The new potential of a recorder in the 21st century

Dissertation

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Abstract

Since its beginnings in the 14th century, the recorder has been undergoing a constant process of transformation as it continually weaves itself into the musical tapestry of the changing times. The variety of designs it has taken throughout history has given us the possibility of working not only with historical instruments, but also with contemporary recorder models. However, the picture is not what one would expect. Copies of historical instruments are still predominantly used for all musical forms and styles, and I work to answer the questions: to which degree can contemporary recorder models enrich the contemporary repertoire, add to the catalogue of available playing techniques, and expand recorder performance practice to fulfil the new challenges and demands of contemporary music.

In my research, I mainly focus on a specific model, the Helder Tenor, which was developed in the 1990s by Maarten Helder and fulfils many of the requirements expected from a recorder in the 21st century: balanced volume, dynamic possibilities, extended pitch range, and an increased variety of tone colours. With regards to method, extended instrumental techniques, and performance practice of this and many more contemporary recorder models, we find ourselves at a beginning point with a world of information yet to research, gauge, and document.

Zusammenfassung

Seit ihrer Entstehungszeit im 14. Jahrhundert hat sich die Blockflöte immer wieder im Detail verändert und den Klangidealen ihrer Zeit angepasst. Gerade durch ihre verschiedenen Erscheinungsformen liegt es nahe, sich in der heutigen Zeit nicht mehr nur mit den historischen, sondern auch den zeitgenössischen Blockflötenmodellen auseinanderzusetzen. Die Realität ist allerdings eine andere und es werden noch immer vermehrt Kopien historischer Modelle für alle Musikformen und -stile zum Einsatz gebracht. So stelle ich mir die Frage, inwieweit zeitgenössische Blockflötenmodelle eine Bereicherung hinsichtlich des zeitgenössischen Repertoires, der Aufführungspraxis, der erweiterten Spieltechniken und der Kombination mit anderen zeitgenössischen Instrumenten sind. Im Allgemeinen geht es mir darum die Vielfalt der Blockflöte zu bekräftigen, insbesondere aber das Potential der Blockflöte von heute und morgen zu erweitern, um den Herausforderungen und neuen Anforderungen zeitgenössischer Musik gerecht zu werden.

In meiner Forschungsarbeit konzentriere ich mich vorwiegend auf ein bestimmtes Modell: den Helder Tenor. Der Helder Tenor wurde in den 1990er Jahren von Maarten Helder entwickelt und erfüllt alle Voraussetzungen, die man im 21. Jahrhundert von einer Blockflöte erwartet: ausbalanciertes Klangvolumen, dynamische Möglichkeiten, erweiterter Tonumfang und vielfältiger Farbenreichtum. Was Methode, erweiterte Spieltechniken und Aufführungspraxis betrifft, stehen wir hier erst am Anfang und es gibt viel zu erforschen, auszuloten und zu dokumentieren.

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Preface

Either it repels, with an intensity approaching physical loathing; or it exercises a fascination bordering on addiction.[1] Kees Boeke

The recorder has, for me, always been an instrument that offers endless possibilities of sound manipulation and great potential for new discoveries. My first music teacher introduced me to the recorder as a multifaceted and versatile instrument and she always showed great interest in new music. Thus, it was natural for me to not only play early music on the recorder, but also work with the sounds and music of our time. Through my studies at the Conservatorium van Amsterdam and the Berlin University of the Arts, where I devoted myself to both contemporary chamber music as well as early music and contemporary solo repertoire, I learned to always bring out the best of my instruments and to find solutions through extended playing techniques, the choice of a specific recorder model or its preparation. It was incredibly exciting and inspiring work. However, I would never have come to question or even demand what I truly wanted to be able to play on my instruments, until the moment, in March 2012, when I met Johannes Fischer, German recorder player and teacher at the Akademie für Tonkunst in Darmstadt. At that time, he had already been exploring a contemporary recorder for almost 20 years and showed me playing techniques way beyond my imagination. This is where my journey begins.

[1] = *Entweder wird sie mit einer Intensität zurückgewiesen, die körperlicher Abscheu nahekommt, oder sie übt eine Faszination aus, die an Abhängigkeit grenzt*; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 18

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My partner, family and friends, and all who endlessly listened to me talking about my vision, believed in it and supported me greatly.

Last but not least, everybody who asked the right question at the right moment.

1. Introduction

Today we have many different types of recorder available. Some are modern developments, others are a revival of certain historical forms, others are deliberately altered historical models - but they are all part of the recorder's history.[2] Fred Morgan

The recorder has a long tradition and recorder players today can choose from a large variety of instruments that differ in model, size, tuning and material. The treatises "Musica instrumentalis deudsch" (1529) by Martin Agricola, "La Fontegara la quale insegno the suonare il flauto" (1535) by Silvestro Ganassi, "Epitome musical" (1556) by Philibert Jambe de Fer and "Onderwyzinge (…) op de Handt-Flyut" (1654) by Gerbrandt van Blanckenburgh provide evidence of the high level of recorder playing during those times. In the early Middle Ages, the recorder developed from the shepherd's instrument to the instrument of jugglers and minstrels and the first examples, found, for example, in Dordrecht and Göttingen, date back to the 14th century. During the 15th and 16th centuries, the recorder entered the court and noble chapels and was built in a consort[3], which suited the performance of vocal and instrumental polyphonic music. The recorder was then redesigned as a solo and chamber music instrument[4] during the late 17th century and featured in solo concertos[5] and sonatas[6] until the 18th century. Historically, the Viennese Csakan together with other members of the recorder family[7] and new instruments such as the English and French Flageolet, bridges the time frame between the baroque period and the "rediscovery" of the recorder in the 20th century. The repertoire ranges from Viennese Classicism, Biedermeier and French Romanticism to English post-Romanticism.[8] While many instruments were developed further during this time,

[2] = *Heute stehen uns viele verschiedene Blockflötentypen zur Verfügung. Einige sind moderne Entwicklungen, andere sind eine Wiederbelebung bestimmter historischer Formen, wieder andere sind gezielt veränderte historische Modelle – aber sie alle sind Teil der Geschichte der Blockflöte*; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 190

[3] from Garklein to Contrabass

[4] mainly instruments in the 4-foot register, from sopranino/soprano to basset

[5] For example, by Johann Friedrich Fasch, Giuseppe Sammartini, Georg Philipp Telemann, and Antonio Vivaldi

[6] For example, by Georg Friedrich Händel, Jean-Baptiste Loeillet, Francesco Mancini, and Georg Philipp Telemann

[7] Peter Thalheimer: *Fleitl – Flûte douce – Flötuse* (Tibia 3/2008), p. 176-183

[8] For example, by Narcisse Bousquet, Francis Chagrin, Auguste F. Devisien, Anton Heberle, Ernest Krähmer, C.J. Müller, and John Parry (www.aura-edition.de, accessed 13.05.2019)

culminating in their use within a symphony orchestra, the recorder was in contrast found in small chamber music groups with guitar, pianoforte, or strings.

The rising interest in the original sound of Renaissance and Baroque music, which began in the 19th century, culminated in a copy of the first baroque, or more accurately said, modern baroque recorder, which is still being built and widely known today. It was developed in England by Arnold Dolmetsch after World War I in 1919. Inspired by these instruments, recorders were also built in Germany on behalf of Peter Harlan from 1926 onwards. These rather simple models fitted perfectly with the returning popularity of folk music and the desire to make music part of everyday life through the recorder. As Paul Hindemith adequately described: *There is no one, who after a few shy attempts, didn't immediately achieve something that sounded nice*.[9] Beyond that, some curious and promising experiments also appeared at this time which provided inspiration for some of the contemporary recorder models of today[10]. After World War II, the recorder began to flourish one again in the 1960s with Frans Brüggen and the Early Music movement from the Netherlands, as well as through the outstanding work by performers such as Konrad Lechner, Hans-Martin Linde and Michael Vetter. Since then, the level of playing has continually risen with each generation of young players and the repertoire in early and contemporary music has constantly grown. We can also look back on an extremely exciting phase in which some promising and trendsetting recorder models were developed: Paetzold (bass) recorders which are now built in six different sizes from tenor in c1 up to the subcontrabass in FF, Strathmann soprano and alto recorders, Helder alto and tenor recorders, Supercorder, modern harmonic soprano, alto and tenor recorders, AKAI EWI Midiflute, Eagle soprano and alto recorders, and Elody.

Although the recorder has been undergoing a constant process of transformation from the Middle Ages onwards and was always adapted to the sound ideals and music aesthetics of its time, copies of historical models are mainly used today, even in contemporary music. Therefore, performance practice and extended playing techniques on contemporary recorder models are still their infancy and there is a lot to develop, explore, fathom and document. This fact marks the starting point of my artistic research and leads

[9] = *Keiner, der nicht nach einigen schüchternen Versuchen sogleich etwas Nettklingendes zustande brächte*; in: Paul Hindemith: *Komponist in seiner Welt* (Mainz 1959), p. 206; First published in: *A Composer's World* (New York 1949/50)
[10] Peter Thalheimer: *Forgotten and rediscovered: The Recorder* (Markneukirchen, 2013), p. 30/31, 44, 68/69, 70/71, 96/97, 100/101, 112/113, 123, 125, 127, 129

me to the following question: How exactly do modern recorder models enrich the contemporary recorder repertoire, the extended playing techniques, the contemporary recorder performance practice and the combination with other contemporary instruments? Broadly speaking, I want to encourage the development of the recorder's enormous variety in model, size, tuning and material, and more specifically I want to extend the potential of the recorder from today and tomorrow to meet the challenges and new demands of contemporary music.

The early music copies of recorders of today are quite heavily modified, especially because they are adapted to modern tuning systems, big concert halls and other contemporary instruments. Even so, while the original performance potential is now virtually non-existent,[11] these recorders can still be regarded as "historical" models, since their design (meaning bore and wall thickness, as well as the shape, size and placement of the finger holes) has a likeness to the early instruments and impacts the basic technical qualities such as fingerings, dynamics and timbre.

One of the most important things a maker can do towards becoming a real instrument maker, rather than a copier, is to think long and hard about the likely reasons for an old instrument being the way it is. We have been accustomed to the conventional modern type of recorder, ubiquitous in the 1960s and early 1970s and still much needed for modern-pitch performances and contemporary music; an old recorder made by Bressan or Stanesby differs from such an instrument in almost every aspect of its design.[12]

Frederick Morgan

Because the types of recorder models mainly in use today are modified baroque recorders and school recorders, most people still consider the recorder to be a simple instrument, made of wood and without keys.

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[11] It is important to mention that it is very hard to know the actual potential of these instruments nowadays. Most of the original instruments are made of wood, have changed massively during the centuries and are rarely able to be played due to museum restrictions. One can only speculate what the original potential could have been.

[12] = *Wer ein richtiger Instrumentenbauer und nicht nur ein Kopist werden möchte, sollte lange und intensiv über die möglichen Gründe nachdenken, warum ein altes Instrument so ist, wie es ist. Dies ist eine der wichtigsten Voraussetzungen. Wir haben uns an den konventionellen modernen Blockflötentyp gewöhnt, wie er in den sechziger und Anfang der siebziger Jahre allgegenwärtig war und der noch heute sehr sinnvoll für Aufführungen in moderner Stimmung und für zeitgenössische Musik ist. Eine alte Blockflöte von Bressan oder Stanesby unterscheidet sich von einem solchen Instrument jedoch in nahezu jedem Aspekt seines Konzeptes*; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 62

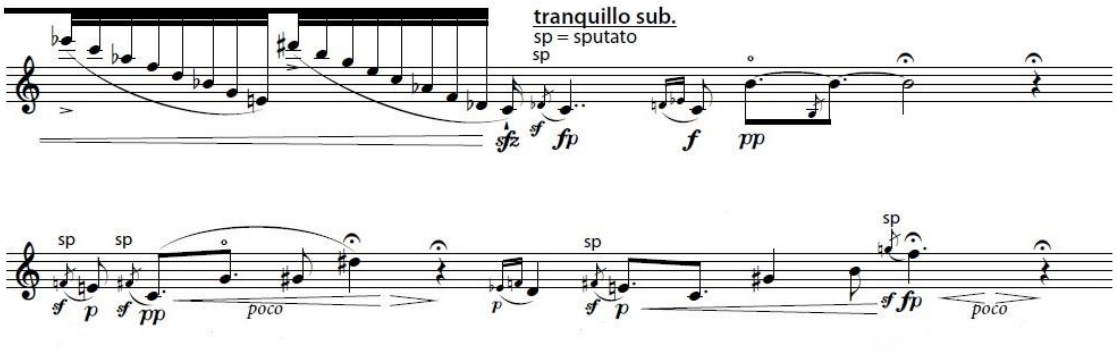
© Markus Berdux

Photo 1: *alto recorder after Jacob Denner by Mollenhauer*

With regards to range, dynamics and balance, the recorder (as mentioned above) is indeed a rather simple or even limited instrument when it comes to our listening habits and music aesthetics of today. One expects to hear an extended range, a balanced volume of tone, many dynamic possibilities and a wide variety in timbre. With this in mind, the limitations of modified baroque recorders are described below. Of course, there are different models from the baroque era with different characteristics, but in general one can say:

- While playing a scale downwards one needs to reduce air pressure, otherwise the lowest notes will be overblown.
- Exactly the opposite must happen while going up. Here, one needs to constantly increase air pressure in order to reach the highest notes.
- When playing louder, the pitch rises and needs to be balanced by adding fingers. Although this is a common playing technique, its execution depends on the register. Very often a multiphonic will appear, especially in the first register on baroque recorders.
- When playing softer, the pitch drops and needs to be balanced by opening or shading with one or several fingers. This technique works quite well but is limited to the moment the pitch completely drops. Therefore, playing “niente” is impossible except for the lowest pitches.
- Although one can certainly play a chromatic scale throughout the whole range, flats and sharps are rather weak and differ a lot in sound and character.

However, it is important to remember that early music instruments where built in a different time, for different music and music aesthetics, as well as different musical occasions, and while it is certainly worth exploring early music instruments for contemporary music, one needs to seriously question what options we have, when a score looks like this:



Tobias PM Schneid: *Vertical Horizon 1a (1996)*

Outline of the doctoral thesis

In the following chapter about recorder organology, I will give an overview of the experiments and developments of instruments during the 20th century, discuss their background and highlight the models that inspired them. This is followed by a first conclusion which leads into the next chapter about the contemporary recorder model I have been exploring over the past few years: the Helder Tenor. Here I present its special features as well as its history and a detailed description of its further development in close collaboration with recorder company Mollenhauer. To show as many details of the instruments discussed as possible, both chapters are illustrated with an array of photographs. The fourth chapter is completely dedicated to the Helder Tenor's repertoire, which includes pieces specifically written for it, as well as contemporary music repertoire for a standard tenor recorder, transcriptions, and my own commissions. Furthermore, I summarize its potential regarding extended playing techniques and a contemporary performance practice. The thesis ends with my conclusion, personal thoughts and questions, and because I have been documenting concerts and experiments in many audio and video recordings, the appendix is a memory stick with all of the extra material one needs to fully enjoy this work.

Artistic result and project goal

Through this research, my goal is to present the recorder as a multifaceted solistic instrument and to expand the knowledge and interest in it internationally. I will initiate artistic exploration and contribute to further development of the artistic capabilities of the instrument. If the research is successful, I will have found and documented a contemporary performance practice, I will have explored new possibilities of expression related to the aesthetics of our time to a much wider degree than ever before, I will have created new repertoire and I will have developed the Helder Tenor further. Based on the newly developed instrument and my new playing technique, I will offer new interpretations of the existing repertoire. The highlight will be the release of my debut CD, introducing contemporary music on this instrument as well as a website with detailed descriptions of my research. Through this I hope to gain interest from composers and artists around the globe and thereby facilitate increased use of the instrument by other recorder players worldwide.

2. Recorder organology

One of the phenomena of our time is the sustained popularity and use of the recorder in so many different fields.[13] Edgar Hunt

Thanks to professional recorder players and the technical progress that has been made in the making of both early music and contemporary recorder models, the recorder has been gaining more and more popularity and reputation on international stages in the past 50 years and is being rewarded with highly regarded music prizes and being included in different kinds of music projects which encompass many different music styles with renowned ensembles, orchestras, bands and theatre groups. However, the recorder is still mainly considered as an exotic instrument in the contemporary music scene and is more likely to be used in unconventional settings or as special effect. Looking at the past, one will notice, that from the baroque period onwards, the recorder was often labelled as something suiting that particular time, for example, the second or third instrument played by multi-instrumentalists in the 18th century, an amateur instrument in the 19th century, an early music instrument since the end of the 19th century. The recorder was given more labels and played numerous roles in the 20th century, so in this chapter I would like to take a closer look at recorder models and their application in this past century. To focus on the essentials, namely the instruments, I am only examining the movements of the two main initiators, Arnold Dolmetsch and Peter Harlan, so this chapter lays no claim to absoluteness.[14]

[13] Edgar Hunt: *The Recorder and its Music* (1962, revised edition 2002), p. 135

[14] For a wide and detailed description of this period, I would like to recommend the following books and articles: Edgar Hunt "The Recorder and its Music" (Jenkins, 1962; revised edition 2002), Hermann Moeck "Zur „Nachgeschichte" und Renaissance der Blockflöte" (Celle, Tibia 1/1978 and 2/1978), Eve O'Kelly "The Recorder Today" (Cambridge, 1990), Peter Thalheimer „Die Blockflöte in Deutschland 1920-1945" (Tutzing, 2010), Geoffrey Burgess "Well-Tempered Woodwinds" (Bloomington, 2015)

2.1. The recorder in the 20th century

To fully understand the Renaissance of the recorder in the 1920s, it is important to recall where the recorder stood at the turn to the 20th century. Although it was still present in different designs such as the Viennese Csakan, the "Flûtes douce" or "Flötusen", and the English, Viennese and French Flageolets, the recorder was seen as a *popular instrument for amateurs*, not as *part of any "official" musical tradition*[15] in the 19th century.

© Peter Thalheimer

Photo 2: *recorder in e1 (a=435 Hz), signed as "A PARIS", and recorder in a1 (a=450 Hz), signed as "SIBOUT / A PARIS", built c. 1840*

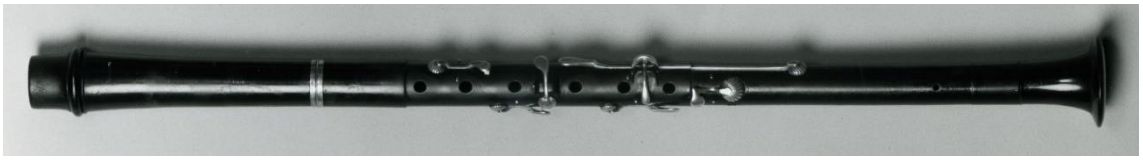


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Photo 3: "*Komplizierter" Csakan in a^b1 (approx. a=432 Hz) by Johann Joseph Ziegler, built c. 1835*

With the rise in musicological interest in early music in the early 19th century, it was just a matter of time until this movement discovered early music recorders. Starting with antiquarians, collectors and exhibitions, the recorder's *revival*[16] began with a few *fairly isolated instances of recorders being played*.[17] In 1885, Professor Dumon from the Brussels Conservatoire performed together with his students mainly on instruments from

[15] Eve O'Kelly: *The Recorder Today* (Cambridge, 1990), p. 4
[16] Edgar Hunt: *The Recorder and its Music* (Jenkins, 1962, revised edition 2002), p. 121
[17] Eve O'Kelly: *The Recorder Today* (Cambridge, 1990), p. 4

the renowned Mahillon collection at the International Inventions Exhibition in the Albert Hall Galleries in South Kensington, London. A little later, a reportedly sensational group of mainly amateur musicians was founded in 1890 in South Germany. These pioneers of virtuosic recorder playing, called the "Bogenhauser Künstlerkapelle", performed on original Bressan and Denner instruments and *became an established part of the musical scene in Munich, playing for civic receptions and festivities and broadcasting.*[18] As well as these notable performances, more attention was drawn to the recorder through the research of Dr Joseph Cox Bridge ("The Chester Recorders", 1901), Canon Francis Galpin ("Old English Instruments of Music", 1910), Christopher Welch ("Six lectures on the recorder and other flutes in relation to literature", 1911), and Arnold Dolmetsch ("The Interpretation of the Music of the 17th and 18th century", 1915). The latter performed on an original Bressan recorder from 1905 onwards and his family workshop has played a significant role in recorder making as we know it today.

After World War I, a few important movements happened at almost the same time and nothing could stop the resulting recorder boom. First of all, the musicological interest in early music instruments was still flourishing. In 1920 Wilibald Gurlitt started to use recorders in his seminars at the University of Freiburg, where he also founded the musicology department and the Collegium musicum. He and his students played on copies of original instruments (Hieronimus Franziskus Kinsecker, from approximately 1670) from the Germanisches Nationalmuseum in Nuremberg. In April 1949 he wrote in his letter to Hermann Moeck: *As far as I am concerned, I have always insisted that our playing on recorders should continue in the service of musicology and the elucidation of the sound of the seventeenth century.*[19]A few years later, in the summer of 1926, the musicologist and folk song researcher Werner Dancker founded a recorder quartet at the Friedrich Schiller University in Jena. Like Gurlitt they used copies of original instruments (the Kinseker set in 1922 and a Denner alto in 1925) from the Germanisches Nationalmuseum in Nuremberg. These instruments were indeed made without any artistic claim and therefore had no impact on later developments. However, this kind of musicological work did bear some fruit and can, for example, be seen in the work of recorder player Gustav Scheck. He was a former student of Wilibald Gurlitt and a

[18] Eve O'Kelly: *The Recorder Today* (Cambridge, 1990), p. 5

[19] = *Was mich betrifft, so habe ich immer Wert darauf gelegt, daß unser Musizieren auf Blockflöten im Dienst der Musikwissenschaft und der Erhellung der Klangvorstellung des 17. Jahrhunderts verbleibt*; in: Hermann Moeck: *Zur „Nachgeschichte" und Renaissance der Blockflöte* (Tibia 1/1978), p. 20

founding member of the early music ensemble "Kammermusikkreis Scheck-Wenzinger". From 1934 to 1945 he was a lecturer at the Berliner Musikhochschule, where amongst others, Paul Hindemith also taught. After World War II, together with Wilibald Gurlitt, co-foundered the Hochschule für Musik in Freiburg, where he was headmaster from 1946 until 1964. Some of his notable students were Hans-Conrad Fehr, Linde Höffer von Winterfeld and Hans-Martin Linde – all *pioneers of the early music movement and, in particular, of the twentieth-century repertoire for the recorder.*[20]

Through musicological interest, the focus on early music and its historic performance practice became increasingly stronger and instrument makers had to rediscover the skills of ancient recorder making. In 1919, forced by the loss of his original Bressan alto recorder, Arnold Dolmetsch *completed one of the first, and certainly the most influential, twentieth-century recorder.*[21] Since he was a performer himself, he made high demands on the reconstruction of this instrument, based on measurements he fortunately had taken down before the loss. After many attempts, the first series was sold in 1920, introducing the "English baroque"[22] fingering system, which is still the standard fingering system for baroque recorders today.

