, practical, and theoretical exploration of sound and music.

Chapter One ends with an overview of the main saxophonists, improvisers, and composers who have contributed to the development of SWMP. Furthermore, I provide analyses of two improvisations and two prominent SWMP works. As such, this chapter lays the groundwork for the detailed technical and performance analyses that follow in subsequent chapters.

In Chapters Two through Five, I investigate each of the four primary techniques in detail: air pitch, tongue ram, trumpet sounds, and saxo-flute hybridity. Each chapter is comprised of videos in which I demonstrate the techniques, and contains the following subsections: description, technical parameters, performance and practice, personal development, and pedagogy. In the description section, I explain what each technique involves, providing short examples of how to produce its specific sound. The technical parameters section addresses essential details such as range, transposition, and embouchure, and offers a review of existing literature. The performance and practice section explores various factors that influence a successful execution of the technique, such as articulation, glissandi, dynamic ranges, the barrissement technique (for trumpet sounds), or changing vowel shapes (for air pitch), etc. The personal development section offers guidance on how saxophonists can build proficiency with each technique, while the pedagogy section provides teachers with practical insights on how to teach these techniques. Each chapter is supported by demonstration videos, transposition charts, and a pitch manual specific to the technique being discussed. The demonstration videos serve as quick references, showing me performing the techniques in various ways, including transitions between

techniques, with brief accompanying texts to offer additional information. These chapters are crucial for gaining a deep understanding of the SWMP techniques, and they provide a comprehensive resource for saxophonists, composers, and educators.

After exploring the four techniques in detail, the main topic addressed in Chapter Six is the issue of how to notate SWMP techniques. As this topic has long been a subject of debate, I found it necessary to examine the various notational practices used for SWMP, trace their evolution over time, analyze what the notation communicates to a performer, and offer guidelines for composers looking to incorporate SWMP techniques into their work. The chapter begins with a discussion about composers' notational choices. In the 20th and 21st centuries, they have not only continued the evolution of notational practices to suit their needs but by doing so have introduced entirely novel and individualistic approaches to notation. While these approaches can often enhance the artistic depth of a work, facilitate the performance and creation of novel and unheard sounds, and offer performers the opportunity to adapt to new signs and symbols, notation must also be clear and efficient, so that a performer may interpret those signs and symbols more or less according to the composer's intentions. Drawing on the contributions of several authors, including Karkoschka, Toop, Fairbairn, Taruskin, Duncan, and Assis, I explore ideas surrounding notation and the vast artistic possibilities afforded by its diversity. On the basis of this exploration a few important observations are made. Firstly, despite several attempts to standardize notation, composers always find novel ways of notating their sonic ideas. Second, many authors agree that notation of complex scores should be appropriate to the music it represents. Therefore, the ongoing flux of notational diversity has resulted in a rich and multifaceted exploration. This evolution both frustrates (as in the case of Taruskin) and encourages (as in the case of Fairbairn) artistic expression. However, in my opinion, notation is first of all intended to communicate sounds through signs and symbols so that the musician can interpret and, ultimately, perform them.

I have sought to uncover a certain consistency in notating these techniques. A performer often bears the responsibility to interpret a score to the best of their abilities, presenting a physical manifestation of a *meta*-physical phenomenon that they must engage with through rigorous daily practice. In this process, they will make certain decisions based on previously learned and embodied experiences. In order to smoothen this process, I present a set of notational guidelines that composers may choose to adopt when writing for SWMP. These guidelines address common notational challenges and provide both general and specific recommendations for notating each technique. Systems of standardization, while not mandatory, can normalize new techniques, enrich artistic expression, and minimize confusion between performers and composers. A certain standardization can be beneficial for composers, and also help performers connect to the techniques, allowing for more fluid interpretations and helping them reach the artistic potential envisioned for them. In this respect, I also argue for a closer collaboration between composers and performers, referencing Roland Barthes' seminal text "The Death

of the Author" (1967), which advocates for a more dynamic relationship between a work's creator and its interpreter who actually is its co-creator.

This research project has taken place in and through my own musical practice. Therefore, it is complemented with personal audio and video performances of various SWMP works. The performances of these works are a crucial element in the possibility of having done (and having been able to do) this research in the first place. The true outcome of this artistic research project lies in successful performances, recordings, and commissions of SWMP works. Additionally, a detailed pitch manual, featuring audio examples of each possible pitch for each respective technique, is included. It is in and through my own artistic practice that I came to the idea that this pitch manual is indispensable. I have also included a repertoire list that shows the growing body of works by composers writing for SWMP and inserted videos of interviews I have conducted with several composers who have written for SWMP and one saxophonist (on her research into early saxophone methods).

Samenvatting

In dit proefschrift wordt saxofoon zonder mondstuk (in het Engels: *saxophone without mouthpiece,* hier verder afgekort als SWMP) onderzocht, een innovatieve benadering van het saxofoonspelen die de traditionele uitvoeringspraktijk uitdaagt. Bij SWMP, de naam zegt het al, wordt het mondstuk – een essentieel onderdeel voor het produceren van het conventionele saxofoongeluid – verwijderd. In plaats daarvan speelt de saxofonist rechtstreeks op het hals. De afwezigheid van het mondstuk creëert nieuwe muzikale en auditieve mogelijkheden en een reeks relatief nieuwe technieken zoals luchtgeluiden (*air pitch*), tongstop (*tongue ram*), trompetklanken (*trumpet sounds*) en fluitklanken (*saxo-flute hybridity*).[46] Deze technieken, die tot nu toe in zowel de muziekpraktijk als de academische wereld nog niet grondig zijn onderzocht, trokken mijn aandacht na mijn eerste ontmoetingen met componisten die ze in hun werk toepasten. Dit leidde tot het huidige artistieke onderzoeksproject dat als doel had om mijn vaardigheden in deze technieken te verfijnen, mijn kennis hierover te delen, hun historische oorsprong en esthetische context te onderzoeken, hun rol in het saxofoonrepertoire te verkennen en hun potentieel voor andere uitvoerders en componisten naar voren te brengen.

Enkele van de onderzoeksvragen die ik in dit proefschrift heb beantwoord zijn: Wat is SWMP? Wat is het artistieke, technische en auditieve potentieel van SWMP-technieken? Wat is de historische achtergrond en context van deze technieken? Hoe passen SWMP binnen het interactieve netwerk van uitvoerders, componisten, materiaal, instrumenten en notatie? Kan er een meer gestandaardiseerd notatiemodel voor deze technieken worden opgesteld dat een basis vormt waarop componisten kunnen voortbouwen? Hoe kan de samenwerking tussen componist en uitvoerder beter gestalte krijgen daar waar het de notatie en uitvoering van SWMP-technieken betreft in (modern) klassieke muziekwerken?

In dit proefschrift worden de technieken voornamelijk in en door het spelen zelf onderzocht en geëvalueerd waardoor hun auditieve potentieel goed kan worden belicht en hun technische parameters gedefinieerd. Daarnaast is de notatie geanalyseerd die tot nu toe vaak gebruikt wordt bij SWMP-technieken, en stel ik een meer uniform systeem voor dat zowel de acceptatie van deze technieken door componisten kan bevorderen als ook het begrip ervan bij uitvoerders kan vergroten. Dit proefschrift is daarom allereerst bedoeld voor saxofonisten, componisten, pedagogen en onderzoekers; het biedt uitgebreide analyses van de SWMP-technieken, inclusief hun historische achtergrond, de technische uitvoering ervan alsmede de uitdagingen met betrekking tot notatie.

In het eerste hoofdstuk plaats ik SWMP in een breder historisch en esthetisch kader en traceer ik de integratie ervan in de hedendaagse saxofoonpraktijk. De wortels liggen in de jaren 1920 en 1930, een periode waarin saxofonisten in vaudeville- en dansbands experimenteerden met verschillende speeltechnieken. In die tijd vonden saxofonisten "trucjes" uit, waaronder het *bugel-effect*, een techniek die verwant is aan wat nu *trumpet*

[46] In het vervolg zullen alleen de Engelse termen gebruikt worden omdat die meer gangbaar zijn.

sounds genoemd wordt. Sommige van deze trucs zijn door de geschiedenis heen blijven bestaan, terwijl andere vervaagden of opgingen in verwante technieken. Maar de SWMP-technieken zoals we die nu kennen, zijn pas veel later formeel ontwikkeld, met name in de jaren 1980. De belangrijkste bijdragen zijn afkomstig van saxofonisten als Daniel Kientzy, Jean-Marie Londeix, Marie-Bernadette Charrier en Marcus Weiss; zij speelden een grote rol bij het formaliseren van de SWMP-technieken.