© The Horniman Museum and Gardens

Photo 4: *no. M10-1983, alto recorder by Pierre Jaillard Bressan*

In the following years Arnold Dolmetsch developed a whole consort from soprano to f-basset in low pitch,[23] which was presented at his second Haslmere Festival of Early Music in 1926. In the same year, his son Carl Dolmetsch took over the recorder production. His

[20] Eve O'Kelly: *The Recorder Today* (Cambridge, 1990), p. 6f
[21] https://www.dolmetsch.com/Dolworks.htm (accessed 13.05.2019)
[22] Better to say Dolmetsch fingering system. There is no evidence, why Arnold Dolmetsch changed the fingering for IV (fourth step above the bottom note) in the first and second registers. Hermann A. Moeck assumes that his goal was to get a stronger low register. Thomas Lerch points out, that Arnold Dolmetsch shortened his original instrument at the bottom to reach the standard pitch, which raises IV in the first and second registers and needs therefore to be lowered by an extra finger movement.
[23] At that time a=approx. 410 Hz

instruments were tuned in C and F and built in low pitch and a few years later also in modern pitch. In 1930 he completed the consort with a sopranino recorder. Because these instruments were high quality custom-made items, they were quite expensive, and therefore limited to professional musicians and serious early music societies in England. Only through musician and musicologist Edgar Hunt, who visited the "Kasseler Musiktage" in Germany in 1934 and arranged a *delivery of inexpensive Herwiga-recorders with the "English fingering system" for the English market* together with distributer Wilhelm Herwig, *a wider spread of the recorder in England was possible.*[24]

Photo 5: *Dolmetsch recorder consort (mid-1970s)*

Dr Carl Dolmetsch, Jeanne Dolmetsch, Marguerite Dolmetsch and Dr Brian Blood

[24] = *(…) die Lieferung preiswerter Herwiga-Blockflöten in "englischer Griffweise" für den englischen Markt vereinbart hatte, war eine größere Verbreitung der Blockflöte in England möglich*; in: Peter Thalheimer: *Die Blockflöte in Deutschland 1920-1945* (Tutzing, 2010), p. 47

If the recorder was first revived as an instrument for the performance of early music in England, to Germany must go the honour of being the home of the more popular use of the instrument.[25] Edgar Hunt

With Peter Harlan we find a movement which had an incredible impact on the recorder's development aside from its importance in early music. Being a musician, instrument maker and distributor himself, Peter Harlan discovered the recorder through his studies with Wilibald Gurlitt in Freiburg in 1921. However, it was not until shortly after the early music festival in Haslemere in 1925, and his visit to the Staatliche Musikinstrumentensammlung in Berlin that he started to believe the recorder is the *most suitable instrument for the current music making* (simple folk music and Renaissance music) *of youth and amateurs.*[26] Peter Harlan was strongly influenced by the German youth movement ("Jugendbewegung") which opposed the urban life marked by industrialization and turned towards the experience of nature. He was looking therefore for an instrument made of natural materials, inexpensive, easy to transport and play, which supported the community and broke with the standards of musical excellence of the 19th century. Historical precision and professionalism were not important to him, so he ordered rather simple designs for his recorders, including a square windway[27] and the German fingering system.[28] Because his ideas were adopted by many other instrument makers, Peter Harlan unintentionally launched a strong development of amateurism, which he already regretted in 1931. In his review he stated:

(…) and now, the latest report on the Leipzig Trade Fair even mentions a "recorder mania". Oh, whatever is meant by "recorder" nowadays. If I only could manage to put the cat back into the bag! But the animal has slipped out and I don't have the power to get hold of it again.[29]

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[25] Edgar Hunt: *The Recorder and its Music* (Jenkins, 1962, revised edition 2002), p. 141

[26] = *für das gegenwärtige Musizieren der Jugend und der Laien sei am geeignetsten die Blockflöte*; Ekkehart Pfannenstiel, 1971; in: Peter Thalheimer: *Die Blockflöte in Deutschland 1920-1945* (Tutzing, 2010), p. 52

[27] Based on windways, which were already built by instrument makers from the Vogtland before.

[28] Better to say Harlan fingering system. The third last finger hole was accidentally built smaller and therefore the advanced fork fingering could be avoided. See also chapter 3.2.

[29] = *(…) und nun war gar bei dem letzten Bericht über die Leipziger Messe von einer „Blockflötenkonjunktur" die Rede. Oh! was nennt sich nun alles „Blockflöte". Wenn ich doch von Fall zu Fall das „Besen, Besen, sei es gewesen" herausbekäme! Aber ich habe die Gewalt nicht über die Geister, die ich rief;* in: Peter Harlan: *Wie kam die Blockflöte wieder in unser Leben?* (1931), p. 17

But Peter Harlan's individual and naïve approach pared with a rapid development of and demand for the recorder, caused further difficulties. Although Arnold Dolmetsch already advertised his first instruments in low pitch based on C and F (from 1932 onward also in modern tuning[30]), Peter Harlan started to sell recorders on E in modern tuning (F in low pitch) in collaboration with Kurt Jacob and Martin Kehr in 1926, and just one year later a quartet based on E and A. Despite this pitch choice causing irritation at first, his mistake finally led to many different tunings, where recorders were built based on g0 diatonically up to d2,[31] and in the end Peter Harlan was responsible for a big diversity in bore concepts leading into a broad variety in timbres.

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Photo 6: *"Chorflöten" by the Kehr workshop*

Before discussing a few advanced recorder models in more detail, it is important to have a look into the repertoire at that time. In summary, I can say that recorder music in the first half of the 20th century was characterized by:

- early music which in Germany was mainly vocal and instrumental music of the 16th and 17th century,
- folk music and children songs,

[30] At that time a=approx. 435 Hz

[31] = *für jede Stufe der C-Dur Tonleiter* (*for each step on a C Major scale*); in: Karl Gofferje (1930/31), p. 161

- "Spielmusik", which was written for amateurs performing on "historical" instruments. The compositional structure of these pieces was simple, pared with no demands for player and instrument, written in a traditional style, and included folksong and folkdance elements. These pieces were often called Sonatina, Sonate, Suite, Partita, Variations, Invention, Bagatelle, or Fantasie, and last but not least,
- new music from 1926 onwards[32] with high musical and technical demands, stylistically free, performed on different recorder models, appropriately described my Manfred Ruëtz, who was looking for music *of greater inner weight and outer format.*[33]

It must be clear that the recorder also needs technical training like any other serious musical instrument, that it is not easy to acquire this training, that however when we have learned to handle this flute, it will be musically fully capable of measuring itself against any other instrument.[34] Karl Gofferje

Like Karl Gofferje, other distributors and instrument makers, as well as some recorder players and composers also recognized the potential of the recorder. Carl Dolmetsch, for example, stated before his first Wigmore Hall recital in February 1939: *One of my aims will be to demonstrate the possibilities of the recorder as a virtuoso instrument on a par with the already accepted violin, flute or pianoforte, and to present masterpieces of music which form part of its literature.*[35] As the level of performance increased, so did the demands and special wishes to the instrument, and composers tried to translate this into their music. I would like to name here Helmut Bornefeld, Gunhild Keetman, Paul Hindemith, Konrad Lechner, Karl Marx and Heinrich Kaspar Schmid as German pioneers and Stanley Bate, Lennox Berkeley, Walter Leigh and Franz Reizenstein as English pioneers.

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[32] In England and from 1930 in Germany.
[33] = *von größerem inneren Gewicht und äußerem Format*; in: Karl Marx (1978), p. 31
[34] = *Es muss klar werden, dass auch die Blockflöte handwerkliche Schulung braucht wie jedes andere ernsthafte Musikinstrument, dass es nicht leicht ist, diese Schulung sich zu erwerben, dass sich diese Flöte aber dann, wenn wir gelernt haben, sie zu handhaben, musikalisch vollwertig mit jedem anderen Instrument sich zu messen* vermag; in: Karl Gofferje: *Blockflöten, die große Mode* (1931), p. 159f
[35] Edgar Hunt: *The Recorder and its Music* (1962, revised edition 2002), p. 132

However, from the 1930s onwards the conventional recorder, as we know it today, became increasingly common[36] and many inexpensive basic instruments were built and sold. This was also the time when the recorder was given a universal function, especially in music education, and the recorder therefore became:

- an instrument for amateurs (first indications were found in the baroque period, but this was established in the 19th century and carried into the 20th century),
- a folk instrument (which began at the end of the 1920s with the German Youth Music Movement ("Jugendmusikbewegung") and required a monophonic instrument handmade out of natural materials, excluding mechanics, suitable for choirs and easy to learn[37]),
- a precursory instrument to give all children a basic music education (established during the 1920s[38]). This idea was carried through the 20th century with inventions such as the Orkon-flute by Edward Powell in 1941 (a soprano recorder with Boehm-type fingering system) and the Strathmann-flutes by Arnfred Strathmann in 1985 (a soprano and alto recorder with saxophone key system[39]). It can also be found in hybrid instruments from today such as the Fipple Head Flute by Martin Niethammer (2015, a modern flute with a recorder head joint[40]) and the Venova by Yamaha (2018, a saxophone with recorder fingering system[41]). These instruments were developed to facilitate certain playing aspects, described by Edward V. Powell as *"easy-to-play" factors.*[42]
- a community-building instrument (since 1929 many people assumed the recorder *hardly allows any personal expression of emotion when producing a sound*[43] and started to organize recorder orchestras)

[36] Cornelia Stelzer: *Die politische Bedeutung der Blockflöte zur Zeit des Nationalsozialismus und ihre Auswirkung auf die Gegenwart* (Tibia 2/2017), p. 404
[37] ibid, p. 406f
[38] ibid, p. 405
[39] More information in chapter 2.2.1.e
[40] https://www.youtube.com/watch?v=Ow7T8vSQTj4 (accessed 13.05.2019)
[41] https://www.youtube.com/watch?v=85_73iAm-sU (accessed 13.05.2019)
[42] Edward V. Powell: *Easy steps to playing the ORKON-flute* (1940), found on: http://www.tjimaging.com/orkon/ (accessed 13.05.2019)
[43] *= (…) weil sie der Ansicht waren, dass das Instrument „bei der Tonerzeugung kaum persönlichen Gefühlsausdruck" zuließe*; Cornelia Stelzer (Tibia 2/2017), p. 409; First published in: Funk-Hennings (1987), p. 226

- an instrument for beginners (since approximately 1930 and especially during the Nazi regime the recorder was rather used for music education than music making[44])
- an instrument of the Hitler Youth ("Hitler Jugend" (HJ); especially since 1936 the recorder was a symbol of German culture[45]), and last but not least
- an instrument for girls (called "Bund Deutscher Mädels" (BDM) during the Nazi regime)

Next to the instruments which fulfilled the functions mentioned above, there have also been high-quality instruments made for advanced amateurs and professional musicians, especially the models after 1936 such as Bärenreiter-Ruëtz-Hüller Meisterflöten (master flutes), Gofferje-Merzdorf-König (starting from Nr. 7000), Harlan-Kehr (with curved windway), Herwiga-Rex (König) and Rudolf Otto Meisterflöten.[46] Although there have been experiments with recorder models with less tone holes, I would like to concentrate on instruments with the 7+1 system, which is most relevant for my research.

Nowadays it is common to distinguish between three different bore designs which were developed and established in early times:

1. Short bore: recorders with an inverted cone which overblow on the fourth harmonic more than 100 cents too high such as:

- Denner alto recorders,
- most of the Voice flutes, and
- recorders in relation to the fingering charts of Robert Carr (1686), Jean-Pierre Freillon-Poncein (1700) and Johann Christian Schickhardt (1715).
  These models are characterized by a brilliant sound, rich in overtones but a soft low register and a quite unbalanced range of two octaves and a fifth.

2. Long bore: recorders with an inverted cone and longer foot joint which overblow on the fourth harmonic up to 100 cents too high[47] such as:

[44] Cornelia Stelzer: *Die politische Bedeutung der Blockflöte zur Zeit des Nationalsozialismus und ihre Auswirkung auf die Gegenwart* (Tibia 2/2017), p. 405
[45] ibid, p. 408
[46] Peter Thalheimer: *Die Blockflöte in Deutschland 1920-1945* (Tutzing, 2010), p. 369
[47] Note IV#‘‘‘ can be played without stopping the bell.

- some of the Stanesby recorders (in regard to the fingering chart),
- Hotteterre tenor recorders,
- most tenor recorders with keys,
- recorders in relation to the fingering charts of Joseph Friedrich Bernhard Caspar Majer (1732, 1741), Pablo Minguet y Irol (1754), John Sadler (1754) and the recently discovered collection for "Baron v. Tschiderer" (mid/end of 18th century), and
- 19th century Csakans.[48]

  These models are characterized by a warm sound with strong fundamental harmonics and are more balanced from the lowest register throughout the range of two octaves and a fifth.

3. Long bore with pure harmonics: recorders which overblow into pure harmonics on the root and extension note such as:

- recorders by members of the Schnitzer family,
- Hans Rauch von Schrattenbach recorders, and
- recorders by members of the Bassano family.[49]

  These models are characterized by a strong and stable sound, rich in overtones and a well-balanced extended range up to three octaves and even more.

Although these designs have been used again from the 1930s onwards, only a few instrument makers knew their true extent. Generally speaking, the longer the bore (within a certain frame and in relation to its size and the respective placement of the finger holes), the more balanced the instrument, the better the response, the wider the range, and the better the quality of the third octave. Instrument makers such as Max König and Martin Kehr, who were also building clarinets and modern flutes, were familiar with these principles. Their instruments with long bores were built until the 1960s and inspired recorder makers of today to build harmonic recorders.[50]

[48] Nik Tarasov: *Eine überraschende Entdeckung. Unbekannte Grifftabelle für Altblockflöte aus dem 18. Jahrhundert aufgetaucht*; in: Windkanal 3/2015, p. 8-13
[49] Documented by Sylvestro Ganassi: *Opera intitulata Fontegara* (Venice, 1535), p. 8f
[50] See chapters 2.2.1.f and 3.1.1.

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Photo 7: *bass recorders by the Kehr workshop*

© Frank Fickelscherer-Fassl

Photo 8: *alto recorder in d1 (approx. a=435 Hz) model Gofferje-Merzdorf by Max König & Söhne*

From the 16th until the 18th century recorders were built with a curved windway and labium, but only a few workshops in Germany copied this rather advanced design for their high-quality models. Inspired by the Csakans and Flageolets from Vogtland, recorders were mainly built with a square windway and straight labium until the late 1960s. It was only through Edgar Hunt, who provided some Dolmetsch recorders to company Wilhelm Herwig in 1934, that attention was drawn to this design[51]. Although there have been no scientific studies on this topic, recorder makers from today certainly agree that this design is more stable in construction and some even believe in a better response and more flexible timbre of the instrument.

[51] Peter Thalheimer: *Die Blockflöte in Deutschland 1920-1945* (Tutzing, 2010), p. 110

© Peter Thalheimer

Photo 9: *curved windway and labium by Max König & Söhne*

© Susanne Fröhlich

Photo 10: *straight windway by Max König & Söhne*

Keys on woodwind instruments compensate the limited spreading of the human hand and have been present since the early 15th century. While the "open" keys (open while inactive) are meant for diatonic extension of the range, "closed" keys which have been around since the 17th century (closed while inactive), are used to raise a certain pitch chromatically (for example the French Baroque oboe, Hotteterre flute and 19th century Flageolet and Viennese Csakan). Next to these two designs, other keys have also been developed such as the open hole key, trill key, and Hamburger key. In 1927 tenor and bass recorders were already built with keys for Peter Harlan. Because he was interested in instruments with a strong low register, meaning that he favoured models with a wide

bore, keys were indispensable and even alto and soprano recorders in a1 included a key for the bottom note later on.

© Peter Thalheimer

Photo 11: *straight and bent key for the bottom note by the Kehr workshop*

In addition, up to four keys were built on the middle joint of tenor recorders in a0, bass and great bass recorders for a well-balanced first and second register.[52]

© Peter Thalheimer

Photo 12: *bass recorder in e0 with extra keys on the middle joint by the Kehr workshop*

Although the recorder was supposed to stay as natural and simple as possible, Peter Harlan and other recorder makers were interested in a well-balanced chromatic scale. Until 1936 (and afterwards made on special request), Peter Harlan offered soprano and alto recorders with three extra keys for I#, II# and IV#. Other recorder makers even offered up to six extra keys for I#, II#, IV#, V#, VI# and VII#.

[52] More information in chapter 3.1.2.

© Peter Thalheimer

Photo 13: *"Harlan Chorflöte" with three extra keys by the Kehr workshop*

© Peter Thalheimer

Photo 14: *soprano recorder in c2 with six extra keys by the Kruspe-Hüller workshop*

Besides that, further interesting experiments with keys and tone holes were made such as:

© Peter Thalheimer

Photo 15: *double key for the bottom note by Kurt Hüller*

© Peter Thalheimer

Photo 16: *perforated key for IV# and IV'# by Johannes Adler*

© Frank Fickelscherer-Fassl

Photo 17: *soprano recorder in c2 (approx. a=435 Hz) with half-tone key by Max König & Söhne*

© Peter Thalheimer

Photo 18: *soprano recorder in c2 (approx. a=435 Hz) with half-tone extension by the Jahn workshop*

© Frank Fickelscherer-Fassl

Photo 19: *alto recorder in f1 (approx. a=435 Hz) model Manfred Ruëtz with double hole*[53] *by Max Hüller*

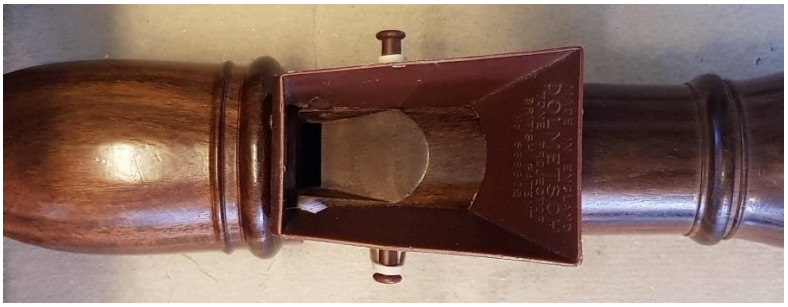
© Peter Thalheimer

Photo 20: *soprano recorder in c2 with metal ring and double hole by Rudolf Otto*

[53] Inspired by recorders with double holes from the 18th century (for example, two Chester recorders by Pui Bressan), respectively by Dolmetsch recorders.

Far from stopping the spread of the recorder, the war and its new conditions only served to increase the demand for music and instruments. Schools had been evacuated from the larger cities to country districts and often there were no pianos to lead the singing. Recorders were sent for.[54] Edgar Hunt

During WW II inexpensive recorders couldn't be delivered from Germany to England anymore, so soprano recorders made from Bakelite were developed by Schott as educational music instruments. From 1947 onwards even the Dolmetsch family produced plastic soprano recorders, followed by altos, tenors and basses. In addition to their standard products there were interesting experiments by Carl Dolmetsch, probably inspired by his father who *sought to 'improve' on the original masters, (…) making use of new materials or creating new designs to meet present day needs. He argued that instrument making had always been, and should continue to be, an ongoing process of development where each design reflected the particular skills and tastes of the maker (…).*[55]



© Dr Brian Blood

Photo 21: *tone projector by Carl Dolmetsch, here on an alto recorder; the effect is to flatten the pitch allowing the player to blow more strongly (produced from 1947 until the 1970s)*

[54] Edgar Hunt: *The Recorder and its Music* (1962, revised edition 2002), p. 133
[55] https://www.dolmetsch.com/Dolworks.htm (accessed 13.05.2019)

Photo 22: *bell key by Carl Dolmetsch to facilitate closing the bell for the f#''' on alto recorders built with a short bore (later version was played by the right pinkie finger; since 1957)*

Photo 23: *lip key by Carl Dolmetsch on an alto recorder used with the lip as piano key (since 1958; first experiments started already in the 1930s)*

While East German recorder workshops were declining, West German recorder workshops were experiencing an upswing due to the division of Germany after WW II, and people like Peter Harlan moving to the West. To sell as many instruments as possible and to reach as many people as possible, recorder makers relied on inexpensive basic models from the 1930s. At that time, the recorder was still mainly used in "Hausmusik" (folk music and Spielmusik), in seminars for amateurs, in music lessons together with Orff instruments and within recorder orchestras. Joachim Paetzold and Rudolf Otto (who was working with an extra foot joint) were the only recorder makers working with long bore designs and it was not until the early 1990s that the principle of harmonic recorders was resumed.[56]

From the 1950s onwards, a gradual development in the artistic performance level on the recorder and its establishment in the field of professional music making started in Central Europe and spread throughout the globe. Then in the 1960s, recorder makers began their first attempts at reconstructing original models by measuring instruments from the 16th, 17th and 18th centuries.[57] Within this strong early music movement, recorder makers were very focused on the principles of historical models, so it wasn't until the 1980s that interest in developing new ideas in recorder making began to appear. Additionally, even though the market of early music and its instruments was very strong, the growing generations of professional recorder players introduced an incredibly wide spectrum of extended playing techniques from the 1960s onwards, inspiring composers such as Louis Andriessen, Jürg Baur, Luciano Berio, Rob du Bois, Gerhard Braun, Maki Ishii and Rolf Riehm to specifically write for this instrument. Ever since, the recorder can be found not only in early music, folk music and children songs, but also in classical contemporary, experimental, Jazz, Rock, Pop and World music.

[56] Peter Thalheimer: *Die Blockflöte in Deutschland 1920-1945* (Tutzing, 2010), p. 369f
[57] Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 18

2.2. Contemporary recorder models in comparison

Nowadays, contemporary recorder models are inspired by either traditional recorders (especially regarding their sound characteristics) or modern instrument making (regarding materials, bore and keys). In the following section I give a detailed description of recorder models from today which hold important approaches and are more and less established on the market and require therefore a closer look. Since my research is very much about the actual sound of the instrument and its very own potential, I consciously focus on recorder models without electronics. For a better understanding I divide the instruments in two different categories: bore and keywork, and mouthpiece.

2.2.1. Bore and keywork

Woodwind instruments are dominated by the bore design, meaning that the generation of sound is dependent on the resonance characteristics of the instrument's body. As soon as the bore profile differs from the cylindrical tube shape, the position of nodes and antinodes of the standing wave no longer conform to the theory. The bore design of recorders relates not only to the diameter, length and wall thickness, but also to the placement, shape and size of the tone holes. This overall package decides the basic technical qualities: tuning, harmonics, general workings (like fingerings, dynamics). I therefore focus on both bore and keywork in this chapter.

a) Paetzold bass recorders, also known as Paetzold by Kunath recorders today

After his first attempts in 1953 and again in the early 1970s, recorder maker Joachim Paetzold developed the first square bass recorders based on tapered organ pipes. His goal was to build a low instrument, inexpensive and with a good sound.

© Herbert Paetzold

Photo 24: *"Ur- Paetzoldbass"*

Joachim Paetzold's nephew, Herbert Paetzold, who at that time was struggling with his carpentry business, took over Joachim's idea and started his own workshop completely unaffected by traditional recorder making.[58] He was inspired to develop bass instruments affordable for schools, music schools, and amateurs that could be technically mastered by children and also meet high demands for sound quality. Patented in 1975, he sold the first further developed contrabass recorder in 1976, now built in three parts, with a bent head joint (to be closer to the windway) and the revised placement of a few tone holes. It was still made from plywood since both Joachim and Herbert Paetzold agreed that varnished plywood is best choice to withstand moisture.[59]

First, the instruments were used as low basses within early music to enrich recorder orchestras and to avoid performing only in the four-foot register. After Frans Brüggen and his trio Sour Cream ordered three contrabass recorders in October 1977, more and more professional recorder players and composers have discovered these basses for contemporary music. Michael Barker even installed electronic devices on his contrabass and created the "Midified Blockflute" in 1986. But it was not until the early 1990s when the repertoire started to constantly grow and the "Paetzold basses" became established in different music genres. Based on the principle of pure harmonics, they offer a rich palette of sounds and a wide variety in articulation. One needs to keep in mind though that these instruments are completely keyed and are therefore limited regarding usual finger movements on tone holes. Harmonics can only be reached by raising the air pressure and using open vowels for the upper notes, glissandi can only be played at the window. Thanks to recorder players Kees Boeke and Antonio Politano further sizes have been developed from the basset (1995) up to the Subcontrabass (2001).

[58] Paul Leenhouts: *Interview mit Herbert Paetzold* (Windkanal 2/2013), p. 18
[59] Wolfram Waechter: *Klingendes Sperrholz* (Tibia 2/1977), p. 303f

Photo 25: *Paetzold-Consort (5 sizes)*

Never before has a modern design and the supply of lower instruments been so successful (…)[60] and the story goes on. In 2012 recorder maker and executive director of Kunath Woodwinds, Jo Kunath, took over the production of the renown bass recorders. Through new technical possibilities in instrument making and the use of new materials, he is constantly improving their design and technical features with his supporting team. Next to the long list of small innovations I would like to point out:

[60] = *Noch nie war ein moderner Entwurf und daneben das Angebot von tieferen Instrumenten so erfolgreich (…)*; in: Paul Leenhouts: *Interview mit Herbert Paetzold* (Windkanal 2/2013), p. 18

- new silent pads, which transmit the instrument's resonance,
- double sealing at the end of each body for a stable air column,
- flow-optimized mouthpieces for a better response and better fit,
- direct blow head joints for all sizes for a fast response and more flexibility in tone
- tenor model to play in a complete set of Paetzold instruments, especially for consort music from the 16th and 17th century
- RESONA plastic for all sizes to reduce weight and be affordable for a wider audience

After an establishment period of approximately 45 years, the Paetzold (bass) recorders have become an integral part of the recorder family. They are an ingenious invention developed for both amateur and professional recorder players and used for solo,[61] ensemble[62] and recorder orchestra repertoire. While the lowest basses are quite audible within a recorder orchestra, when performing solo or within a mixed ensemble it is recommended to amplify the three lowest models from the contrabass downwards. One can easily include a volume pedal and other effect pedals[63] to enrich the palette of sounds. In 2007 Italian recorder player Antonio Politano began thorough research on the Paetzold bass recorders, called Paetzold Recorder Investigation for Music with Electronics (PRIME) with the aim of developing a sound catalogue, implementing digital processing, and supporting new compositions. His results can be found on www.primeresearch.ch.[64]

b) Silberton-Metallblockflöte (silver tone metal recorder)

Inspired by the Boehm-flute, Hungarian shepherd's flute and renaissance recorders, Hungarian pianist, flutist and composer Gyula Foky-Gruber developed an all-metal soprano recorder made of nickel-plated brass in 1958.[65] It is built with a cylindrical bore (overblowing in almost pure harmonics) and includes an interchangeable mouthpiece.

[61] Live recording of the piece "Concetto di aura" written by Mauricio Azzan can be found in the APPENDIX: 8.7. Video recordings
[62] Live recording of the piece "Matra" written by Oscar Bianchi on https://www.ictus.be/matra2 (accessed 13.05.2019)
[63] Live recording of the pieces "Crepusculo" written by Oscar Bianchi and "Heel" written by Timo Tuhkanen can be found in the APPENDIX: 8.8. Recital *recorder evolution* and *recorder evolution I*
[64] Accessed 13.05.2019
[65] Nik Tarasov: *Gyula Foky-Gruber* (Windkanal 4/2000), p. 16

This system enables one to adjust the voicing[66] by altering the height of the windway through different positions of the windway roof. What was first meant to be an instrument for his own folk band and compositions, was finally mass-produced by company Hopf from 1965 till 1970, supervised by Foky-Gruber himself. Next to the soprano, sopranino and alto (here made from a combination of metal and wood) silver tone metal recorders were developed, and one could choose between German and English baroque fingering. The instrument's characteristics are: a well-balanced range of two octaves with a stable response (the high falsetto range of an augmented fourth sticks out dynamically), endless durability and resistance against moisture. Despite their advantages, these recorders were only supported by a miniscule group of recorder players and never seriously penetrated the traditional recorder world. A live recording can be found in the appendix.[67]

© Susanne Fröhlich

Photo 26: *silver tone metal alto recorder*

© Susanne Fröhlich

Photo 27: *mouthpiece of the silver tone metal alto recorder*

[66] = fine tuning of the windway, block and labium.
[67] "Lobgesang" written by Sarah Nemtsov, APPENDIX: 8.8. *Recital Salon de musique*

c) von Huene tenor recorder

German American recorder maker Friedrich von Huene started to build instruments in the renowned Boston flute workshop of Verne Q. Powell in 1956 and opened his own workshop in 1960. After exploring pre-war instruments with different bore designs made by the Dolmetsch family, Robert Gobel, Max König & Söhne, Rudolf Otto and Ernst A. Stieber, and taking measurements to compare these different models, he wanted *to make a compromise of everything so that all the tones were playable, including the high f#* (f#3)[68] on an alto recorder. In the first years he made various sizes of baroque type recorders in his own design *that were stable, had good response over the whole range, and a strong, penetrating tone to balance with modern orchestral instruments*.[69] Being trained in a flute workshop and experiencing the advantages of a long bore design, Friedrich von Huene knew that keys are essential for tenor recorders, especially for a strong sounding low register. He has experimented with an additional key for the c#1, as well as double hole keys for d1 and d#1. In the early 1990s he even developed a half-tone extension to b.[70] His design for the tenor recorder inspired many other recorder makers to build these models with keys for the two bottom notes as well, for example, recorder companies Küng (Switzerland), Mollenhauer (Germany) and Yamaha (Japan). The latter is most commonly used in contemporary music today.[71]

© Susanne Fröhlich

Photo 28: *Friedrich von Huene tenor recorder*

[68] = *(…) einen Kompromiss aus allem machen, so daß alle Töne gut spielbar waren, eingeschlossen das hohe Fis (…);* Ralf Ehlert und Sabine Haase-Moeck: *Das Portrait* (Tibia 2/1999), p. 444
[69] Geoffrey Burgess: *Well-Tempered Woodwinds* (Indiana, 2015), p. 116
[70] Joachim Paetzold, who was experimenting with different bore designs of the foot joint and found out about the relationship of foot joint and response and intonation of the highest registers, developed a half-tone extension for the tenor recorder already in 1966. The year when Friedrich von Huene travelled to Europe with the help of a Guggenheim scholarship to measure original instruments in museums and private collections.
[71] Studio recordings can be found in the APPENDX: 8.6. Audio recordings: "Points of contact I" written by Joep Straesser and "The visitor of the Idyll" written by Isang Yun

© Susanne Fröhlich

Photo 29: *Yamaha tenor recorder*

d) Modern Ganassi recorder

At the instigation of[72] Dutch recorder player Frans Brüggen, Australian recorder maker Fred Morgan started to explore the Ganassi recorder in the mid-1970s. At that time this instrument only existed in Sylvestro Ganassi's treatise *Opera Intitulata Fontegara* (Venice, 1535). His fingering charts feature different models made by different makers with different fingering systems and range. Since Fred Morgan found and measured only one original instrument that might have worked with the advanced Ganassi fingerings,[73] he had to find his own way to reconstruct this type of recorder. His goal was to build an instrument with an almost cylindrical bore, an opening at the bell and large finger holes, overblowing into a pure XVth. This harmonic (fingering Ø 1 2½ 3 4567) is normally too high on recorders with a tapered or cylindrical bore design, because it's dependent on the sounding length of the instrument and not the shape or size of the foot joint. The bottom note, however, is defined by the length and size of the foot joint, so Fred Morgan realized that he could tune both notes by balancing the sounding length (lowering the bottom note) with the opening of the bell (raising the bottom note). To facilitate the production of these instruments (also with consideration to future generations of recorder makers), Fred Morgan started to build his *new "Ganassi" recorder*[74] not only in one part, but also in two parts: head joint and lower joint, connected with a brass ring to radiate more sound.[75] Although the Ganassi fingering system differs from the baroque fingering system, the highest notes from XVth onwards are rather difficult to play, and chromatic scales are

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[72] = *auf Anregung*; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 65

[73] = a Renaissance alto recorder in g with a nearly cylindric bore, an opening bell and large finger holes, nº SAM 135, from the Kunsthistorisches Museum in Vienna. The mouthpiece is unfortunately damaged, so these fingerings could not be tested (Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 65). However, American recorder maker Bob Marvin claims to have found one ivory alto recorder that functions with these fingerings at the Musée de la Musique in Paris (Adrian Brown: *Die „Ganassiflöte"* (Tibia 4/2005), p. 577)

[74] = *neue „Ganassi"-Blockflöte*; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 65

[75] More information in chapter 3.3.2.2.

rather limited, recorder players immediately started to integrate this instrument into their repertoire, happy to finally be able to perform early baroque Italian sonatas, not questioning *if it made sense to play such late pieces on instruments that had probably originated almost a century earlier.*[76] However, originally developed for consort music, this modern version of the Ganassi recorder has also found its way into contemporary music.[77] Since the late 1980s composers have been intrigued by its archaic, powerful and flexible sound, using its range of two octaves and a fifth[78] and its possibilities of sound manipulation through its bigger tone holes. Now, produced in the size of a soprano, alto and tenor, these instruments have become indispensable in contemporary music and composers such as Moritz Eggert, Liza Lim, Georg Nussbaumer, Samir Odeh-Tamimi, Rolf Riehm and Calliope Tsoupaki have written specifically for them.

© Kunsthistorisches Museum, Vienna

Photo 30: *SAM 135, Ganassi recorder*

© William Stickney

Photo 31: *Ganassi alto recorder in g (a=466, 440, 415 Hz) by Fred Morgan*

[76] = *was es für einen Sinn machte, so späte Stücke auf Instrumenten zu spielen, die vermutlich fast ein Jahrhundert früher entstanden waren*; in: Adrian Brown: *Die „Ganassiflöte"* (Tibia 4/2005), p. 577

[77] Live recording of "The long forgetting" written by Liza Lim and performed by Genevieve Lacey can be found on: https://soundcloud.com/lizalimcomposer/the-long-forgetting-2007 (accessed 13.05.2019)

[78] Fred Morgan even writes about two octaves and a sixth in a letter to Frans Brüggen in December 1974; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 67

e) Strathmann-flute

In the early 1980s German instrument maker and Jazz musician Arnfred R. Strathmann developed a soprano recorder with a saxophone key system which he patented in 1983 and presented in 1985. Shortly after he developed a mouthpiece with an adjustable block[79] which he patented in 1989. Next to his profession as a saxophonist, he built these recorders in small numbers and developed an alto version in 1997. His goal was to create an instrument for jazz, folk and classical music with a rich sound which lies between the Boehm-flute and the recorder, played with the saxophone key system, including the octave key instead of the thumb hole.[80] His choice of materials was ABS resin for the body, silver for the keys, and stainless steel for the spindles, springs and screws. Although his idea was quite spectacular, promising quick and easy learning, his instrument is nowadays rather a collector's item than regularly used on stage. Having tested these instruments myself, I can only assume why. Arnfred Strathmann wanted to appeal to a variety of customers, namely saxophone players, recorder players, some flute players and the younger generations. This desire for wide market appeal might have been the biggest problem, but let's have a closer look at the details: Since the instrument's tuning in C and F is incompatible with the standard tuning in B^b and E^b on a saxophone, saxophonists would need to transpose for their standard repertoire when playing on the Srathmann-flute. Recorder players, who are accustomed to having as few keys as possible, need to adjust their fingering technique to a completely keyed instrument. This is quite an effort, especially for an instrument (in this case the soprano recorder), which is rarely used in solo and even mixed ensemble repertoire. Furthermore, the instrument was quite expensive (1630.- German marks in 1991) and therefore not affordable for children, so Strathmann's flute was out of reach in becoming a precursory instrument. Regarding the sound, the instrument couldn't offer what it promised. The flute (in this case the soprano) was not balanced overall, especially the low register which was too week because of the rather narrow, short bore design based on a Hohner soprano recorder.[81]

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[79] More information in chapter 2.2.2.a
[80] Advertising flyer by Andresen und Klein GmbH (late 1980s)
[81] Video live-recording performed by Arnfred Strathmann on https://www.youtube.com/watch?v=qWtp7kVAqLs (after approximately 35 minutes; accessed 13.05.2019)

© Susanne Fröhlich

Photo 32: *alto Strathmann-flute*

f) **Modern (harmonic) recorders**

Based on his research on instruments of the 19th and 20th centuries, German recorder player and journalist Nik Tarasov developed a new alto recorder based on the principle of pure harmonics together with recorder maker Joachim Paetzold in the early 1990s. Their experiments started with the improvement of two tenor recorders in d1 by Max König & Söhne from the 1930s. The goal was to establish a contemporary recorder which is compatible with orchestral instruments such as the modern flute, pianoforte and strings. Furthermore, this harmonic recorder should *strengthen the original characteristics of the recorder* and *minimize the weakness of standard models,*[82] meaning it should provide a balanced extended chromatic range, stability, dynamic flexibility and good tuning. It was built with a long bore design with a simple taper that overblows into pure harmonics. It was also fitted with two keys for the bottom notes and has modern voicing.[83]

Since 1996 the *modern alto recorder*[84] has been produced in series in collaboration with recorder company Mollenhauer. In 2004 the foot joint was improved with a half-tone extension to e1, which extended the range up to three octaves and added more stability and power to the instrument. Besides that, a soprano model was developed in the same year, also with a half-tone extension to b. Nik Tarasov focused on these two sizes only, because of their penetration power in mixed chamber ensembles[85] and (symphony) orchestras.[86] In 2003 German recorder company Moeck developed the Ehlert Alto in collaboration with German recorder maker Ralf Ehlert, also based on the principle of pure

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[82] = *Sie möchten ureigene Charakteristika der Blockflöte verstärken und die Unvollkommenheit herkömmlicher Modelle minimieren*; in: Nik Tarasov: *Harmonische Blocklöten* (Windkanal 2/2004), p. 15

[83] Detailed description below and in chapter 2.2.2.a

[84] Nik Tarasov: *Harmonische Blocklöten* (Windkanal 2/2004), p. 20

[85] Video clip "Candybox" by Ensemble "Spark – die klassische Band" on https://www.youtube.com/watch?v=Qp-DhGTQseY (accessed 13.05.2019)

[86] Video live recording of "Recordare" written by Markus Zahnhausen, performed by Michala Petri and the Aalborg Symphony Orchestra on https://www.youtube.com/watch?v=jxb_XiR6Pl4 (accessed 13.05.2019)

harmonics, promising a balanced chromatic range of two octaves and a fifth. A few years later the soprano and tenor model followed. Currently, Ralf Ehlert is working on a basset to complete the four-foot family of modern recorders which has been long awaited by recorder players.

Besides the half-tone extension, the other main difference between Mollenhauer and Moeck modern recorders is their voicing. While the instruments by Moeck pare the advantages of a harmonic recorder with baroque type voicing to remain as close as possible to the traditional sound ideal, Mollenhauer offers two types of voicing: baroque and modern. This means wide and flat angles, a low block and thick labium for a round and smooth baroque sound based on the root tone (acousticians describe this sound as hollow because of the missing 2^{nd}, 4^{th} and 6^{th} harmonics), contrasted with narrow and steep angles, a high block and thin labium for a sharp and piercing "modern" sound, rich in overtones and well-balanced throughout the whole range with a very responsive third octave. The baroque voicing certainly affects the range and the response of the "modern" instrument, and recorder players should know exactly what kind of repertoire they can and want to perform on these instruments.

Photo 33: *Modern alto recorders (with f' and e' foot joint) in comparison with an alto from 1935 (Herwiga Rex by Max König) and a baroque alto after Jacob Denner (Denner-Morgan edition by Mollenhauer)*

g) **Eagle recorders**

Based on *wide-bore fantasy/meditation models that are not based on original models,*[87] the "Eagle" recorder by Dutch recorder maker Adriana Breukink has undergone rapid development since 2007. Its basic idea is to free the baroque recorder from its narrow, strong tapered bore design, to open its sound and inspire recorder players to break new ground. While the timbre changes on most contemporary recorder models, the Eagle Alto remains faithful to the actual sound of the "sweet flute" but makes it stronger and more balanced, which is quite interesting especially for the first octave.

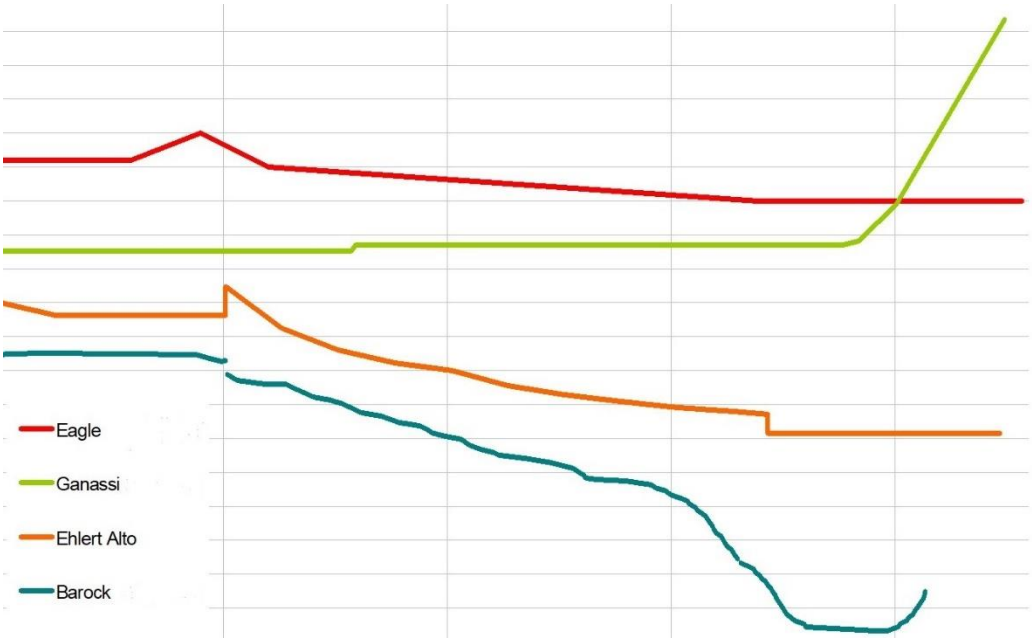


Figure 1: *bore designs in comparison: Eagle alto, Ganassi alto, Ehlert-Moeck modern alto and baroque alto*

After experimenting with "Archaïc Eagle" recorders with a range of only one octave and a sixth, Adriana Breukink started to collaborate with Swiss recorder maker Geri Bollinger in 2009 to develop keys for a longer bore and therefore a wider range. When combining a wider range (in this case two octaves and a fifth) with a wide bore, the high notes from

[87] Adriana Breukink's Eagle recorder website: http://www.eagle-recorder.com/page.php?pag=visie&lang=en (accessed 13.05.2019)

the third register onwards need to be stabilized by a register key.[88] This mechanism, which was developed in 2010, is built below the labium and operated by the left index finger. Only one year later the instrument was improved in its stability and tuning by using African Blackwood and a half-tone extension to e1, and it gained more precision in response when a metal labium[89] was added. Like the modern harmonic recorders by Mollenhauer and Moeck, the Eagle Alto is based on the principle of pure harmonics and therefore offers a more balanced range. The wide bore, however, makes it impossible to play a balanced, dynamically flexible high range.

© Adriana Breukink

Photo 34: *Eagle alto with metal labium, register key and extension key to e1*

In 2015 Adriana Breukink sold the first Eagle Sopranos and only one year later she developed a kind of "lighter" version of the Eagle Alto, the Eagle Ganassi in collaboration with recorder company Kunath. The goal was to allow amateur recorder players this new freedom in sound with an easier fingering system (double holes on II and V, baroque and Ganassi fingerings for the third and fourth registers), lighter weight, and inexpensive materials.

© Jo Kunath

Photo 35: *Eagle Ganassi*

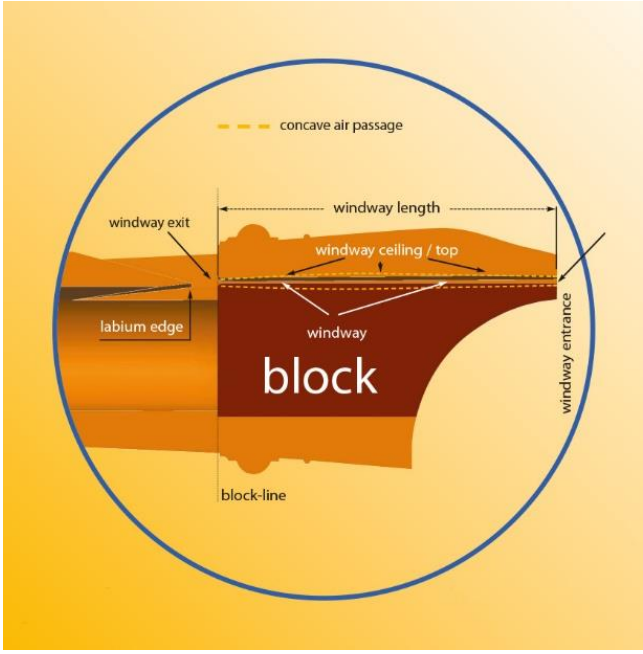
[88] By opening a hole close to the labium, air is released and changes the pitch depending on the registers and position of the tone hole. The closer to the middle joint the bigger the impact on the notes. In this case, the key is used to guarantee the quality of the third octave and adjust its dynamics. Its position was chosen in relation to f3.

[89] Detailed information in chapter 2.2.2.d

The Eagle instruments are nowadays used in many different styles ranging from medieval through to Klezmer, Jazz and some classical contemporary music.[90] Swedish recorder player Dan Laurin was one of the first to perform on the Eagle Alto and Dutch composer Chiel Meijering wrote a cycle of Eagle concertos for him (2012-2015).[91]

2.2.2. Mouthpiece

While the bore design defines the instrument's true potential, it is the interaction between the bore design and the mouthpiece's voicing that significantly influences the way the instrument sounds. Essentially, the character of the recorder comes from the bore design and the voicing adds the last bit of flavour. It gives a certain feel and polish to the sound and can help with stability and air use. Balancing this bore design and voicing relationship is important because an instrument built with a consistent bore design allows a lot more flexibility in the voicing and enables a wide sound palate, while on an instrument with an inconsistent bore design, the voicing always tries to compensate and results in a less balanced instrument.



© Markus Berdux (Mollenhauer recorders)

Photo 36: *close-up of a baroque recorder head joint*

[90] Live recording of "Aus Gyergyó" written by Béla Bartók performed with Jan Gerdes on piano can be found in the APPENDIX: 8.6. Audio recordings

[91] "The pied piper" performed by Dan Laurin and Club Classique on https://www.youtube.com/watch?v=z0byJQE28nw (accessed 13.05.2019)

The voicing is an integral system and consists of various parameters that are dependent on each other: length of windway, angel and shape of windway, height and arch of windway roof, depth and hollow of windway floor, tapered or not-tapered windway height and width, top and bottom chamfer, width of windway and window, length and shape of window, edge, shape and size of the ramp, edge, size and shape of the candle-flame. Each recorder maker needs to find a compromise for each type of instrument and therefore develops his or her own philosophy through empirical studies, growing expertise and intuition. An interesting research project on recorder voicing by Andrew A. Willoughby[92] in 1984 presents not only the technical relationship of the various parameters, but also the discrepancies between recorder makers regarding the overall voicing package.