In hetzelfde hoofdstuk breng ik SWMP in verband met bredere muzikale, esthetische en filosofische ontwikkelingen. De opkomst van experimentele muziek en de zogenaamde *sonic turn* – een verschuiving van aandacht voor traditionele muzikale elementen zoals melodie en harmonie naar aandacht voor het geluid zelf – vormden een vruchtbare voedingsbodem voor de ontwikkeling van nieuwe saxofoontechnieken, waaronder SWMP. In dit hoofdstuk ga ik in op belangrijke esthetische evoluties zoals bijvoorbeeld beschreven in Luigi Russolo's *The Art of Noises* (1913), waarin hij pleit voor het invoegen van alledaagse en industriële geluiden in muziek. Ook Edgard Varèse stelde in zijn manifest *The Liberation of Sound* (1966) een breuk voor met de traditionele muzikale parameters en promootte het gebruik van nieuwe geluiden, waaronder geluiden die mogelijk werden gemaakt door elektronische instrumenten en nieuwe speeltechnieken. Helmut Lachenmann's concept van *musique concrète instrumentale* is in dit opzicht eveneens relevant omdat het de meer traditionele instrumentale technieken samenvoegt met de esthetiek van *musique concrète* en zich richt op de lichamelijkheid van geluidsproductie. Russolo's introductie van niet-traditionele geluiden in muziek, Varèse's nadruk op de materialiteit van geluid, zijn timbres en texturen, en Lachenmann's idee dat de handeling van het maken van geluid eigenlijk net zo belangrijk is als de auditieve resultaten, ondersteunen het idee dat SWMP-technieken niet slechts cultureel-technische curiositeiten zijn, maar deel uitmaken van bredere historische, artistieke, praktische en theoretische verkenningen van geluid en muziek.

Het eerste hoofdstuk eindigt met een overzicht van de belangrijkste saxofonisten, improvisatoren en componisten die hebben bijgedragen aan de ontwikkeling van SWMP. Verder geef ik analyses van twee improvisaties en twee prominente SWMP-werken. Als zodanig legt dit hoofdstuk de basis voor de gedetailleerde technische en uitvoeringsanalyses in de volgende hoofdstukken.

In de hoofdstukken twee tot en met vijf onderzoek ik elk van de vier primaire technieken in detail: *air pitch*, *tongue ram*, *trumpet sounds* en *saxo-flute hybridity*. Elk hoofdstuk bestaat uit video's waarin ik de technieken demonstreer en bevat verder de volgende onderdelen: beschrijving, technische parameters, uitvoering en praktijk, persoonlijke ontwikkeling en pedagogie. In het beschrijvingsgedeelte leg ik uit wat elke techniek inhoudt en geef ik korte voorbeelden van hoe je de specifieke klank kunt produceren. In het onderdeel 'technische parameters' behandel ik essentiële details zoals bereik, transpositie en embouchure, en geef ik tevens een overzicht van bestaande literatuur. Het gedeelte over uitvoering en praktijk gaat in op verschillende factoren die van invloed zijn

op een succesvolle uitvoering van elke afzonderlijke techniek, zoals articulatie, glissandi, dynamisch bereik, de *barrissement* techniek (voor *trumpet sounds*) of het veranderen van klinkers (voor *air pitch*), enz. Het gedeelte over persoonlijke ontwikkeling biedt richtlijnen over hoe saxofonisten vaardigheid kunnen opbouwen met elke techniek, terwijl het pedagogische gedeelte docenten praktische inzichten biedt over hoe ze deze technieken kunnen onderwijzen. Elk hoofdstuk wordt ondersteund door demonstratievideo's, transpositietabellen en een handleiding voor het spelen van de desbetreffende techniek. De demonstratievideo's dienen als referenties en laten zien hoe ik zelf de technieken op verschillende manieren uitvoer, inclusief overgangen tussen alle technieken, met korte teksten die aanvullende informatie geven. Deze hoofdstukken zijn essentieel voor het verkrijgen van een diepgaander begrip van de SWMP-technieken en ze vormen een uitgebreide bron voor saxofonisten, componisten en docenten.