Because the recorder is played without an embouchure in the classical sense like the clarinet, modern flute, oboe or saxophone, the recorder is famous for its easy response. While this could be described as a "what goes in, comes out" sound, recorder pioneers from the 1960s such as Frans Brüggen and Kees Boeke have related the recorder's timbre to *innocence* and *purity*.[93] A recorder player indeed has quite a personal relationship with the instrument as one takes the instrument to the lips and literally breathes life into it. Due to the fixed windway and therefore less possibilities to manipulate sound like on other woodwind instruments, one is always busy searching for alternative techniques such as tongue, palate and throat position, air speed (air temperature), air pressure and virtuosic finger technique to create a wide spectrum of timbres. Although this physical limitation was the recorder's characteristic for centuries, there have been some interesting experiments worth looking into on this topic.

a) **Modern voicing**

Since original instruments are no longer in original condition, it is hard to know how they sounded in the past. While it can be said that all copies of historical instruments are built with modern voicing, recorder makers of today certainly have some historical clues, for example, different design principles which can be explored, copied and developed further,

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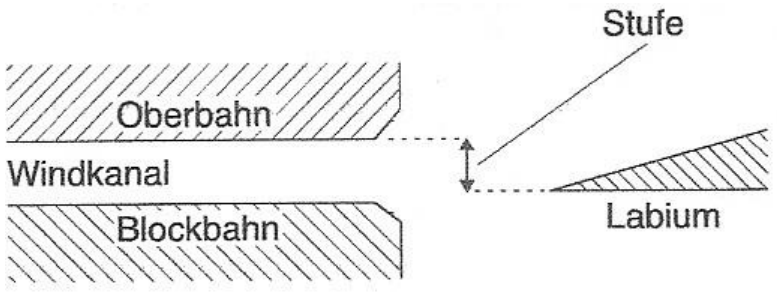
[92] Andrew A. Willoughby: *Recorder Voicing – Answers to My Questions* (FoMRHI Quarterly No. 34, 1984), p. 57-69

[93] Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 18; can already be found in 17th century iconography.

treatises that describe the sound ideals of the time periods and the repertoire of each epoch. Once all of the parameters are understood, one needs to find and follow his or her own path. It is a fact that recorder players of today are highly trained and expect a certain flexibility in sound which wasn't always needed in the past. Oboists and flutists from the 18th century played the recorder part in a cantata, for example, needed a different voicing to play a steady tone on their second instrument compared with a recorder player who is specialized in this instrument and completely knows how to manipulate its sound. Of course, listening habits and today's lifestyle, as well as orchestral instruments, modern tuning and big concert halls, all have a big impact on the choice of voicing as well.

Although every recorder maker will say something different about a recorder's voicing, there is one aspect everybody agrees on: the voicing is a very personal matter and depends a lot on the performer and his or her skills. Therefore, every recorder player should find his or her recorder maker(s) so that they can fully exploit and enjoy the instrument. There is one recorder maker who caused a sensation in the past and brought the voicing on different type of recorders to extremes: Ernst Meyer. He believed in a voicing for "wet" recorders, meaning that the real voicing appears after a certain amount of playing. Next to many parameters that he explored to their absolute limit, his voicing is mainly characterized by a higher step of up to 1.3 mm (standard would approximately be 0.95 mm) in combination with a steep gradient of the block surface of 1.5 mm and a thin labium. Depending on the type of instrument, this leads to less resistance, definition and control, but more flexibility in sound and dynamics, which needs to be incredibly mastered by the performer. While some recorder players enjoy this freedom, others are simply overwhelmed.



© Ernst Meyer

Photo 37: *close-up of a recorder windway* (Stufe = step)

Because of his early and sudden death in 2016, his sons Sebastian and Joel continue the path without him, specialising in baroque recorders built after Jakob Denner and Pierre Jaillard Bressan, always on the search of a well-balanced, flexible and voluminous instrument.

In the end only a few wooden dustbins lie between a piece of wood that looks like a flute and a playable instrument. Hundredths of a millimetre decide on right or wrong.[94]

Ernst Meyer

b) **Adjustable block**

In 1989 Arnfred R. Strathmann developed and patented the adjustable block for his new recorder with saxophone key system. He was looking for an easy way to manipulate the sound and response of the recorder. Although working with plastic material for the instrument's body, he still believed in a block made from cedar wood. This wood is standard in recorder making and *due to its high resin content (…) especially resistant to changes caused by humidity.*[95] However, Strathmann's system enables one to react to temperature and humidity and adjust the recorder's response and timbre by moving the block up and down (narrow or wide windway) through a screw built at the back of the mouthpiece. Only a few years later this mechanism was also used on the harmonic recorder by Dutch recorder maker Maarten Helder[96] and was further developed in collaboration with recorder company Mollenhauer in 1996.

[94] = *Am Ende liegen zwischen einem Stück Holz, das aussieht wie eine Flöte, und einem spielbaren Instrument nur wenige Holzstäubchen. Hundertstelmillimeter entscheiden über richtig oder falsch;* Ernst Meyer in: Ines Müller-Busch: *Porträt: Ernst Meyer* (Tibia 1/2005), p. 339

[95] Stephan Blezinger on www.blezinger.de/en/cedar.html (accessed 13.05.2019)

[96] More information on Maarten Helder's harmonic recorder can be found in chapter 3

© Susanne Fröhlich

Photo 38: *adjustable block by Arnfred Strathmann with an extra piano key for the lip (similar to the designs in the following sections c and e)*

c) **Breukink-Slide-Recorder**

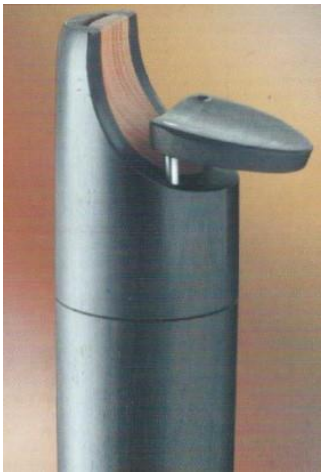
In 1997 recorder company Moeck started to produce and sell the Breukink-Slide-Recorder, which was developed by the Dutch recorder maker Adriana Breukink for contemporary and non-western music. This Ganassi type of recorder was built with a wide bore, large finger holes and double holes for I and I#, and II and II# on a soprano and alto model and included a mechanism, called slide, to allow a wider spectrum of dynamics on that instrument. This mechanism is based on the principle of releasing air (in this case through the block) for piano playing and could be operated in various ways:

4. *by moving the instrument either towards or away from one's body,*
5. *by changing the position of the recorder with the help of a thumb hold (…) so that the slide moves up and down,*
6. *by changing the position of the mouthpiece in the mouth, or*
7. *by pushing the jaw backwards and forwards.*[97]

Although Dutch recorder player Paul Leenhouts supported this development by testing this mechanism and developing the fingering chart, the right playing technique couldn't be found and established and therefore, recorder players couldn't be convinced by what

[97] Advertising flyer by Moeck (1997)

the instrument was promising: *a more flexible and much more creatively variable tone* and *an enormous potential of dynamics.*[98]

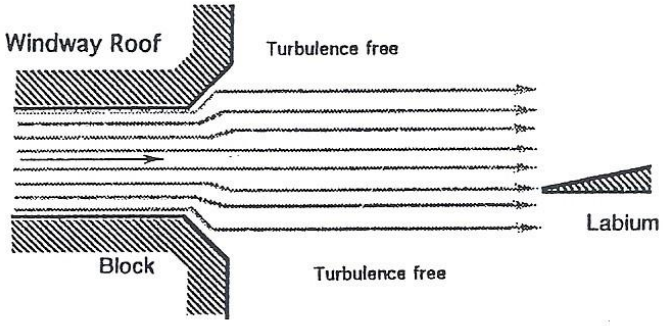


© Moeck

Photo 39: *Breukink-Slide-Recorder*

d) **Labium**

The labium, also called lip, has a hard edge and splits the air column. Its shape depends on the overall design of the recorder and differs from model to model and size to size.



Block and Windway Roof with chamfers

© Alec V Loretto

Photo 40: *air stream at labium*

[98] Advertising flyer by Moeck (1997)

Like the mouthpiece, the labium has to be seen within the overall concept of a recorder and therefore in relation to the mouthpiece and bore. Although the labium is usually integrated into the head joint, there have been some experiments with the material used for it.

In the late 1930s German physicist and recorder player Arndt von Lüpke scientifically explored the acoustics of the recorder[99] and found out about the irregularity of harmonics and dynamics on recorders, especially models with a tapered bore. Through his research he modified his instruments to his own ideas and taste, and, for example, glued an ivory platelet on the labium of his soprano recorder made by Max Hüller after a model by Manfred Ruëtz.

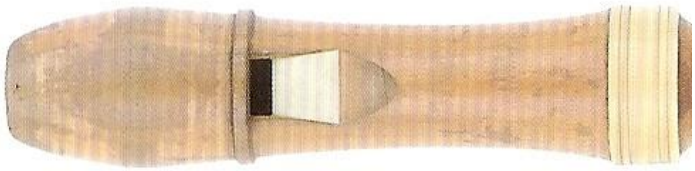


Photo 41: *ivory platelet on labium*

Detailed information on this experiment couldn't be located, but another recorder model which was recently developed might provide some insightful information into the relation between the labium's material and the sound quality of a recorder. Inspired by metal organ pipes, tin whistles and Csakans,[100] recorder maker Geri Bollinger developed a metal labium[101] for Adriana Breukink in 2011 to give the Eagle recorder a more precise and faster response. At that time the metal blade was attached with two screws to adjust the step and angle, as well as thickness and shape of the labium.

[99] Arndt von Lüpke: *Untersuchungen an Blockflöten* (Investigations into recorders); in: Akustische Zeitschrift 5, 1940, p. 39-46

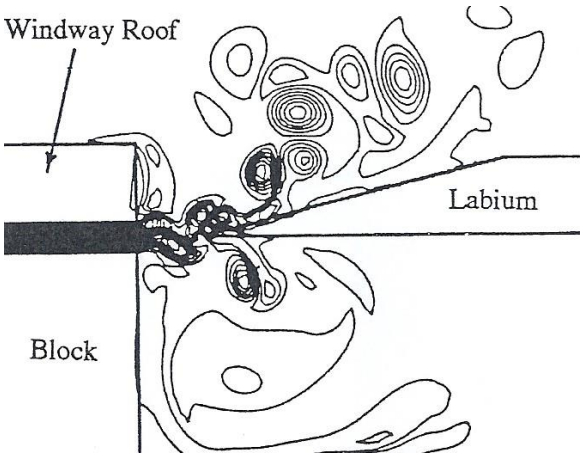
[100] Already in the Renaissance and Baroque period recorders with a broken labium have been repaired with metal materials.

[101] The blade that worked best was a razor blade.

© Adriana Breukink

Photo 42: *metal labium with screws*

Although this metal labium had a positive impact on the overall sound of the Eagle recorders and produced clear benefits,[102] Adriana Breukink had the feeling that both screws caused unnecessary turbulence at this quite sensitive spot. Because recorder players didn't dare to experiment with adjustments to the blade, she searched for a new shape and in 2017 developed a curved metal labium in collaboration with recorder company Kunath, which supports the air flow. There were immediate positive results: better control of the air stream in all registers, easier response in all registers, dynamic flexibility, and more harmonics. This design is still in the testing phase and more experiments to explore its full potential will hopefully be done in the future.



© Alec V Loretto

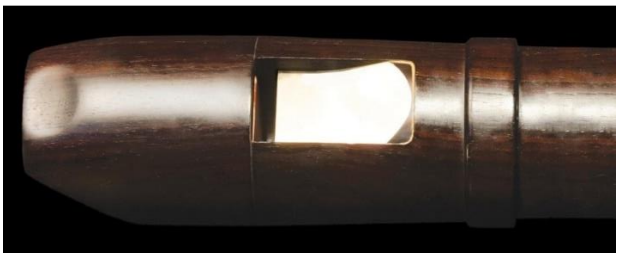
Photo 43: *air flow in circles at labium*

[102] Small adjustments to the blade through the screws have a big impact on sound and response. The blade is interchangeable with other blades (also when damaged), and in contrast to wood, metal can be quite thin and retain its shape when played.

© Adriana Breukink

Photo 44: *metal labium by Adriana Breukink and recorder company Kunath*

Since 2019 Adriana Breukink has been building the metal labium in combination with a short beak to further improve the Eagle Alto's flexibility in sound and dynamics (detailed information below in subsection d). This design is still in its testing phase and there have only been a few experiments with other recorder models such as Adri's Dream tenor recorder produced by recorder company Mollenhauer.



© Jo Kunath

Photo 45: *Eagle alto with short beak in combination with metal labium*

e) **Dynamischer Kurzschnabel** (dynamic short beak)

The dynamic short beak was developed by Swiss recorder maker Geri Bollinger in 2019 and is based on several experiments beforehand, resulting in a combination of the Souffleur (operated by the lip, releasing air through an extra hole built in the block, 2005) and the short beak (much shorter windway than standard, 2017/18). His goal is to manipulate dynamics, sound and pitch through the lips (different positions) and the mouth (different internal shapes using different tongue and throat positions) on a recorder. The combination of both within one instrument offers four ways to manipulate sound:

1. flexible sound: the short windway is less stabilizing for the airflow than a long windway and therefore offers more flexibility for the player. Any change within the mouth has a stronger impact on the timbre.
2. forte: by using a diagonal position towards the beak, one can close the upper part of the windway exit with the upper lip. This causes a lowering in pitch which can be adjusted by adding more air pressure meaning that one can play louder without raising the pitch.
3. piano: the extra hole in the block, called "Variokanal",[103] allows one to release air by lifting the upper lip from this hole. This way the pitch is raised (depending on the registers and the position of the tone hole) and can be adjusted by air pressure, meaning playing softer without dropping the pitch.
4. changes in timbre: in addition to the windway, one can blow extra air through the short Variokanal and create different timbres and air effects without changing the pitch.

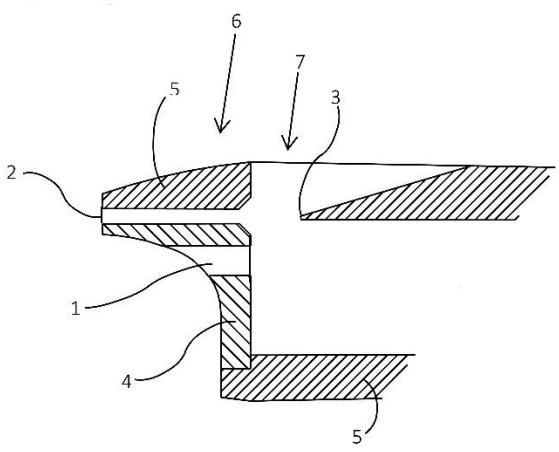


Photo 46: *dynamic short beak*

"Variokanal" (1), short windway (2), labium edge (3), block (4), mouthpiece (5), beak (6), window (7)

Geri Bollinger was looking for a natural and intuitive way to manipulate the sound of the recorder. This design is still in its testing phase and I hope it will be built on instruments with long bore designs in the future, so that their advantages combined with this unique mouthpiece can show even greater results.

[103] = *variable windway*, which is much shorter than on the Souffleur through the shorter windway.

2.3. First conclusion

I would like to point out that the further development of an instrument is very dependent on the political and economic situation in the country of origin and worldwide, technical progress, the market, and last but not least the interest, vision and openness of instrument makers, performers and composers. Next to that, it is very important that I know what kind of repertoire I want to play on an instrument as well as what I technically want to be able to achieve when playing it. In my research project I wanted to question, shift and dissolve technical limits and aesthetic borders of today's recorder performance practice, thus making the recorder genuinely contemporary. Therefore, I searched for an instrument with the greatest potential.

Comparing the recorder models mentioned above, I realized that many recorder makers focused on only one or two aspects to develop further such as the volume (Eagle Alto by Adriana Breukink), the quality of the third octave in balance with a strong low register (modern harmonic recorder by Mollenhauer) or the tone colour (Souffleur by Geri Bollinger). This is an understandable approach in instrument making and in any case an enrichment to our instruments, as well as an inspiration for further ideas and next steps in recorder making. In recent years, I've experienced the tendency for recorder makers to collaborate more and more with recorder players to meet specific needs, as well as to test certain features. I have already mentioned a few examples where the instrument has developed step by step with the growing expertise of performers and makers and technological progress such as the square Paetzold recorders (working process of 50 years) or the Eagle Alto (process of more than ten years). Furthermore, I have experienced that compromised recorder models (for example baroque voicing on a modern harmonic recorder) or rather small improvements (for example the dynamic short beak on a tenor with a short bore design without keys) are too little to be recognized, too limiting for a true revolution and therefore less appreciated by recorder players of today and tomorrow. There is only one instrument that I have found where the recorder maker considered the overall concept of a recorder and combined several new features in his development. This instrument is called the Helder Tenor.

3. The Helder Tenor

Inspired by German recorder models from the 1930s, and especially by the thorough research of Peter Thalheimer[104] and Nik Tarasov,[105] Dutch recorder maker Maarten Helder developed a contemporary tenor recorder in the early 1990s. His goal was to set *a new standard in recorder making* and to bring *a new dimension*[106] into recorder performance practice. Like other recorder players and makers, Maarten Helder felt too restricted with the baroque-type recorders being built in those days, especially regarding range, dynamics and balance. So, he questioned *whether it would be possible to build a modern recorder with strong low notes and an exploitable third octave*.[107]

During his research on the German instruments from the 1930s, Maarten Helder realized that next to their new and strong sound world they include an essential feature and *fantastic improvement*:[108] *on overblowing the bottom or second note these instruments produce a pure set of harmonics.*[109] After two years of physical calculations and empirical experiments, he developed the first prototype of his harmonic tenor recorder, which he presented among others at the Hochschule für Musik und Tanz Köln in December 1993.[110]

This instrument caught the attention of keen recorder players right away, was even praised as *first true revolution in recorder making since Hotteterre*[111] by Dutch recorder virtuoso Walter van Hauwe and is now known as the Helder Tenor. Articles like "The Birth of a Truly Contemporary Recorder"[112] have been written about the Helder instruments and professional recorder players have been playing on the tenor and later also the alto model ever since its development. However, players have been waiting for another big breakthrough ever since. Through my research and my studies with Johannes Fischer, I wonder why, and at the same time understand why. It is one matter to play this instrument,

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[104] Peter Thalheimer: *Die Blockflöte in Deutschland 1920–1945* (Tutzing, 2010)
[105] Nik Tarasov: *Harmonische Blockflöten. Die Geschichte einer neuen Blockflöten-Generation* (Windkanal 2/2004), p. 14–21
[106] Advertising flyer by Maarten Helder (1995)
[107] = *ob es nicht möglich wäre, eine moderne Blockflöte mit starken tiefen Tönen und einer ausgeweiteten dritten Oktave zu bauen*; in: Maarten Helder: *Die rein überblasende Blockflöte* (Karlsruhe, 1996), p. 39
[108] = *enorme Verbesserung*; ibid, p. 39
[109] = *Beim Überblasen der zwei tiefsten Töne, ergab sich eine Reihe reingestimmter Partialtöne;* ibid, p. 39
[110] Nadja Schubert: *Helder-Blockflöten. Harmonische Blockflöten als neue Generation in der Blockflötenfamilie* (Windkanal 2/2002), p. 22
[111] Walter van Hauwe: *recorder versus blockflute* (Windkanal 2/1997), p. 7
[112] Peter Bowman: *The Birth of a Truly Contemporary Recorder* (Recorder Magazine 4/1995), p. 126

but another matter to handle its full potential. So, what exactly is different on the Helder Tenor and how does this influence the playing technique and performance practice of a recorder player today?

3.1. New potential

Regarding its technical construction, a lot of things have changed on the Helder Tenor in comparison to 18th century recorders (models, which are still primarily used for contemporary music today[113]): bore, length, weight, key work, embouchure and not to forget the additional piano key – pretty much anything you can think of. Quite a challenge to put into practice, but also a chance towards an extended and new recorder performance practice, a chance towards a new and contemporary sound world. The following sections will give a detailed overview on the Helder Tenor's special features and its potential.

3.1.1. Extended range

My harmonic tenor recorder has a completely different bore conception in order to provide pure harmonics. The head joint is cylindrical, the middle joint has a single taper and the foot is again cylindrical. (…) A recorder with this type of bore proved to have outstanding qualities.[114] Maarten Helder

The bore of the Helder Tenor is close to baroque recorders, although with a smaller, single taper and a longer, cylindrical foot joint, starting from the second last tone hole downwards.[115]

[113] Maarten Helder: *Die rein überblasende Blockflöte* (Karlsruhe, 1996), p. 39
[114] = *Meine rein überblasende Tenorblockflöte hat einen anderen Bohrungsentwurf, um reine Partialtöne erreichen zu können. Ihr Kopfstück ist zylindrisch, ihr Mittelstück hat einen einfachen Konus und ihr Fusstück ist wieder zylindrisch. (…) Es hat sich erwiesen, dass eine so gebaute Blockflöte ausgezeichnete Eigenschaften besitzt;* ibid, p. 41
[115] Detailed information in chapter 3.2.1.

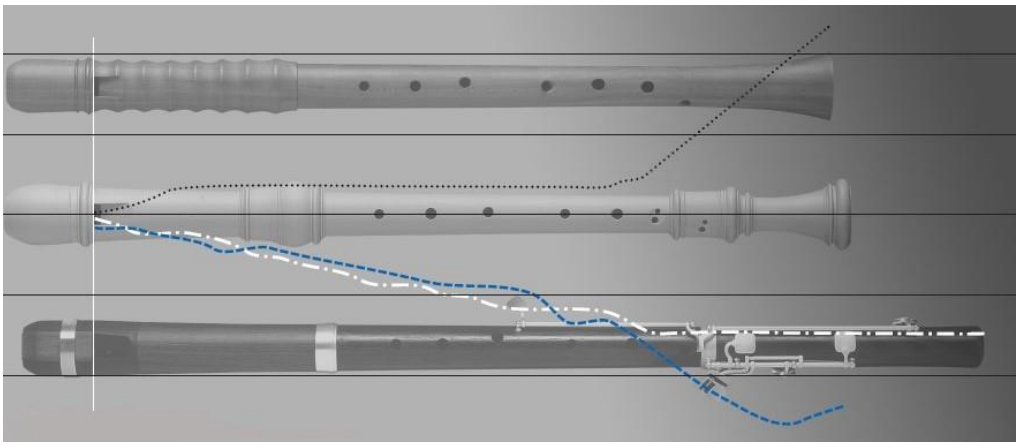

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Figure 2: *different bores in comparison*

……. = Renaissance, ------- = Baroque, _._._._ = Helder

Today the standard range of a recorder is approximately two octaves and a minor third. Every note beyond this would be regarded as altissimo range, a term which is normally used for the utmost top notes of an instrument (Grenztöne[116]). Looking back in history, we will find extraordinary and visionary recorder players and makers, who believed in a wider range and who experimented with chromatic or microtonal scales and alternative fingerings:

- Sylvestro Ganassi (1535):[117] two octaves and a major sixth (I' – VI'''), scale not completely chromatic
- Joseph Friedrich Bernhard Caspar Majer (1732):[118] two octaves and an augmented fourth (I' – IV#'''), chromatic scale
- Pablo Minguet y Irol (1754):[119] two octaves and a fifth (I' – V'''), chromatic scale
- Anonymous (18th century):[120] two octaves and a sixth (I' – VI'''), chromatic scale
- Wilhelm Klingenbrunner (1810):[121] two octaves and a fifth (I' – V'''), chromatic scale

[116] Helmut Mönkemeyer: *Handleitung für das Spiel der Alt-Blockflöte in -f'-* (Celle, 1937), p. 30
[117] Sylvestro Ganassi: *Opera intitulata Fontegara* (Venice, 1535), p. 10, 11, 13
[118] Joseph Friedrich Bernhard Caspar Majer: *Museum Musicum Theoretico Practicum* (Schwäbisch Hall, 1732), p. 30f
[119] Pablo Minguet y Irol: *Reglas, y Advertencias Generales* (Madrid, 1754), p. 118f
[120] Nik Tarasov: *Eine überraschende Entdeckung* (Windkanal 3/2015), p. 10
[121] Wilhelm Klingenbrunner: *Neue theoretische und praktische Csakan-Schule* (Vienna, 1815), p. 2

- Ernest Krähmer (1821):[122] two octaves and an augmented fourth (I' – IV#'''), chromatic scale
- Helmut Mönkemeyer (1937):[123] two octaves and a fourth (I' – IV'''), chromatic scale
- Michael Vetter (1969):[124] two octaves and a minor seventh (I' – VIIb'''), including a chromatic scale and alternative fingerings
- Frederick Morgan (1987):[125] two octaves and a sixth (I' – VI'''), chromatic scale (except g#1)
- Johannes Fischer (1990):[126] three octaves and a major second (I' – II''''), including a quarter tone scale and dynamic indications for alternative fingerings and six very soft extension notes below the bottom note
- Walter van Hauwe (1992):[127] three octaves and a minor third (I' – IIIb''''), including a chromatic scale and dynamic indications for alternative fingerings and three very soft extension notes below the bottom note

Looking at these ranges carefully, it is rather surprising why many recorder players don't use the full range today, especially considering the growing level of performance over the last decades. There are several reasons. Firstly, the repertoire mainly performed today is early music from the middle ages to the late 18th century, folk and traditional music, as well as children's songs and popular music. Here the altissimo range is rarely used and thus not in the focus of makers and players. Furthermore, a single model is often used for a wide variety of repertoire, although this instrument is built for one style and music aesthetic only and therefore not capable of covering it all. In addition, many recorders from today are modernized and compromised copies of renaissance and baroque instruments and therefore lack in sound quality as well as flexibility within the third octave. Apart from that, dynamics are very often inflexible within the third octave, depending on the bore and the voicing. This leads to the fact, that the third octave can be uncomfortable to play, because of the closed bottom hole on baroque recorders in

[122] Ernest Krähmer: *Neueste theoretisch practische Csakan-Schule* (Vienna, 1821), p. 12
[123] Helmut Mönkemeyer*: Handleitung für das Spiel der Alt-Blockflöte in -f'*- (Celle, 1937)
[124] Michael Vetter: *Il flauto dolce ed acerbo* (Celle, 1969), p. 16-20
[125] Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 66; First published in: Early Music, January 1982, Oxford University Press
[126] Johannes Fischer: *Die dynamische Blockflöte* (Celle, 1990), p. 38-43
[127] Walter van Hauwe: *The Modern Recorder Player vol. 3* (Mainz, 1992), p. 23-30

combination with a lot of air pressure or leaking fingerings[128]/*long fingerings*[129] on the Ganassi instruments. Ernest Krähmer explicitly mentions this in his fingering chart: *higher notes than this d* (notated d3 = sounding b^{b}3) *are not enjoyable on any csakan, they are rarely used, the composer would only use them, if they are articulated strong or short.*[130]

An extended range was quite important to Maarten Helder. His goal was to develop a recorder with a range comparable with other contemporary woodwind instruments. Through the principle of pure harmonics, the low extension note b0 and the extra keys, he found a way to play the third octave completely without stopping the bell. The chromatic scale on the Helder Tenor starts from b0 up to e4 (missing eb4). One can still use fingerings with a closed bottom hole as well and some of them will work better regarding the quality and tuning.[131] But this is then a question of practicality, speed and effectiveness. One has to keep in mind, that on the Helder Tenor the third octave does not require force and a lot of air pressure anymore. Rather the opposite is the case: the playing position is comparable to singing in head voice with a high palate.[132] My fingering chart for standard fingerings can be found in the appendix.[133]

Furthermore, the second, third and fourth registers are now extended and chromatically well balanced. *This way register changes can be avoided*[134], which is useful for musical phrasing, chromatic lines, legato playing, wide intervals, trills, tremoli and glissandi:[135]

- Second register: b1-b2 (b2 must be slurred from a2)
- Third register: f#2-c#3 (c#3 must be slurred from c3)
- Fourth register: b2-eb3

[128] = slightly opened or closed finger holes, a technique which is already mentioned in Sylvestro Ganassi: *Opera intitulata fontegara* (Venice, 1535), p. 9
[129] Peter Bowman: *The Birth of a Truly Contemporary Recorder* (Recorder Magazine 4/1995), p. 126
[130] = *Höhere Töne als dieses d sind auf keinem Csakan angenehm, sie kommen auch äusserst selten vor, der Componist dürfte sie allenfalls nur anwenden, wenn sie stark und kurz angestossen werden*; Ernest Krähmer: *Die neueste theoretisch praktische Csakan-Schule 1. Teil* (Vienna, 1821), p. 12
[131] also mentioned by Johannes Fischer: *Hat die Zukunft im Blockflötenbau bereits begonnen?* (Üben & Musizieren, 1996), p. 53
[132] Nik Tarasov: *Der gläserne Blockflötenspieler* (Windkanal 1/1999), p. 8f
[133] APPENDIX: 8.1. Charts
[134] = *So können Registerübergänge (…) vermieden werden*; Maarten Helder: *Die rein überblasende Blockflöte* (Karlsruhe, 1996), p. 41
[135] also mentioned by Johannes Fischer: *Hat die Zukunft im Blockflötenbau bereits begonnen?* (Üben & Musizieren, 1996), p. 53

My fingering chart for trills from the second register onwards can be found in the appendix.[136]

3.1.2. Dynamic possibilities

And just as a painter imitates natural effects by using various colours, an instrument can imitate the expression of the human voice by varying the pressure of the breath and shading the tone by means of suitable fingering.[137] Sylvestro Ganassi

Since the beginning of the 16th century changes in volume have been increasingly documented and notated in treatises and musical scores. Amongst others Michael Praetorius writes that dynamics should be for example used *by moving the bow strongly or softly on the strings.*[138] Knowing that every epoch and aesthetic makes its own demands on dynamics, Hugo Riemann captured this in a nutshell in 1895, where he considers *the constant dynamic shading as principal, as the only foundation of musical expression.*[139]

With this in mind, it is interesting to take a closer look on what recorder visionaries of the second half of the 20th century wrote about the dynamic possibilities on the recorder:

- Michael Vetter notes in 1969: *If one combines breath-, finger- and fingering-dynamics intelligently, one gains a complete dynamic range which is not inferior to that of other wind instruments, in some aspects even superior (…).*[140] Probably motivated by the collaboration with composers and their common experiments, as well as the rising interest in the recorder at that time, he clearly had a very positive vision on its dynamic possibilities, *though unusual technical abilities are*

[136] APPENDIX: 8.1. Charts
[137] *=siil dipintore imita li effetti de natura cô uarii colori lo instruméto ímitera il proferir della humana uoce cô la proportion del fiato & offuscation della lingua con lo agiuto de deti*; in: Sylvestro Ganassi: *Opera intitulata Fontegara* (Venice, 1535), p. 3
[138] *= mit dem Bogen auff der Geigen, nach dem er starck oder leise drauff streicht und aufdrückt*; in: Michael Praetorius: *Syntagma musicum, Band II* (Wolfenbüttel, 1619), p. 69
[139] *= die durchgehende dynamische Schattierung als Prinzip, als einzige Grundlage des musikalischen Ausdrucks*; in: Hugo Riemann: *Die Elemente der musikalischen Ästhetik* (Leipzig, 1895), p. 146
[140] *= Verbindet man Atem-, Finger- und Griffdynamik sinnvoll miteinander, so ergibt sich ein dynamischer Gesamtradius, der dem eines anderen Blasinstruments nicht nachsteht, ja der ihn sogar in manchem übertrifft (…)*; in: Michael Vetter: *Il flauto dolce ed acerbo* (Celle, 1969), p. 70

required.[141] He certainly was aware how much effort it takes to realize dynamics on a recorder.

- In 1984 Elisabeth Delker proves the close relationship between volume – *the most important criteria for dynamics*[142] – and timbre with regards to the harmonic structure of each note. In addition to discussing the use of the mouth cavity and sound pressure (two common influences on sound), Delker adds one more important element for creating tonal and dynamic differentiation on the recorder: the vibrato.

- In 1989 Benjamin Thorn writes honestly about the recorder and *its extremely narrow dynamic range.*[143] In his article he offers, next to a few extended techniques, *an array of alternative expressive devices* for *creating the illusion of dynamic range*[144] on the recorder, such as *rhythmic shifting*, *tonguing* and *timbral alternations.*[145]

- In 1990 Johannes Fischer describes the recorder as an instrument, *whose dynamic possibilities are still limited.*[146] One can certainly recognize his doubts on this subject and after studying his book, one understands the big effort required to realize dynamics on the recorder through complex finger work.

- In 1992 Walter van Hauwe writes his very honest point of view on the recorder and *its small dynamic range* and he explains why: *It is hard to have to admit it, but the built-in embouchure, with the necessarily fixed windway and labium, while giving the player an extremely quick response, leaves us with a frustratingly poor range of dynamic colours.*[147] He knows that one cannot realize dynamics only through virtuosic finger work and something would need to be changed with the

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[141] = *wenn das auch einen ungewöhnlich technischen Aufwand erfordert*; in: Michael Vetter: *Il flauto dolce ed acerbo* (Celle, 1969), p. 70
[142] = *dem wichtigsten Kriterium für die Dynamik*; in: Elisabeth Delker: *Ansätze zur Untersuchung dynamischer Ausdrucksmöglichkeiten auf der Blockflöte* (Celle, 1984), p. 6
[143] Benjamin Thorn: *"New" sounds from old pipes"* (The Recorder: Journal of the Victorian Recorder Guild No. 10, 1989), p. 5
[144] ibid, p. 5
[145] ibid, p. 5f
[146] = *dessen dynamische Gestaltungsmöglichkeiten noch begrenzt sind*; in: Johannes Fischer: *Die dynamische Blockflöte* (Celle, 1990), p. 5
[147] Walter van Hauwe: *The Modern Recorder Player, vol. 3* (Mainz, 1992), p. 19

mouthpiece. Having studied in Amsterdam, I am quite familiar with his technique of suggesting dynamics through other ways of expression, such as articulation, rubato, timing, variations in timbre, adding air or vocal sounds.

Maarten Helder's final solution for realizing dynamics was the combination of several new features: a bore based on the principle of pure harmonics, a cylindrical foot joint, an extended key system, a piano key and a flexible block system. His tenor is built on the concept of Dolmetsch fingerings, including 6 open holes in the front, one open hole in the back plus an extended key system. Standard fingerings work as well as piano fingerings and any other alternatives you can think of within the first two octaves. The third octave works through the principle of pure harmonics and its fingerings are similar to the Ganassi fingerings (leaking fingerings/long fingerings) which don't require closure of the bell. My fingering chart for dynamic fingerings can be found in the appendix.[148]

Because of the wide, cylindrical foot joint this recorder radiates much more sound than baroque instruments with their narrow, tapering foot.[149] Through the addition of extra keys for b0, c1, c#1, d#1, the position of the finger holes are (mostly) well placed in relation to the bore and therefore create a balanced chromatic low range.[150]

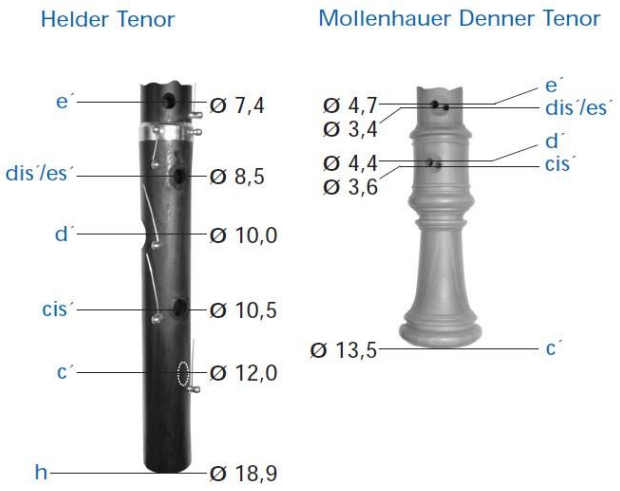

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Figure 3: *key positions in comparison*

Relation of position and size of tone holes on recorders with long and short bore.

[148] APPENDIX: 8.1. Charts
[149] = *Durch das weite zylindrische Fusstück ist die Klangabstrahlung viel grösser geworden als bei den barocken Blockflöten mit ihrem stark konischen Fuss*; in: Maarten Helder: *Die rein überblasende Blockflöte* (Karlsruhe, 1996), p. 40
[150] Detailed information in chapter 3.2.1.2.

As shown in my dynamic fingering chart,[151] this key system enables one to use forte fingerings within the first register for d#1, e1, f1, f#1, g1, a1, a#1, b1, c2, c#2, d2. They are rich in overtones, add another layer of timbre and dynamics and work well in combination with the piano key. This is attributable to the phenomenon of the long fingerings. *In this case, a hole that is built in a particularly convenient spot, will provide more stabilization than others and thus occupy a privileged position, which we describe* in German *as "Endloch"* (end hole).[152]

The piano key releases air close to the Labium and therefore rises the pitch.[153] By reducing air pressure one can play softly staying on the standard fingering without changing the pitch but keeping the sound quality of the standard fingering. Besides that, one can play a smooth crescendo or decrescendo on most notes, depending on the register. By keeping the air pressure one can create microtones and small glissandi. From c3 onwards this key is used as register key to stabilize and balance the third octave. A detailed list of the piano key's impact on each pitch can be found in the appendix.[154]

© Markus Berdux

Photo 47: *piano key on the Helder Tenor*

While overblowing the first five bottom notes, the first five harmonics are (more or less) pure. Working with the technique of leaking fingerings in combination with the lip control,[155] these notes can also be played softly (up to g3). There is a general rule that applies: the more finger holes that are covered, the more stable the tone. One or two fingers (often finger 2 and 6) are responsible for its reliability. My fingering chart for

[151] APPENDIX: 8.1. Charts

[152] = *Dabei wird ein Loch, das an einer besonders günstigen Stelle liegt, stabilisierender als andere wirken und damit eine Vorzugsstellung einnehmen, die wir als „Endloch" umschreiben*. (The „Endloch" defines the effective length of the tube at that moment); in: Werner Richter: *Die Griffweise der Flöte* (Frankfurt a.M., 1986), p. 41

[153] Detailed information in chapter 3.2.1.3.

[154] APPENDIX: 8.1. Charts

[155] Detailed information in chapter 3.1.3.

harmonics as well as for the third octave using the lip control can be found in the appendix.[156]

3.1.3. Diverse spectrum of timbre

We have learned so far, that the Helder Tenor offers a wide spectrum of timbre through the principle of pure harmonics and the extended key system. Forte fingerings and keyed low notes create for example a powerful, strong first register. But also, regarding sound and dynamics the third octave is in balance with the first two octaves, through the use of long fingerings in combination with the piano key.

In addition, the Helder Tenor is equipped with a flexible block system,[157] called Sound Unit.[158] With this device recorder players can adjust the sound to their taste and optimize the response in all registers. Moving the block up or down by twisting a screw built into the block at the back of the head joint, one can adjust the size of the windway easily, *even during a short pause*,[159] to react to temperature and humidity conditions. This mechanism is also used to change the general sound quality of the standard windway from noisy (narrow windway, rich in overtones) to airy (wide windway, with less overtones), but here one needs to be aware of the respective air pressure. A narrow windway requires more air pressure, but less air speed, volume and attack (of course depending on what is wanted), the pitch will slightly decrease, and the total range gets smaller. A wide windway needs less pressure, but more air speed, volume and attack and the pitch will slightly increase. One can control the adjustment visually through the marked dot on the screw. To be able to remember the three best positions I work with clock-numbers and notate for example: 12h (standard) plus 9h (wide), or 12h minus 6h (narrow). Furthermore, different platelet materials such as rosewood, African blackwood and synpor[160] for the windway roof impact the general timbre, quality and attack. Synpor is in that case the most neutral and reliable platelet one can use, for it is not swelling and moving like wood.

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[156] APPEDNIX: 8.1. Charts
[157] modified version of the Strathmann-flute mouthpiece with adjustable core gab
[158] More information in chapter 3.2.2.
[159] Peter Bowman: *The Birth of a Truly Contemporary Recorder* (Recorder Magazine 4/1995), p. 126
[160] = synthetic material created by Hans-Joachim Burger for Nik Tarasov and recorder company Mollenhauer, which absorbs liquids without swelling and makes recorders more durable.

For me, the true revolution lies within the lip control. This mechanism works due to the placement of soft rubber material on the lower half of the underside of the block. By pressing the lips together, the block tilts through the rocking motion of the soft material and one can close and open the entrance of the windway while playing. Thereby one can add variation to beginnings and endings of musical phrases, give tones a proper ending or even a soft start throughout two and a half octaves within the standard block position. Experimenting with this mechanism I realized that a decrescendo is easier to perform than a crescendo. Reducing air pressure while closing the windway and opening certain finger holes is something one can control through the feedback of the existing air column. However, beginning a note is a different story since the air column must first build up which requires care with the note's initial onset. Air and lip pressure as well as finger positions must be moved and regulated in relation to each other and this differs from tone to tone. A slightly more open windway simplifies this technique. Furthermore, one must keep in mind, that using the lip control will create a small rise in pitch, which must be corrected through an extra finger movement, either completely closing or shading an open hole. In contrast to the normally quick response on the recorder, every tone produced with the lip control has a slower response, depending on the register and fingering.

Photo 48: *Sound Unit*

3.1.4. Acoustic analysis of the Helder Tenor's new sound world

To learn and understand more about the Helder Tenor's potential, it was important to explore more than the instrument's new features from a practical perspective. I wanted to dig deeper and do an acoustic analysis as well, hopefully proving what I was experiencing. For this I found Larissa Kocher, who was studying at the IEM based at the Technical University (TU) in Graz. She supervised the recording sessions and made a detailed analysis of the recordings for her bachelor thesis called "Acoustic Analysis of the Modern Recorder".[161]

Her analysis focused on the frequency response characteristics and the partial harmonics of the Helder Tenor in comparison:

- a baroque recorder with a short bore,[162] which is still the most common recorder model today
- the Herwiga Rex Tenor, a pre-war recorder from the 1930s, which inspired the Helder Tenor,[163] and
- the Yamaha Tenor, a recorder model developed in the late 1980s, which is mainly used for contemporary recorder music today.

The recordings took place in December 2016 in one of the recording studios[164] of the KUG. A detailed description of the technical equipment used can be found in Larissa Kocher's thesis. For now, it's important to know that I recorded every tone ten times and chose the best three versions from which an average was made. To ensure that the same air pressure and stable tuning was retained throughout the session, I worked with a tuning device and a heat cushion.

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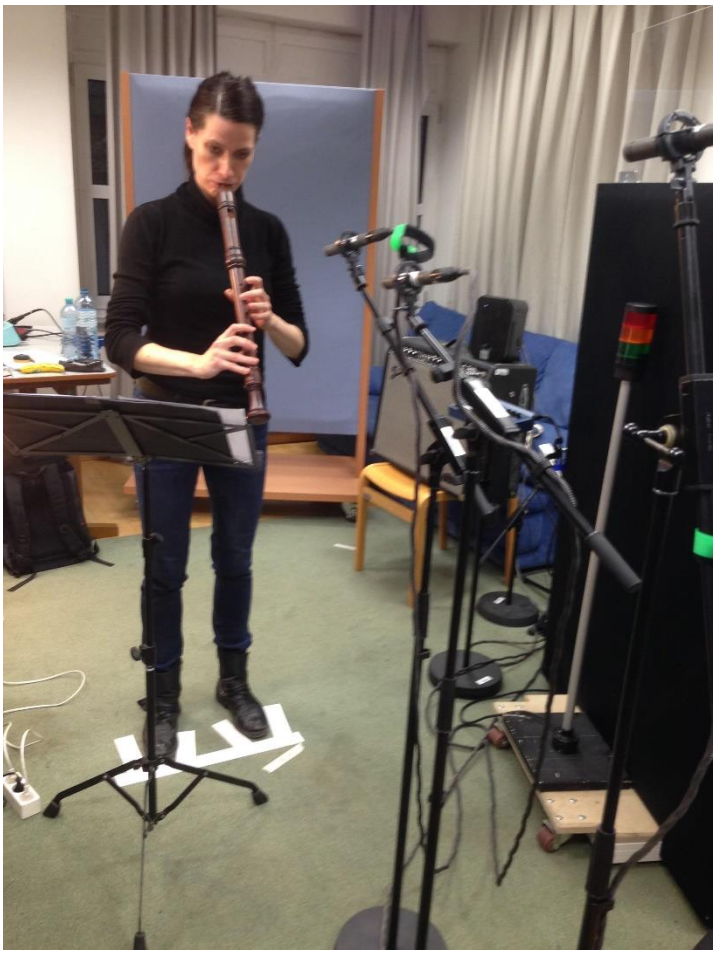
[161] Submitted in January 2019, supervised by O.Univ.Prof. Mag.art. DI Dr.techn. Robert Höldrich
[162] Voice flute after Bressan tuned on d1 in 415Hz made by Joachim Rohmer
[163] Through his research on recorders of the 1930s, Peter Thalheimer was finally given the Herwiga Rex Tenor, which Maarten Helder could borrow for his own studies. Unfortunately, this was later than the recordings and analysis made for my research project. The actual model is a post-war instrument and slightly different from the pre-war instrument used for the analysis.
[164] 6th and 7th of December 2016 at "Tonstudio", Brandhofgasse 21, under the special direction of Mag.art. Ulrich Katzenberger and Korin Rizzo.



© Larissa Kocher

Photo 49: *recording session at the studio*

3.1.4.1. Standard fingerings

In our first examination we focused on standard fingerings only. Our goal was to explore the balance within each instrument and to find out how the instruments relate to each other. The diagram demonstrates the dynamic trend of tones being played on each recorder over its entire range. The chromatic scale is shown on the horizontal line with the circles representing the average of each tone and the vertical line depicts the sound pressure level in dB(A).[165] In addition, Larissa Kocher included a regression line, to clearly recognize and at the same time be able to compare the dynamic tendency of tones (here called trend) of each instrument.

[165] Since we don't perceive loudness linearly, this unit presents how our ears experience the whole range in reality. It differs from the purely physical unit dB.