Na de gedetailleerde verkenning van de vier technieken is het belangrijkste onderwerp in hoofdstuk zes de vraag hoe SWMP-technieken genoteerd kunnen worden. Aangezien dit onderwerp al lange tijd onderwerp van discussie is, vond ik het nodig om de verschillende notatiepraktijken die gebruikt worden voor SWMP te onderzoeken, hun evolutie door de tijd heen te volgen, te analyseren wat de notatie communiceert naar een uitvoerder, en richtlijnen te bieden voor componisten die SWMP-technieken in hun werk willen opnemen. Het hoofdstuk begint met een discussie over de notatiekeuzes van componisten. In de 20e en 21e eeuw hebben zij een enorme veelheid aan notatiesystemen ontwikkeld om hun ideeën vast te leggen, en geheel nieuwe en individuele notatiesystemen geïntroduceerd. Deze particuliere systemen hebben zeker de artistieke reikwijdte van een specifiek werk kunnen vergroten, de uitvoering en creatie van nieuwe en tot dan toe ongehoorde klanken vergemakkelijkt, en uitvoerenden de kans geboden om zich nieuwe tekens en symbolen eigen te maken. Echter, notatie moet ook duidelijk en efficiënt zijn zodat een uitvoerder die tekens en symbolen zo goed mogelijk, dat wil zeggen volgens de bedoelingen van de componist, kan interpreteren. Aan de hand van bijdragen van verschillende auteurs, waaronder Karkoschka, Toop, Fairbairn, Taruskin, Duncan en Assis, verken ik de diversiteit van notatievormen en de enorme artistieke mogelijkheden die dat biedt. Op basis hiervan kom ik tot een paar belangrijke observaties. Ten eerste, ondanks verschillende pogingen om notatie te standaardiseren, zijn componisten altijd op zoek gebleven naar nieuwe manieren om hun muzikale ideeën vast te leggen. Ten tweede zijn veel auteurs van mening dat complexe partituren passen bij de muziek die zij representeren. Deze diversiteit aan notatiesystemen kan enerzijds frustraties oproepen (zoals in het geval van Taruskin) maar moedigt ook artistieke expressie aan (zoals Fairbairn beweert). Maar notatie is, volgens mij, allereerst bedoeld om door middel van tekens en symbolen klanken te communiceren zodat de musicus die kan interpreteren en vervolgens uitvoeren.

Uiteindelijk ben ik op zoek gegaan naar een zekere consistentie in het noteren van deze technieken. Een uitvoerder is verantwoordelijk voor het zo nauwkeurig mogelijk interpreteren van een partituur, waarbij hij of zij een fysieke vertaling geeft van een

metafysisch fenomeen, wat dagelijkse, rigoureuze oefening vereist. In dit proces baseren uitvoerende musici hun keuzes op eerder opgedane en belichaamde ervaringen. Om dit proces soepeler te laten verlopen, presenteer ik een aantal richtlijnen die componisten kunnen gebruiken bij het schrijven voor SWMP. Deze richtlijnen gaan in op veelvoorkomende notatieproblemen en bevatten zowel algemene als specifieke aanbevelingen voor het noteren van elke SWMP techniek. Een zekere vorm van standaardisatie, zonder daarbij dogmatisch te zijn, kan nieuwe technieken normaliseren, de artistieke expressie verrijken en mogelijke verwarring tussen uitvoerders en componisten verkleinen. Het kan zowel componisten als saxofonisten helpen om zich de technieken beter eigen te maken, waardoor rijkere uitvoeringen mogelijk worden en het artistieke potentieel dat ze voor ogen hebben beter benut kan worden. Mede daarom pleit ik ook voor een nauwere samenwerking tussen componisten en uitvoerders, waarbij ik verwijs naar Roland Barthes' baanbrekende tekst 'The Death of the Author' (1967), waarin hij een meer dynamische relatie ziet tussen de auteur van een werk en zijn lezer of vertolker, die eigenlijk de medeauteur is.