Here is what Larissa Kocher found out: *The trend of the baroque model is the steepest with a sound pressure level of 66 dB(A) reaching up to 98 db(A), which makes a difference of 37 dB(A). The Yamaha is already more balanced with a difference of 27db(A) in sound pressure level. Additionally, it is louder than the baroque recorder, naming a difference of 9 dB(A), regarding its regression line. Taking a closer look at the linear regression of the Herwiga-Rex with its sound pressure level reaching from 67 dB(A) up to 106 dB(A), speaking of 39 db(A) difference, as well as the line of the Helder Tenor, those two are likewise well-balanced. This is because the Herwiga-Rex is skipping*[166] *a lot more than the Helder Tenor, which is rather continuously becoming louder over its range. It goes from 70 dB(A) up to 96dB(A), which leads to a difference of 26 dB(A). Hence it can be said that the balance of the instruments got improved a lot throughout the years and the aim of an even more balanced course of the Helder Tenor in the first octave as well as the third got well achieved.*[167]

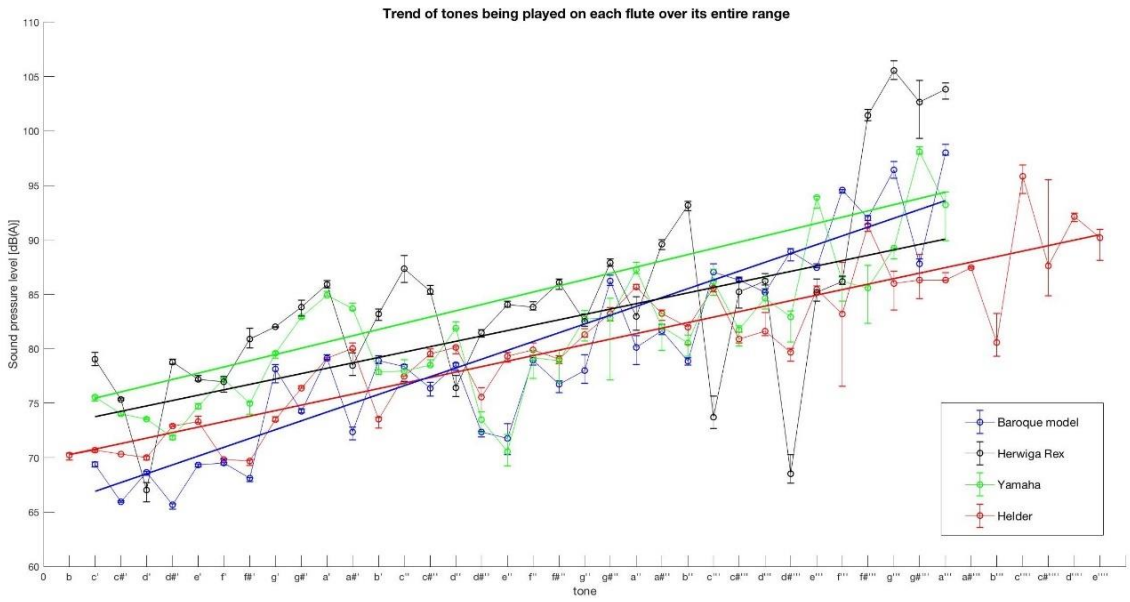


Figure 4*: dynamic trend of tones of each recorder over its entire range*

[166] Meaning: The volume differences between the adjoining tones are much larger than on the Helder Tenor.
[167] Larissa Kocher: *Acoustic Analysis of the modern Recorder* (Graz, 2019), p. 10f

3.1.4.2. Dynamics

Because I use both standard fingerings and numerous dynamic fingerings, like forte fingerings (adding fingers) and piano fingerings (shading finger holes), I was keen to learn more about the dynamic possibilities of the Helder Tenor in comparison with a baroque recorder. As the Yamaha Tenor and the Herwiga Rex Tenor aren't built with any extra features like the lip control and the piano key, they were excluded from any further evaluations.

In our recordings we focused on two different kinds of dynamics:

1. special piano and forte fingerings for each instrument, and
2. standard fingerings including gradually opening or closing (extra) finger holes,[168] for which Larissa Kocher evaluated the loudest and the softest point.

The tones are now presented as Roman numerals, since the baroque recorder (starting on d1 in 415Hz = c#1 in 440Hz = I') has a different pitch than the Helder Tenor (extension note b in 443Hz = VII).

The first graph (figure) shows, that on the baroque recorder *both times the trend of loudness of the piano tones is quite stable, whereas the trend of loudness of the forte tones is highly increasing. Against expectations, the piano-fingering is louder than a piano played with standard-fingering and the forte-fingering is lower* (softer) *than a forte played with standard-fingering. Although the player has got the feeling to achieve a louder or softer sound by using forte- or piano-fingerings, with standard-fingerings it is still possible to play with a greater variety in dynamics.*
By taking a closer look at the piano-fingerings it can be seen that despite the highest tone (d#"') every other is louder than the piano played with standard-fingerings. The a", for example, almost has got the same loudness at both types of fingering with only one sone[169] *difference. On the contrary, the g' with piano-fingering is twice as loud as with standard-fingering.*[170]

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[168] Gradually adding fingers means *forte dal niente* and gradually taking away fingers means *piano al niente*.
[169] Larissa Kocher: Sone *is a psychoacoustic unit of loudness and describes the subjective perception of sound pressure. Doubling the perceived loudness doubles the sone value. (for example, 10 sones are twice as loud as 5 sones, whereas when calculating in dB double sound pressure level means +6dB)*; (Graz, 2019), p. 13
[170] This was a big surprise to me, because I realized that the timbre change of the note tricked me to think this note would be softer with this particular piano fingering.

The forte-fingering don't show that a big difference in loudness. c' and g' have got almost the same loudness with less than one sone difference and c''' is one sone lower with forte-fingering than with standard-fingering. In comparison to piano-fingerings, forte-fingerings are sometimes louder than standard-fingerings, as can be seen at c', d'', a'' and c'''.

Taking a look at the difference in loudness from the lowest tone, the c', to the highest one depicted, a d#''', the d#''' is in forte about five times and in piano only about three times as loud as the c'. This shows the increase in loudness in the higher octaves, which was desired to be reduced with the Helder Tenor.[171]

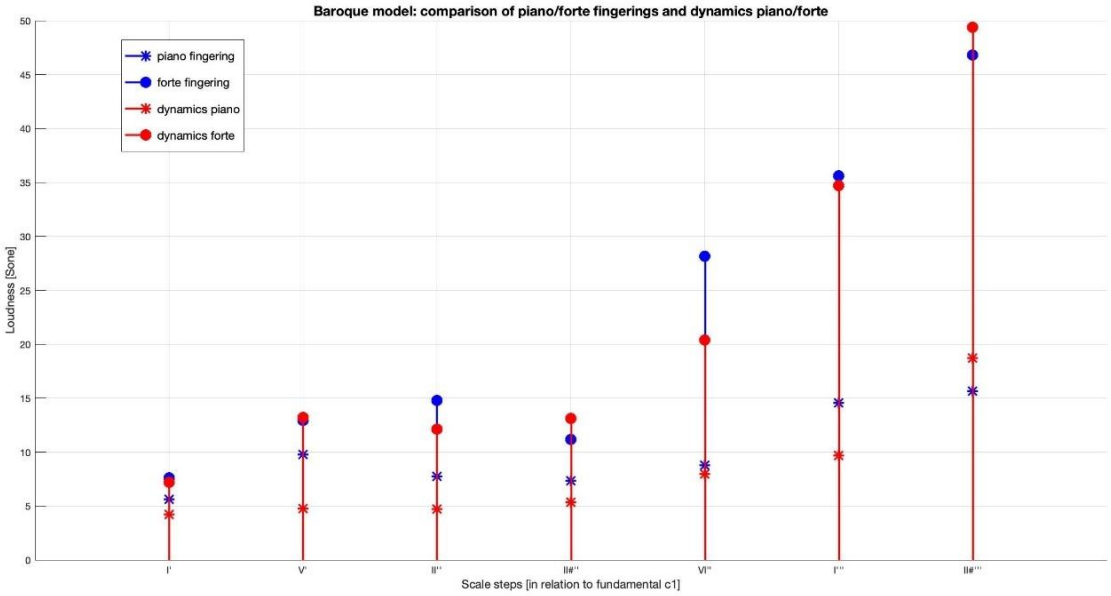

Figure 5*: piano/forte fingerings and dynamic piano/forte in comparison on the baroque recorder*

The next graph *shows the comparison of nine tones in piano and forte being played on the Helder Tenor. This time, the trend of loudness of the forte tones as well as of the piano tones is increasing a lot more than with the baroque model. The f#''' in forte with standard-fingering is, for example, four and a half times as loud as the b, whereas with forte-fingering the same tone is not even four times as loud. This shows that with standard fingerings a greater variety in loudness is possible than with forte fingerings. In the first two octaves the difference in forte of standard-fingering and forte-fingering is between*

[171] Larissa Kocher: *Acoustic Analysis of the modern Recorder* (Graz, 2019), p. 13f

three sones and eight sones. The biggest difference is at d#”’ with 41 sones. This means that the standard fingering is more than one-third louder than the forte fingering. Taking a look at the piano one can see that compared to the baroque model, the piano fingerings work better with the Helder Tenor. Five times out of nine the piano-fingering is lower (softer) *than the standard-fingering. d” has got almost the same level of loudness in both versions, the biggest difference is at g”’ with 20 sones, which means that the piano fingering is one and a half time louder than the standard-fingering.*[172] *Against expectations, b has got almost the same level of loudness with less than one sone difference in piano and forte fingering.*[173]

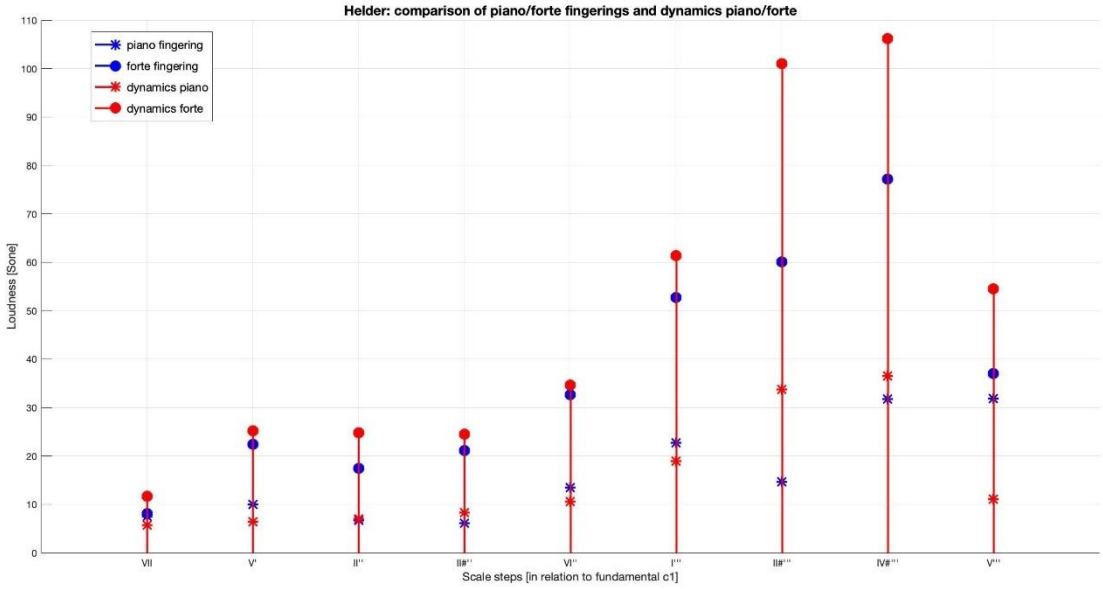

Figure 6*: piano/forte fingerings and dynamic piano/forte in comparison on the Helder Tenor*

In the last graph (figure) *the comparison of piano- and forte-fingerings of both models, the baroque and the Helder Tenor, is shown. For some tones don’t exist piano- and forte-fingerings, that’s why standard-fingerings are used in these cases. For the Helder Tenor there is a missing piano-fingering for a#”’ and missing forte-fingerings for b, c’, d#’ and b”’. For the baroque model piano-fingerings have to be replaced for f”’, f#”’ and g”’ and forte fingerings have to be replaced for c’-f#’, g#’, a#’ and g#”. It is remarkable that the*

[172] This was again a big surprise to me, because here I also realized that the timbre change of the note tricked me to think this note would be softer with this piano fingering.
[173] Larissa Kocher: *Acoustic Analysis of the modern Recorder* (Graz, 2019), p. 14f

baroque model is rather stable in loudness in the first register. Another thing that is noticeable is that the piano-fingering of the Helder Tenor is, against expectations, until a#' louder than the baroque recorder. From b'-e'' it is lower (softer) *and then from f''-d''', despite a few exceptions, louder again. Simplistically, in the second register the piano-fingering of the Helder Tenor is lower, in the other registers it is the opposite way. Besides, it has to be marked out that the difference in loudness sometimes is so high that one piano fingering is twice as loud as the other, talking about extrema like d#', e' and a#', for example. Taking a look at the forte-fingering, the Helder Tenor is despite g''' always louder than the baroque recorder, often even almost twice as loud.*[174]

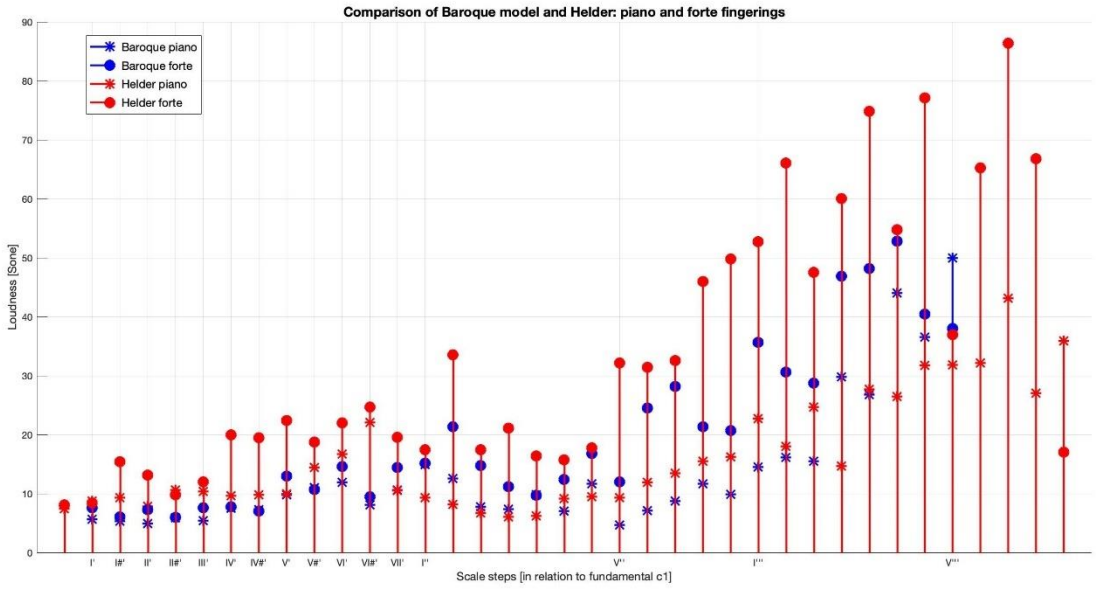

Figure 7: *piano/forte fingerings in comparison with the baroque recorder and the Helder Tenor*

3.1.4.3. Lip control

The lip control is a unique feature on the Helder Tenor, offering many possibilities to manipulate dynamics and timbre. For me it was important to find out how much influence the lip control actually has. Therefore, Larissa Kocher did a spectral analysis of five tones played with the lip control in comparison with forte fingerings and piano fingerings and found out, that *the piano being played using the lip control is even lower* (softer) *in*

[174] Larissa Kocher: *Acoustic Analysis of the modern Recorder* (Graz, 2019), p. 15f

loudness than when using piano fingerings. The minimum of reduced loudness is one sone, as for d#", piano fingerings of d" and g#" are even twice as loud as with lip control.[175]

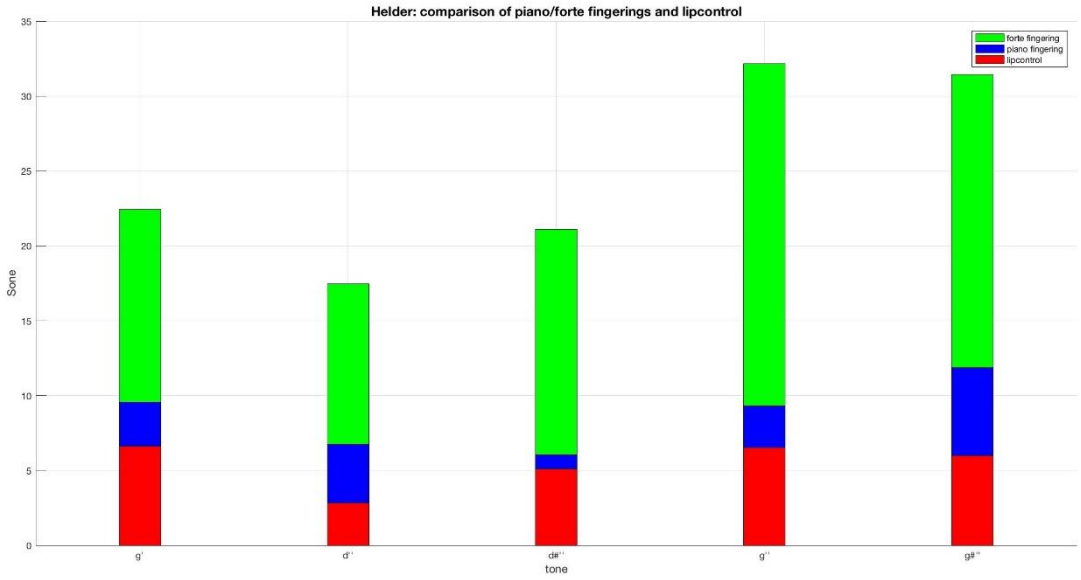

Figure 8: *comparison of piano/forte fingerings and the lip control of the Helder Tenor*

Furthermore, Larissa Kocher evaluated the fundamental and partial harmonics on these five tones and concluded that *the first few harmonics are higher developed, in comparison to standard fingerings. What is conspicuous is that the second overtone is higher developed* (more present) *with lip control than with standard fingerings. Furthermore, the third and the fifth are louder than the second and the fourth, so it can be said that all odd harmonics are higher developed, which leads to a hollower and warmer sound.*[176]

[175] Larissa Kocher: *Acoustic Analysis of the modern Recorder* (Graz, 2019), p. 16f
[176] ibid, p. 18

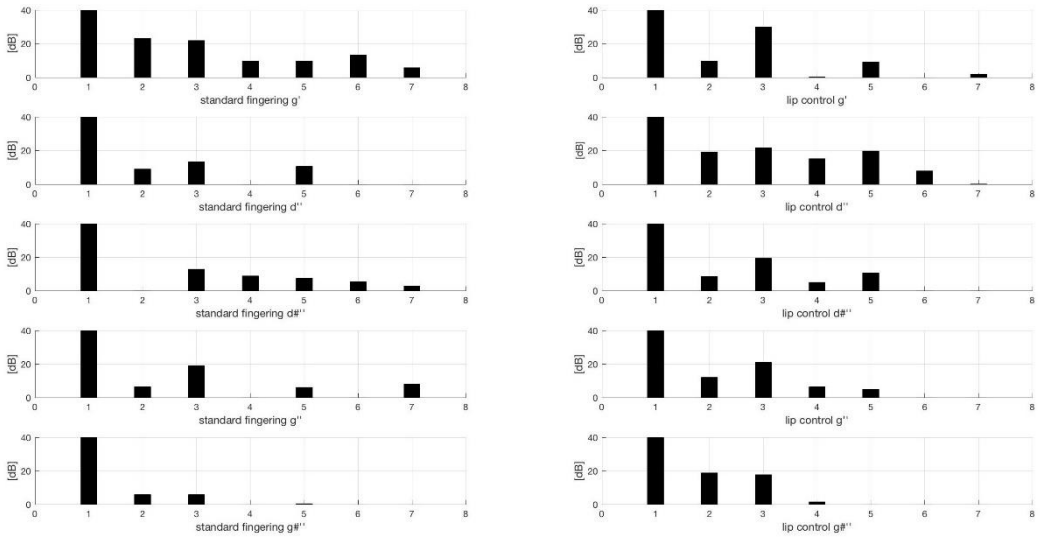

Figure 9: *comparison between standard playing and use of lip control when playing fundamental and partial harmonics on the Helder Tenor*

3.1.4.4. Partial harmonics

Since the Helder Tenor is based on the principle of pure harmonics, I was curious to find out how this would influence the overtone structure of the instrument. Therefore, we recorded the border areas of each register (always the first and the last three tones) and Larissa Kocher concluded that: *Especially the lower part of the first register, but* also *the lower part of the second, are richer in overtones than the upper parts. The third register has got very few overtones and the following registers are rather poor in overtones, too. (…) the seventh register again is very rich in overtones. Knowing that the properties of partial harmonics depend on the fingering, the individual graphs can be explained easily. The first two octaves hardly contain any fork fingering whereas in the upper registers, especially from a#" to d#"', meaning third, fourth and half of the fifth register, only fork fingerings are* being *used.* A *fork fingering causes a loss in overtones,* which can be clearly seen in the graph*. The seventh register* as well as the three highest tones, have *got a relatively closed fingering, which explains the exceeding richness in overtones.*[177]

[177] Larissa Kocher: *Acoustic Analysis of the modern Recorder* (Graz, 2019), p. 11f

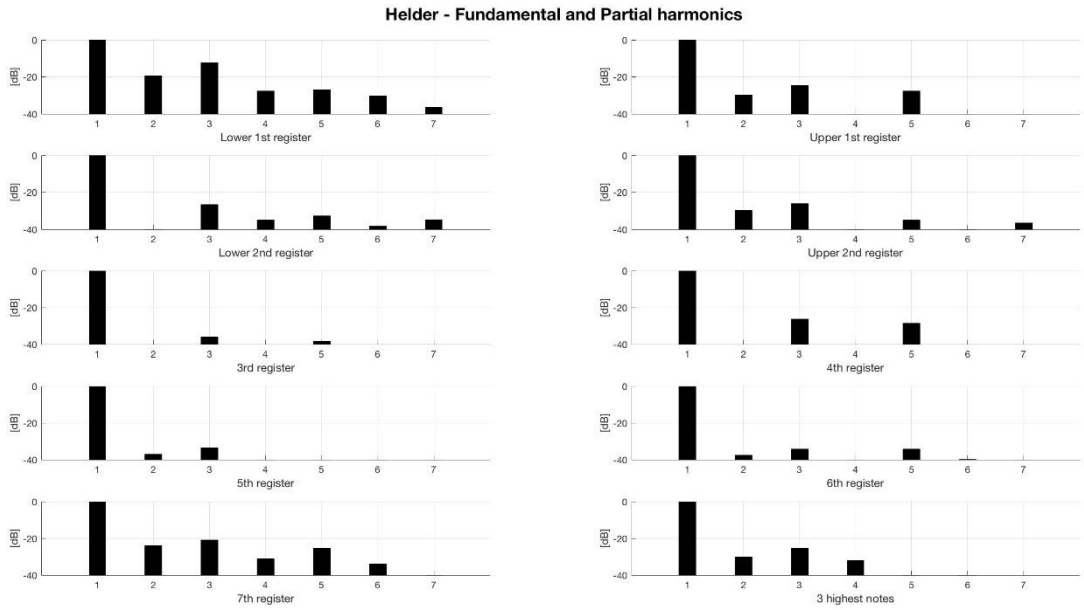

Figure 10: *fundamental and partial harmonics of the Helder Tenor*

From a playing perspective, I found it difficult to determine what was happening and being experienced by a listener when exploring the new features of the Helder Tenor. Therefore, all graphs and conclusions are quite important to me because they help me consciously choose between certain options, such as the dynamic fingerings, the extended registers, the piano key or the lip control. For example, knowing now that my piano fingering for b3 is much louder than the actual standard fingering, changed my fingering charts. Or that a dynamic piano and forte has much more influence than actual dynamic fingerings, proves the relevance of the piano key. Knowing more about the physics of the recorder certainly brings me to another level of recorder performance. But it is not only the physics. To gain an understanding of its new features, it is worthwhile having a closer look at the Helder Tenor's historic development.

3.2. Historic development of the Helder Tenor

Like already indicated in chapter two, an instrument's development is always dependent on several aspects which influence its establishment and uptake. Firstly, I would like to name the political and economic situation in both the country of origin and worldwide. Are people able to spend time and money on instruments or are there more important priorities? What is the market situation regarding repertoire, instruments and concerts?

Then technological progress significantly influences ideas of instrument builders looking to make technical improvements. One example is 3D printing, which enables makers to experiment in completely new dimensions and to get feedback right away. These printers can now produce objects which were totally inconceivable before, because the production was limited to traditional methods. Furthermore, interest, vision and the openness of makers, performers and composers play a fundamental role. Without this inspiration there would be no adventurous instrument making. Here it is very important that all partners work together and share their expertise. Going one step further, repertoire will also influence the development. What exactly should the instrument be able to do? What do I want my instrument to be able to do? What does the composer ask for? What exactly does the audience want to hear?