Dit onderzoek is tot stand gekomen in en door mijn eigen muzikale praktijk. Daarom is een belangrijk deel van dit proefschrift gevuld met persoonlijke audio- en video-uitvoeringen van verschillende SWMP-werken. Dit was essentieel om het onderzoek überhaupt te kunnen doen. Een belangrijk mogelijk resultaat van dit artistieke onderzoeksproject ligt namelijk in nieuwe uitvoeringen, opnames en opdrachten voor SWMP-werken. Daarom ook is er een gedetailleerde handleiding voor het produceren van tonen door middel van SWMP-technieken, inclusief audiovoorbeelden van elke mogelijke toon voor de bijbehorende techniek. Het is de artistieke praktijk die me ertoe bracht dit tot onderdeel van dit proefschrift te maken. Ik heb tevens een repertoirelijst toegevoegd die het groeiende aantal werken laat zien van componisten die voor SWMP schrijven. Daarnaast zijn er video's van interviews die ik heb gehouden met een aantal van deze componisten, evenals met een saxofoniste die onderzoek heeft gedaan naar vroege saxofoonmethodes.

Curriculum Vitae

Renowned as an “artist beyond his time” by distinguished American composer John Corigliano and praised by Brutal New Music Reviews as possessing “the caliber of a soloist with whom composers dream to collaborate,” American saxophonist Don-Paul Kahl (born in Harrisburg, Pennsylvania on 29 January 1989) has performed across Europe, the United States, Australia, Japan, and South-East Asia. His performance record includes invitations to prestigious music festivals such as the KURAIA Festival (ES), Tallinn New Music Days (ET), Mise-En Music Festival (US), and SoundPlasma Festival (DE), among many others.

Don-Paul was a prizewinner at the prestigious contemporary saxophone competition, the 4th Jean-Marie Londeix International Saxophone Competition in Bangkok, Thailand. A passionate advocate for and specialist in contemporary music, he has premiered many new works for saxophone by established composers, contributing significantly to the evolution of modern music. Recent commissions include works by Ramon Lazkano, Stratis Minakakis, María Eugenia Luc, Yotam Haber, Katarina Miljokovic, and Nicholas Tzortzis, etc.

Among many publicly released albums, Don-Paul released his debut solo album, Go Within, on the Equilibrium Label in September 2021. Featuring six compelling works, the album demonstrates his commitment to championing the works by living composers. Collaborating with pianist Alessandro Cervino, the project showcases compositions by Molly Joyce, Stratis Minakakis, Eleni Ralli, Gregory Wanamaker, Mischa Zupko, and Kenichi Ikuno Sekiguchi.

As an avid and in-demand chamber musician, Don-Paul is active with the internationally acclaimed saxophone quartet, Ensemble du Bout du Monde (EBM), his duo with clarinetist, Jackie Glazier, Duo Entre-Nous (D2), with Woodwork, a dynamic reed quintet based in Belgium, and the Central Pennsylvania saxophone and piano duo, Kahl & Nyce Duo.

Don-Paul also maintains an active practice as a researcher, academic, and teacher. With respect to saxophone, saxophone without mouthpiece, and modern pedagogical practices he has given many masterclasses and guest artist recitals at universities in the United States and Europe.

In 2017, he completed a post-graduate performance and research program at the Lemmensinstituut in Leuven, Belgium. Previously, he earned a Master of Music degree from the University of Florida and a Bachelor of Music degree from Susquehanna University (Summa Cum Laude). His primary teachers and mentors are Jean-Michel Goury, Marcus Weiss, Jonathan Helton, Geoffrey Deibel, and Gail B. Levinsky, with additional study with Frederick L. Hemke.