Looking back in history, there is one more important aspect, which one unfortunately cannot control by her- or himself: coincidence, luck or let's call it "being at the right place at the right time". There were many curious and visionary instruments on the market, which disappeared after a short while such as the Orkon by Edward Powell,[178] which is hardly used these days, or the bell key by Carl Dolmetsch,[179] which one can sometimes find on modified versions of bass and tenor recorders today.

However, some inventions have been made without even being planned and are still having a positive or negative effect on the instrument's further development. For example, the lip control of Maarten Helder's Sound Unit.[180] It enables such an enrichment in sounds and dynamics that I cannot imagine the instrument without it anymore. But this mechanism was indeed found by coincidence. The initial model by Arnfred Strathmann[181] used soft rubber material in the middle of the underside of the block. For technical production reasons, the piece of rubber was put at the very end of the underside of the block. Through its leverage one could then unexpectedly move the block while playing.

[178] See chapter 2.1.
[179] See chapter 2.1.
[180] = flexible block system; detailed information in chapter 3.1.3.
[181] See chapters 2.2.1.e and 2.2.2.b

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Photo 50: *soft rubber at the underside of the block*

Also, the German fingering for the f on an instrument in c was a rather *unintentional discovery*.[182] A tuning apprentice of the recorder company Kehr in Zwota drilled the fifth finger hole too small. *(…) this by chance (…) found fingering system (…)*[183] was approved right away because this enabled an easy diatonic scale to be played from the bottom note upwards which fit perfectly with the ideas of the "Wanderjugend" at that time. However, since the fingering for chromatic scales is rather complicated and the tuning is poor when playing chromatically, this fingering system is one of the most controversial discoveries in recorder history.

© Markus Berdux (Mollenhauer recorders)

Photo 51: *two soprano recorders with German and English fingering systems*

[182] = *unfreiwillige Entdeckung*; in: Hermann Moeck: *Zur „Nachgeschichte" und Renaissance der Blockflöte* (Tibia 2/1978), p. 82

[183] = *(…) durch Zufall (…) zwangsläufig gefundene Griffweise*; ibid, p. 84

3.2.1. Early 1990s

In 1990 the focus was mainly on early music recorders, especially on modified baroque recorders, and in Maarten Helder's opinion, these models limited a performer's ability to progress further. Although more and more contemporary pieces were written for the von Huene type of tenor recorders (for example, the Yamaha Tenor) and the modern Ganassi recorder at that time, his goal was to develop a *new recorder for new music*[184] equal to other classical orchestral instruments. Here it is important to emphasize the term recorder. As Walter van Hauwe stated: *The most important requirement was that it should remain a recorder.*[185] Other recorder makers assumed before the development of the harmonic tenor recorder, that by changing the basic concept of a recorder to avoid certain deficiencies, *we will come up with something that looks suspiciously like a Boehm flute*[186] and nobody would know how to perform on it or would refuse learning a completely new instrument. *(…) But what we wanted was an instrument* (recorder) *with a wider range, tuned in equal temperament and more dynamic possibilities.*[187]

Inspired by the range of the flute, oboe and clarinet, Maarten Helder decided that the tenor recorder was the most compatible model to focus on. Nik Tarasov, who was both a recorder student of Peter Thalheimer at the Hochschule für Musik Nürnberg and collaborating with recorder maker Joachim Paetzold at the time, showed him several pre-war tenor recorders from the 1930s. Maarten Helder was fascinated by their new sound world[188] and the fact that they are based on the principle of pure harmonics which allows one to play the third octave without stopping the bell at all. Flutist Jeanette Flöel[189] loaned him the model called Herwiga Rex made by the workshop Max König & Söhne in Zwota.

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[184] Pete Rose: *A new Recorder for New Music* (American Recorder 4/1996) p. 18

[185] = *De belangrijkste eis was dat het een blokfluit moest blijven*; in: Frits van der Waa: *De blokfluit begint nu echt modern te worden* (de Volkskrant, 01.07.1998)

[186] = *werden wir etwas erhalten, das verdächtig nach einer Boehmflöte aussieht*; in: Gisela Rothe: *Recorders Based on Historical Models* (Fulda, 2007), p. 32; First published in: The Recorder, No. 2, March 1985, The Victorian Recorder Guild, Australia

[187] = *(…) wat we graag wilden was een instrument* (blokfluit) *mit een grotere omvang, dat gelijkswevend gestemd zou zijn en dynamisch meer mogelijkheden had;* in: Frits van der Waa: *De blokfluit begint nu echt modern te worden* (de Volkskrant, 01.07.1998)

[188] A recording of Peter Thalheimer performing on a Gofferje Merzdorf tenor recorder in d can be found in the APPENDIX: 8.6. Audio recordings (Helmut Bornefeld: Suite IV, first movement).

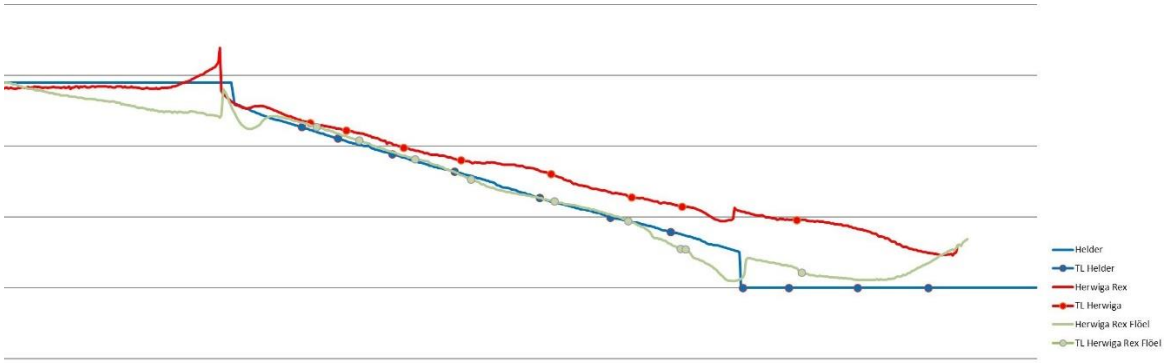
[189] Jeanette Flöel received this instrument around 1954 as a present from her mother, which she bought in the former GDR. Since there is no serial number on this instrument and because of the time frame, it is a post-war model from the workshop Max König & Söhne, working for company Wilhelm Herwig in Markneukirchen until 1960; Peter Thalheimer (Phone call with Jeanette Flöel on 29.05.2018)

© Markus Berdux

Photo 52: *post-war Herwiga Rex tenor recorder*

Maarten Helder's first approach was to copy the Herwiga Rex. He explored its new sound qualities and wanted to see how far he could develop it from there, but the slightly different tuning, and the fact that he had to deal with keys, made it quite difficult for him. Maarten Helder didn't reach the result he was hoping for. In his second approach, based on mainly empirical experiments and a few physical calculations, he finally developed the harmonic tenor recorder with the following features:

1. A **bore based on the principle of pure harmonics** for a balanced range of three octaves.



© Erik Jahn

Figure 11: *bore of the Helder Tenor in comparison with both Herwiga Rex recorders, including positions of finger/key holes*

2. **Extra keys** for a balanced low register and good intonation overall.
   a) The extension note b0 was inspired by instruments of recorder maker Joachim Paetzold (1966) and the research of Peter Thalheimer.[190]

[190] Peter Thalheimer: *Beobachtungen zum Überblasverhalten von Blockflöten – alte Bauprinzipien als Ausgangspunkt für neue Instrumente?* (Tibia 1/1995), p. 362–368

© Peter Thalheimer

Photo 53: *alto recorder with e1-foot joint by Joachim Paetzold*

b) A diatonic system for the c1 and c#1 keys, meaning that c1 is on the outside and an open key, and c#1 is on the inside and a closed key. This position allows the main note (in this case c1) to be easily reached without tension in the right pinkie finger. Next to that, it was important for Maarten Helder that d3 could be played softly using the fingering Ø 13 46.

   The shape of the keys is inspired by the key work of other woodwind instruments at that time.

© Maarten Helder

Photo 54: *right hand key system of the Helder Tenor (first series)*

c) The d# key was built to tune and stabilize the d# in the first and second register and is also used for several notes in the third octave. Half tone keys like this one were already being built in the late 17th century and are found on csakans and other wind instruments.

© Peter Thalheimer

Photo 55: *"Einfacher" Csakan with d# key*

3. A **piano key** for dynamic playing, including a metal pin to facilitate opening and closing the hole in an organic way. This key was inspired by echo, halftone, octave and register keys of earlier recorder models[191] and other woodwind instruments. Maarten Helder wanted this to be barely visible and therefore placed it at the back of the instrument.

© Maarten Helder

Photo 56: *piano key of the Helder Tenor (first series)*

4. A **flexible block system** for varied timbre, as well as the flexibility regarding humidity and temperature. As mentioned before, this system was a patent owned by Arnfred Strathmann.[192] There is even an earlier, slightly different version from the 1960s made by Gyula Foky-Gruber working for company Hopf.[193]

[191] See chapter 2.1.
[192] See chapter 2.2.1.e
[193] See chapter 2.2.1.b

Photo 57: *adjustable block system of the Helder Tenor (first series)*

Maarten Helder got inspiration from other instrument makers and researchers, but still faced many challenges.[194] He had no recorder players to collaborate with and therefore had to make all decisions by himself, such as bore design (if completely cylindrical and therefore completely keyed or not), which finger to use for the piano key (left index or left pinkie finger), which wood for the body, which material for the keys, which design in general, and so on. Furthermore, before showing this instrument to other recorder players he had to find a new fingering system within the third octave by himself, even though he was not a professionally trained and experienced recorder player. Lastly, just before finishing and selling the first series, the foundry made a mistake with the gold keys. The gilding was too thick, and he had to adapt the keys all by himself and almost couldn't finish in time.

Then, in spring 1995, a *new chapter of recorderplaying*[195] began. He sold his first series of 20 tenor recorders,[196] he won the Chambre des Métiers prize for craftsmanship and the Musicora innovation award, and the first pieces were written for his instrument and premiered by recorder players like Johannes Fischer and Joseph Grau. Furthermore, *during the open Dutch Recorder Festival in Utrecht, Walter van Hauwe played this recorder for the first time for a critical audience of recorder players, the 4th of June 1995.*

[194] This information is based on an interview with Maarten Helder through a phone call on 16.03.2016
[195] Pricelist of the Harmonic tenor recorder by Maarten Helder (1995)
[196] Unfortunately, this list could not be completely reconstructed, but known buyers from the first instruments were: Carola Bodanowitz, Gabi Bultmann, Robert Finster, Jeanette Flöel, Johannes Fischer, Joseph Grau, Michael Hell, Silke Jacobsen, Ulrich Ludat, Stefan Möhle, Simone Nill, Ulrich Pollmann, Siri Rovatkay, Marie Schmeding (former Scheffer), Martin Schmeding, Nadja Schubert, Walter Van Hauwe.

In performing the two new and very demanding pieces by Donatoni, it was proved that this instrument can cope with extreme difficulties of these pieces: piano playing in the third octave, balance of the registers, solid bottom notes, piano passages (with the piano key).[197]

Photo 58: *Harmonic tenor recorder by Maarten Helder (first series)*

3.2.2. After 1995

Motivated by his first success and knowing that the production of his harmonic tenor recorder was too expensive for a freelance recorder maker, Maarten Helder started to look for a collaborator. In the spring of 1996, recorder company Mollenhauer took over the production of his instrument, which was then named "Helder Tenor". While the company was responsible for manufacturing corpus and keys, Maarten Helder was in charge of intonation, voicing and the final touch.

Right from the beginning of this partnership, the Helder Tenor was adjusted to improve both manufacturing efficiency and the cost of technical construction. Firstly, the piano key was changed for practical reasons from the left pinkie finger to the left index finger and placed on the left-hand side just below the Labium. Even though this key had proven to be a solid working mechanism, once manufacturing began, a leather pad was used instead of a pin, and customers could order the instrument either with or without the piano key. Secondly, the keys on the foot joint were adjusted for customers with smaller sized hands and therefore also the length of the foot joint was shortened. Besides that, the mechanics and design of the keys were modified to save costs and to speed up production. Thirdly, depending on how much one wanted to spend on a recorder *in the "de luxe"*

[197] Pricelist of the Harmonic tenor recorder by Maarten Helder (1995)

class of Harmonic recorders,[198] customers could choose between silver or gold keys, as well as between a standard ring or the "H"(elder) ring made by Dutch artist Lideka Middelbeek which decorates the lower part of the head joint.

© Maarten Helder

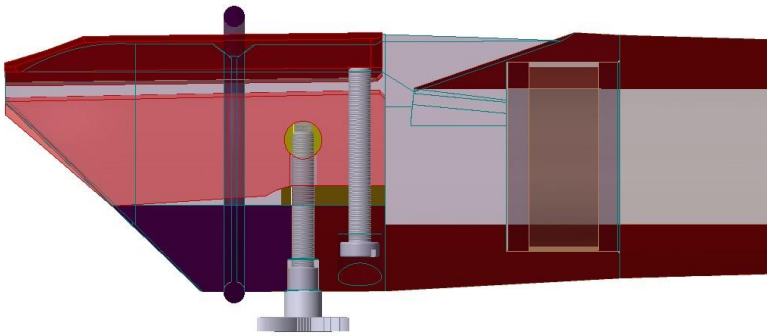
© Markus Berdux

Photo 59: *"H"(elder) ring and standard ring for the Helder Tenor*

Later on, changes were made to the mouthpiece. The windway roof was separated from the rest of the corpus which enabled direct access to the block and the roof. This modification allows one to use different materials for the platelets as well as let the block and platelet dry more efficiently after playing. The platelet was first held in place by a metal ring but was changed to a rubber ring shortly after. A design adaption was made to keep the rubber ring in place – a groove that was the exact size of the ring was cut around the mouthpiece and positioned above the screw. As mentioned previously,[199] one could adjust the size of the windway to react to temperature and humidity by twisting the screw at the back of the mouthpiece. In addition, one could now adjust the height of the windway exit by twisting two screws with a screwdriver. Both systems change the general sound quality and response of the instrument. The lip control was improved by using an even softer rubber material on the lower half of the underside of the block instead of a hard rubber. As already stated, one can use this mechanism to close and open the entrance of the windway while playing and therefore add variations to beginning and endings of

[198] https://www.mollenhauer.com/en/recorders/recorders/recorderoverview/helder#content (accessed: 13.05.2019)
[199] See chapter 3.1.3.

tones. The head joint was made out of two different materials: caoutchouc[200] for the upper part to maintain stability and rose wood for the lower part (starting after the labium). This combination helped to minimize unnecessary abrasion of head joints in case the voicing didn't turn out that well.



© Markus Berdux (Mollenhauer recorders)

Photo 60: *Sound Unit by Mollenhauer (real and virtual)*

[200] = elastic material that can be melted and finished into a variety of products.

Next to the tenor model, Maarten Helder developed an alto recorder, which was presented during the "Frankfurter Musikmesse" in spring 1997, together with the freshly developed modern Alto by Nik Tarasov.[201]

© Markus Berdux

Photo 61: *Helder Alto and Tenor*

Despite its promising kick-off when it was introduced to the market, recorder company Mollenhauer started to rethink the Helder Tenor's production efficiency, general costs, and design in 1999. According to written records of that time, customers were dissatisfied with the mechanics of the Sound Unit and the quality of the third octave. Apparently too much air was leaking through the flexible block system and it seems that the overall concept of the harmonic tenor recorder got out of balance through its further development. Sales were going down, so Maarten Helder decided to stop with his profession as a recorder maker and pursue a new career path. However, soon after, Mollenhauer started another round of developing this instrument together with recorder developer Erik Jahn, and in 2002 began promoting the Helder Tenor again through articles and workshops. The Sound Unit was improved, the bore was redesigned to a length, and the key system, now silver-plated, was adapted to a general-sized hand stretch.

As recorder player Nadja Schubert mentions at the end of her article on the Helder instruments, their development will be pushed through new materials, new innovations in recorder making, and the ideas and requests of recorder players,[202] Johannes Fischer and Karel van Steenhoven developed their own versions together with recorder company Mollenhauer only a few years ago: the Helder Tenor made out of acrylic glass with extra

[201] Unknown: *Arbeit am Detail* (Das Musikinstrument 4/1997), p. 42
[202] Nadja Schubert: *Helder Blockflöten* (Windkanal 2/2002), p. 24

keys for g# and the bottom hole in 2012,[203] and the Helder Alto with an extended key system in 2015.

© Markus Berdux (Mollenhauer recorders)

Photo 62: *Plexiglas (acrylic glass) Helder Tenor built for Johannes Fischer*

© Markus Berdux (Mollenhauer recorders)

Photo 63: *Helder Alto with extra keys built for Karel van Steenhoven*

As soon as I started to perform on the Helder Tenor and got to know the intricacies of the instrument, I realized that all of the new features it has to offer are brilliant ideas which open up a new and contemporary sound world and expand the playing techniques and performance practice on the recorder. At the same time, I discovered that these new features were technically not yet mature. Motivated by my colleagues Johannes Fischer and Karel van Steenhoven, I started to critically examine my instrument together with recorder developer Erik Jahn.

When I stopped flute (recorder) *making, I realized that this flute* (Helder Tenor) *had enormous potential, but the path to perfection was long.*[204] Maarten Helder

[203] Pinnwand (Windkanal 4/2012), p. 6

[204] = *Als ich mit dem Flötenbau aufgehört hatte, war mir klar, dass die Flöte ein enormes Potential besitzt, aber der Weg zur Perfektion noch lange war;* Maarten Helder in an email after meeting in Berlin on 04.04.2019

3.3. The core of instrument making

...when Nature cannot help, Art must be your teacher.[205]
Sylvestro Ganassi

At this point, I would like to mention that making an instrument is not only about empirical studies, physical calculations, mechanics and ergonomics. It is also very much about personal decisions, experience and taste based on the background of each person involved. One will put all of his or her desire, energy, know-how, time and vision into this delicate working process: into making this one piece of art. I have learned that variables in this process of development when collaborating with a recorder maker are not only expertise, openness and patience, but also respect for each other's opinion and trust in shared ideas. In the following section I will give a detailed description of my working process with Mollenhauer's recorder developer Erik Jahn.

3.3.1. Stages of a three-year collaboration

In my research project, I have focused on the Helder Tenor only, even though both Helder instruments (tenor and alto) are built with the same extra features: a bore based on the principle of pure harmonics, a flexible block system, an extended key system and a piano key. One of the reasons is that the range of the Helder Alto starts too high for the solo and chamber music repertoire I wanted to explore. Besides that, the general sound world of both instruments differs much more than one would expect and to include a second instrument would have been far beyond the scope of this project.

The most essential decision had to be made right at the beginning of our collaboration. Either to start from scratch and to completely rethink the recorder not knowing where we would end up – including questions about the new instrument's potential, its usage and repertoire – or to build on a pre-existing system and to critically examine how we could improve this system and what we'd gain from it. For Theobald Boehm for example, it was important to develop a flute, which is capable of playing fortissimo and pianissimo

[205] = *doue má ca la natura bisogna che larte sia maestra*; in: Sylvestro Ganassi: *Opera intitulata Fontegara* (Venice, 1535), p. 8

in all registers, with all tones being flexible in articulation in any tempo and a good intonation in all 24 tonalities.[206] At first thought this sounds like the perfect flute and certainly brings many advantages. However, this can also be very restrictive which German flutist Dorothea Seel found out through her artistic research project on the sound of the flute and its aesthetics in the 19th century.[207] Her investigations *have not resulted in a uniform picture of a definitive, standardized flute sound. There was in fact a great variety of sound that stemmed both from the instruments and from the different preferences in performance practice in the countries in question.*[208] After careful consideration it was clear that we wanted to work with what existed, meaning we wanted to develop an instrument further which already had new features we could build on: the Helder Tenor.

After all, the charm of our work lies in getting the very best out of every single instrument.[209] Adrian Brown

Our final goals were to achieve acoustical balance through the bore, expand the dynamic possibilities of the Sound Unit and the piano key, and to improve the mechanics and ergonomics in general. From our first meeting, I kept a logbook to document our steps of development and to have a record to regularly draw conclusions from. Looking now at these written records from our three-year collaboration and getting an overview of the whole process, I realize how far we have come and how much our list of improvements has grown. The deeper we delved into the matter, the more detailed our work became.

At the beginning Erik Jahn introduced me to the recorder's acoustics and physics, including a simulation of the flow behaviour at the labium as well as experiments with Kundt's cylindrical tube. This rather theoretical phase was quite important for me as I wanted to explore my instrument from a different angle and get to know it through its physical characteristics – features, which I wasn't yet aware of. Through Kundt's tube for example, I was literally able to see nodes and antinodes of a standing wave. Through the

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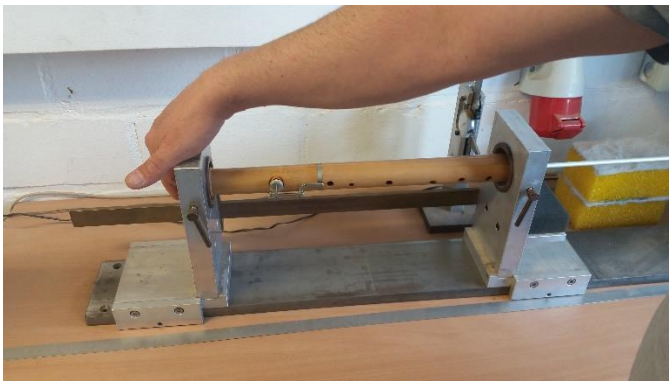
[206] Theobald Boehm: *Ueber den Flötenbau und die neuesten Verbesserungen* (Mainz, 1847), p. 20
[207] Dorothea Seel: *Der Diskurs um den Klang der Flöte im 19. Jahrhundert*; is due to be published by Wißner-Verlag Augsburg in July 2019 (accessed 13.05.2019)
[208] Booklet of the Symposium "ARTikulationen" at the KUG (October 2018), p. 16
[209] = *Der Reiz unserer Arbeit liegt gerade darin, aus jedem einzelnen Instrument noch das kleine Extra herauszuholen;* in: Das Portrait: *Ralf Ehlert im Gespräch mit Adrian Brown* (Tibia 1/2003), p. 339

acrylic glass Helder Tenor of Johannes Fischer, we could transmit this behaviour towards an inverted conical bore, which helped me understand the concept of leaking fingerings on my instrument.

© Susanne Fröhlich

Photo 64: *acrylic glass Helder Tenor used for Kundt's experiment*

Furthermore, I have been traveling to colleagues and collectors to have a closer look at certain instruments from the 20th century. Taking measurements and making recordings helped me to compare these models with my Helder Tenor and to get more ideas for further improvements. I had the privilege to play and explore quite a few pre-war instruments owned by Peter Thalheimer, the Helder Tenor of Andrea Ritter with a b-flat extension key, and some instruments of the private collector Ralph Burke, who introduced me to both Arnfred Strathmann recorders, the Gyula Foky-Gruber alto, a keyed bass recorder by Hammerschmidt & Söhne and a keyed soprano recorder by Max König & Söhne, amongst others.



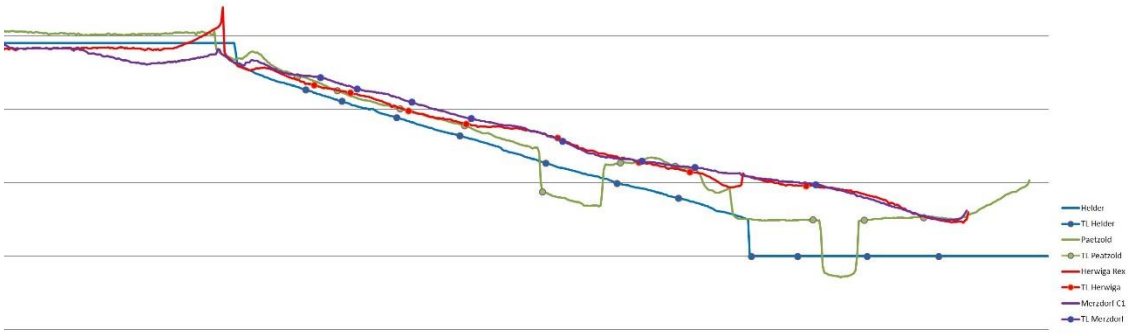
© Susanne Fröhlich

Photo 65: *taking measurements of recorders from the 1930s*

© Susanne Fröhlich

Photo 66: *standard Helder Tenor in comparison with a Helder Tenor in b0*

Through these experimental sessions, I realized that it is not the volume of the bore, but the length of the instrument and the tone holes in relation to this length (including position, size, undercut and height) which play a decisive role regarding tuning, general balance and the overall range.



© Erik Jahn

Figure 12: *comparison of different bore designs, including positions of the finger/key holes*

Besides that, I could confirm that extra keys and modifications to the mouthpiece truly enrich the sound and enhance extended techniques. Through the Strathmann block I could quickly change the timbre of the instrument without using any kind of extra preparation such as half-closing the windway entrance with Sellotape or inserting a paper strip into the windway. On the Bass by Hammerschmidt & Söhne I could produce a great variety of special multiphonics due to the extra keys.

© Susanne Fröhlich

Photo 67: *bass recorder with extra keys built by Hammerschmidt & Söhne*

Our first ideas of improving the Helder Tenor could be tested on my standard model and we experimented with: different materials for the block and platelets, wood varnish, the keypads, the tuning slide, and the pin for the piano key. During the whole process of our collaboration, we found it very helpful that certain parts of the instrument can be removed, especially the Sound Unit. This enabled us to try out different ideas with the same voicing throughout the process. For me this is quite future-oriented recorder making, since mechanisms become exchangeable and make the instrument more durable and more accessible to experimentation. In the end we even tried out different foot joints on my standard model and experimented with their length and taper.

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Photo 68: *Erik Jahn at the Mollenhauer workshop*

© Susanne Fröhlich

Photo 69: *Helder Tenor experiments at a glance*

Afterwards we worked with several prototypes and through each of them we tested different aspects such as the arrangement of the keys, extra keys, the shape of the mouthpiece, the piano key, and the foot joint. To save costs and valuable materials, we worked with 3D printed parts and pear wood. We knew that, if our idea worked on an instrument like this, it would work even better on an instrument with first class materials and all features combined. We were all very excited when the new version of the Helder Tenor was finished.

3.3.2. Helder-Jahn Tenor[210]

Our project began with a list of seven improvement ideas:

- the material of the instrument
- the shape of the Sound Unit
- a bent head joint
- the shape of the piano key
- a metal tuning slide
- some extra keys (up to four)
- the shape of the keys in general

[210] Provisional name.

However, in the end, we worked on 21 aspects of improvement and at the time of writing, my freshly developed Helder-Jahn Tenor is still in its trial phase. I am asking fellow recorder players and recorder makers for their opinions and expertise. Consultation over the past months has already resulted in the enhancement of several features and there may be more ideas to come. This further development of the Helder Tenor is still a work in progress, and this may never end. While our ideas are very much inspired by instrument making of other woodwind instruments, Johannes Fischer's research and the ideas of other recorder players who have worked with the Helder Tenor, our decisions are also based on the company's own interests and possibilities, as well as the wider music market including music education, ensemble settings, listening habits, contemporary repertoire and recorder players worldwide.

By way of illustration I have divided the different aspects of technical progress into four categories, which are as follows: sound, intonation, mechanics and ergonomics. Some of them will of course overlap, since they have an impact on more than only one aspect. For a better understanding, we have systemized the improvements starting from top of the instrument downwards.

3.3.2.1. Sound

It was striking to realize that the low register on the standard Helder Tenor is, for example, strong but not flexible while using the piano key or vibrato. So, the main idea was to explore how much we could still enrich the Helder Tenor sound-wise. This meant to get even more resonance and projection, bring more balance within the chromatic scale and more flexibility into its sound world.

a) Material of the instrument

Instrument makers and musicians have many different opinions about how much materials, which are used for instrument making today, influence the sound quality. In my experience, certain synthetic materials don't differ from hard wood with regards to the sound. However, when you consider how this material can be processed and worked with, and how much one can rely on this material, especially if the instrument is supposed to be produced in series, the choice of material plays quite an important role. Theobald Boehm, for example, only used metal at a certain point of his research because of the

inconsistency of the wood.[211] Furthermore, it is very much about how the instrument "feels" and each musician and instrument maker will have his or her own philosophy and preference on that.

Practically speaking, for a recorder like the Helder Tenor which plays more than three octaves and a wide range of dynamics, one needs to use a material which effectively supports the air column, meaning that the surface needs to be as hard and smooth as possible. Maarten Helder used rosewood, which for the reasons just specified, was not the best choice due to the many small cracks in the wood. Varnishing definitely helps and we successfully experimented with this on my standard model. However, we wanted to make sure we used the best we could and selected African blackwood which is still first choice in making oboes, clarinets and flutes. It is an extremely hard and dense (almost pore free), heavy, water resistant wood, that is rich in natural ingredients like resins and oils and doesn't shrink when it dries. The new protection status of CITES might make travelling into foreign countries with an instrument made out of this wood more difficult these days, but as long as the instrument is below 10kg and one can show the receipt with clear details that CITES II-legal wood was used, there should not be any problem.

Several factors are likely to have an impact on the wood choice of musical instruments sooner or later, climate change and the resulting changes in the quality of the wood, as well as the goal to reduce the exploitation of our planet. Taking this into account, I would recommend the composite man-made material Grenaditte, which was developed in 2004 by the Taiwanese GUO Musical Instruments Company[212] to resemble instruments made of African blackwood. Its advantages are: light in weight, stable intonation, fast response, expressive sound, indestructible and insensitive to changes in temperature and humidity. In addition, the materials Green LinE developed by Buffet-Crampon[213] and Swiss Ebony developed by Start-up Swiss Wood Solutions[214] are interesting alternatives to African Blackwood.

[211] = *Unbeständigkeit des Holzes*; in: Theobald Boehm: *Ueber den Flötenbau und die neuesten Verbesserungen* (Mainz, 1847), p. 45
[212] http://www.gflute.com/aboutguo/aboutus (accessed 13.05.2019)
[213] https://www.buffet-crampon.com (accessed 13.05.2019)
[214] https://swisswoodsolutions.ch (accessed 13.05.2019)

b) Form and material of the block and platelet

Like the Strathmann recorders and the instruments from the 1930s, Maarten Helder built a cylindrical block for his harmonic tenor recorder which is easier to produce and fit into the instrument but is quite limited when it comes to flexibility in sound and tuning. Therefore, we assumed that the Helder Tenor would gain from an inverted conical air jet, which was standard for recorder making from the baroque period onwards. A tempered windway speeds up the air towards the labium and the instrument profits through a fast response and attack, a good quality in the third octave, more flexibility in sound and more control while using the lip control. One can imagine it that way, it is much easier to manipulate fast air than slow air.

A tapered windway is best to reach through a tapered block and platelet, so Erik Jahn adjusted the mouthpiece, the block, and the platelet for the first prototype. The Sound Unit is an independent mouthpiece and works on any Helder Tenor. Therefore, we could compare our new idea easily with the standard version and got positive results right away. We have already learned that Synpor absorbs liquid without swelling. This is a big advantage for the airtight fit and thus long hours of practicing and performing. However, after approximately one year of intense playing, this material shrinks and becomes porous and needs to be replaced, otherwise the sound quality will completely change (especially within the lowest and highest register). At this stage in the development, we have agreed on using three different blocks and five different platelets for two reasons: so that the material can be spared and used longer, and to have variation in voicings which can be used for special tasks.

If we aim to make instruments especially for these high notes, the voicing can also be set to produce these notes with greater ease than would other equally legitimate voicings.[215] Frederick Morgan

Maarten Helder and recorder company Mollenhauer decided to use three different materials for the platelets on the standard model but didn't include a different voicing to support the respective material. The material itself has only a small influence on the sound

[215] = *Wenn wir Instrumente speziell für diese hohen Töne bauen wollen, kann das Voicing so gestaltet werden, dass diese Töne leichter erzeugt werden können als bei anderen möglichen Voicings*; in: Gisela Rothe: *Recorders Based on Historical Models* (Mollenhauer, 2007), p. 66

and will change its quality from clean to more noisy or airy. The voicing however has an impact on the attack, response, stability, quality of the third octave and balance in the low register. Not using different voicings is in my view wasted potential.

For now, I am still trialling which voicing suits which repertoire best which is of course a personal matter. Other woodwind players can make choices such as selecting the most suitable reed and I find it pretty comforting to just change the voicing rather than the whole instrument for the respective repertoire. Regarding block positions, I can already recommend using a slightly narrowed windway for pieces with a focus on the low register, and a slightly wide windway, also in combination with the lip control, for the third register on. One should keep in mind that, the drier the block and the platelet, the less noise will appear.

Photo 70: *three different blocks and five different platelets*

I am using mainly number 4 for the extended range, number 3 with the focus on the lower register, the Delrin-combination for an excessive use of the lip control.

I would like to mention one more idea of the American recorder player, Emily O'Brien, who is experimenting with interchangeable block surfaces[216]. Two small magnets are embedded inside the block as well as the removable shim which makes them stick together. This enables one to have direct access and to experiment even more with different materials and voicings. At the moment I am using this system to experiment with three different woods (cedar, cherry and ebony), and am quite surprised by the many variations in sound and effects these small pieces of wood create.

Photo 71: *block with interchangeable block surfaces by Emily O'Brien*

On the standard version of the Helder Tenor one was able to change the windway exit by moving the lower part of the platelet upwards by two screws. This had quite an impact on the general timbre, similar to the wide block position, but also resulted in major differences in the instrument's response: hardly any articulation, no third octave, and a lot of air leaked through both screws. Since this mechanism posed a risk to the underside of the platelet and the two small screws built in at the back of the mouthpiece added further complication, we have agreed to leave out this mechanism completely. After consulting with other recorder players who liked using this effect, we are considering building a platelet with a higher roof at the windway exit. Another possibility would be to prepare this part with paper stripes.

[216] http://www.emilysdomain.org/Recorderland/2016/09/01/helder-tenor-experimentation/ (accessed 13.05.2019)

Looking again at the material of the platelet, rosewood is not the best choice except if one likes extremely noisy timbres. We have now chosen Synpor and one platelet made out of African blackwood, which should be warmed up before playing to avoid croakiness. One has to keep in mind, that African blackwood raises the pitch by approximately a quarter tone. Furthermore, Erik Jahn has changed the edges of the platelet. In the standard version the edges were higher on both sides, which caused abrasion of the whole platelet during insertion. Besides that, the platelets made out of wood that swells such as rosewood and blackwood got easily stuck because of this extreme interlinking. Now these edges are smaller for a better fit and handling.

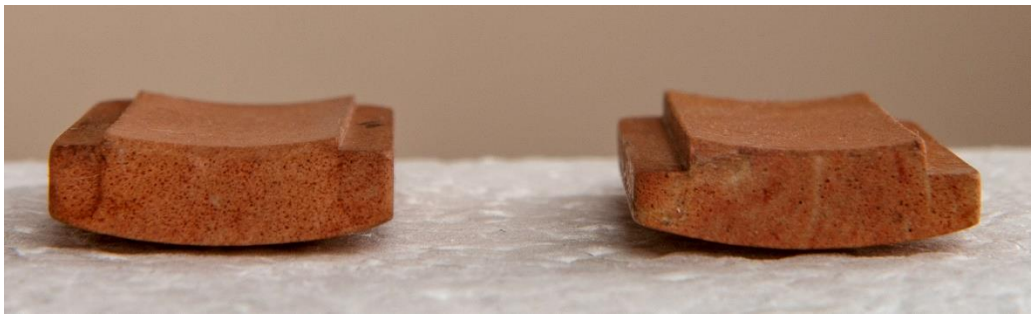


Photo 72: *new platelet in comparison with standard platelet (right)*

c) Extra keys

I have mentioned above the possibility and great potential of forte fingerings in the first register. They are such an enrichment for the recorder's sound world that they are no longer indispensable. Unfortunately, it was not possible to find a forte fingering for the g#1 since this note would always overblow into a multiphonic no matter which additional keys and tone holes were closed. It was clear that we needed at least one extra key for the g# which possibly worked in the first and the second registers. My former teacher, Johannes Fischer, showed me a great forte fingering for the f#1 which didn't overblow into a multiphonic, but needed to be played with the piano key to adjust its intonation. While this is definitely an option, it's not at all logical to perform a forte fingering including the piano key. Because of this, we also agreed to build an extra key for the f#1 that possibly works in both registers and in combination with the f1.

Inspired by the oboe and clarinet, Erik Jahn developed a key for the g# (in first and second registers), which can be played either with the left pinkie finger (8a) or the right index finger (4a). Inspired by different models like the Viennese Csakan and instruments from the 1930s, Erik Jahn developed a key for the f# (0 123 4 6a) in combination with the f1 (0 123 456a) for the right ring finger. This works very well in both registers, though with a slight inconsistency in sound quality between these two notes in the first register. The f# is slightly too flat and therefore needs to be played slightly stronger, which works well in combination with a stronger f1 played with the extra d# key (f1 = 0 123 456a 7a and f#1 = 0 123 46a 7a), though both tones are slightly raised by approximately 10 Cents. A long-term solution would be to move the position of this key upwards. But this would affect the colour and dynamics of the f1 so much, that it no longer could be used for both tones. Another approach could be to leave the baroque fingering behind and go into the controversial German fingering system. One big advantage here would be to avoid uncomfortable fork fingerings and use following fingerings for f1 (0 123 456a) and f#1 (0 123 4). This would have an impact on the whole instrument regarding the tuning though, changing the fingering system throughout, restricting the use of alternative fingerings in the first and second register as well as multiphonics and microtones.

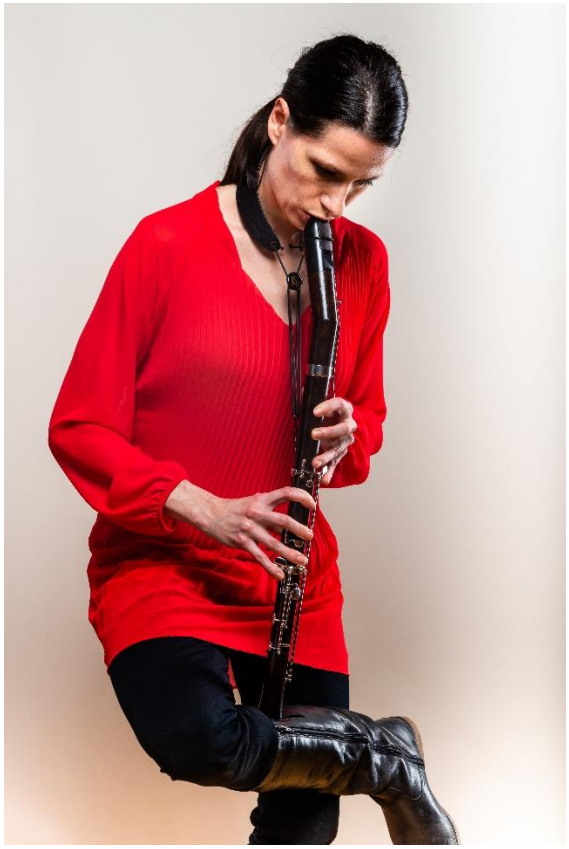
Photo 73: *g# and f/f# key on the Helder-Jahn Tenor*

We have discussed two further key options which were developed and used in the past: the bell key, and a key for the a#. Erik Jahn believes strongly in the musical instrument being a coherent system throughout. We needed to balance the possibilities of further extensions with what would truly add value to this system. Some contemporary woodwind instruments, for example, include keys for one special movement or

connection which is hardly ever used.[217] For systems which are built on many keys, it doesn't matter if there is one key more or less. Adding keys to a system with mainly open finger holes will always have side effects and an impact on the whole instrument, including it becoming heavier and being more susceptible to damage. Although a key for the a# would facilitate legato playing as well as more comfortable trills and tremolos which avoid the fork fingering, it would also negatively influence the third octave which is the most fragile and challenging area to handle. In the end, especially after having studied and performed many contemporary music pieces, we couldn't work out its real necessity and decided not to include it.

Whether or not to develop a bell key was a far more difficult decision to make. On the standard model, I have found a few fingerings which include the closed bottom hole. Not having to close the bottom hole with the knee or calf bone would allow greater agility. Johannes Fischer's modified system provides an interesting example as it has a completely closed bottom hole with a bell key on the side of the instrument. This has a positive effect on the fingerings and the tuning of the third octave since one can make use of both even and uneven partial tones. However, through my growing practice on the Helder Tenor, I have found it quite advantageous to be able to slowly close the bottom hole, as well as close it only halfway to support dynamics and the variety of multiphonics and microtones. To meet all of these requirements would involve the development of a rather complicated key system, and this would again mean more weight and more susceptibility, as well as more challenging key activity for the left pinkie finger. So far, I am happy with our choice to change my standing position to a sitting position when performing a piece where I have to close the bottom hole. Another option would be to put my right foot on my left leg for shorter passages or my right foot on a chair or a small box for longer passages.

[217] For example, the "banana key" for the sixth hole on the oboe.



© Markus Berdux

Photo 74: *playing positions with Helder-Jahn Tenor while stopping the bell*

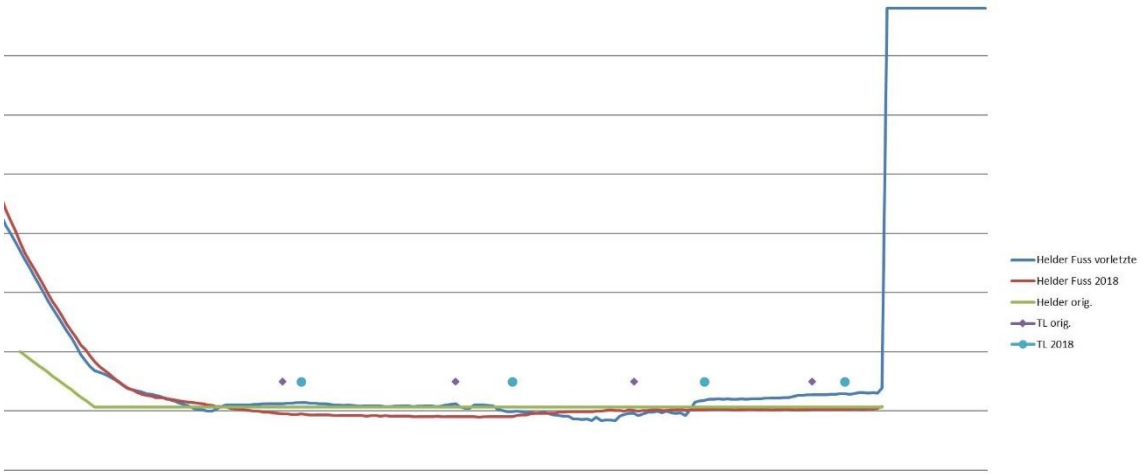
d) New form of the foot joint and new position of its keys

The overall construction of a recorder is based on the interaction of various factors to achieve an optimal sound and response: the bore profile, the position, shape and size of the tone holes, as well as the measure of windway and labium. On early music recorders keys are mainly used from a bass recorder downwards, which means that tone holes must be arranged so that they remain easily accessible for the right-hand fingers. This results in a short bore and therefore in compromises to intonation and sound. For example, the dissatisfying solution using double holes for I and I# as well as II and II# on baroque recorders, leaving the instrument with an extremely weak I# and II#.

The long bore, including an extension note in combination with a sophisticated key system for the right hand, brings decisive advantages to the standard Helder Tenor: the additional note b0, a powerful and stable sound in the low register, better tuning in general, and a relatively balanced third octave with easier fingerings (mainly without closing the bottom hole).[218] During my research I realized that the low register of my standard model was not as balanced as I'd ideally like it: the quality of the c#1 and d1 were weaker and more instable in comparison with the voluminous tone colour of the other notes around them. Besides that, I noticed that I was not flexible in manipulating this particular penetrating timbre of the low register. As soon as I started to use vibrato or the piano key, I experienced quite some limitation.

Erik Jahn agreed with my observations and his goal was to develop a foot joint which creates a full and flexible sound. This was indeed his greatest challenge and it took him several foot joints and endless tone holes to come to following solution: the interaction of a small inverted conus at the top, a cylinder in the middle and an opening at the end. This is a combination of three valuable factors: resistance, volume and opening. The chromatic scale from b0 upwards is now well balanced until d#1. Unfortunately, e1 is often not as rich in timbre as the notes below. This also depends on the voicing and can be easily solved by additionally using the d# key. We have already learned that this key has a positive effect on the second register for the tones g2, g#2 and a2. In the first register it can also be used for the f1, therefore solving the slight imbalance between f1 and f#1.

[218] Fingering charts for standard fingerings and harmonic fingerings on the Helder-Jahn Tenor can be found in the APPENDIX: 8.1.



© Erik Jahn

Figure 13: *standard foot joint in comparison with the prototype and final foot joint*

© Markus Berdux

Photo 75: *foot joint experiments on the Helder-Jahn prototype tenor recorder*

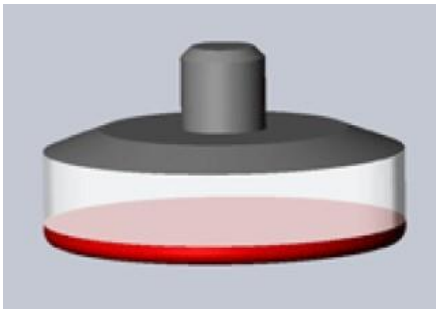
e) Resonance pads

Keypads are an extension of our fingertips and therefore a very personal matter. Already in earlier times instrument makers experimented with different materials like leather, "Fischhaut",[219] cork and silicone. The choice always depends on several questions such as: what kind of instrument is it, are the keys closed or open, and what repertoire does one want to perform on it? It is certainly also a matter of resonance characteristics, sustainability and tightness. Materials such as leather or felt change their characteristics after a while. For example, condensation causes leather pads to become hard and change position which negatively affects the sound.

[219] Skin produced from beef or sheep gut (not fish).

Some woodwind players prefer to close the keys as smoothly as possible. As a recorder player, I am accustomed to closing tone holes without keys, so for me it was important to get as much feedback from the keys as possible. Through my research on this subject, I found a company in Baden-Württemberg[220] which developed the "Quartz-Resonance-Pad" (QRP) *specifically for a better and permanently constant resonance level of woodwind instruments*. These pads have following characteristics:

- *Tightness: airtight closing of the tone hole*
- *Reflection: the reflection of sound waves while the key is open*
- *Impact damping: reduction of noise when closing the key without eliminating the sound vibration.*[221]



© Clarissono

Photo 76: *resonance pads built by Clarissono*

The support layer *consisting of aluminium; it guarantees the absolute evenness of the pad surface and enables a simple padding with every common glue.*

The damping layer *consisting of transparent silicone; cushions the impact on the tone-hole and balances minimal asperities in the tone-hole seat.*

Surface layer *consisting of a special red silicone including 24% of quartz flour; arranges for an optimal tightness and reflects the sound waves to a great extent. The included ferrum oxyd is responsible for a warm and sonorous sound.*[222]

After we tried these pads on my standard model, we learned that these pads do work well for the Helder Tenor's sound world. One can literally feel the resonance while playing and gets direct feedback through the fingertips. This is similar to the feeling of closing the tone hole with only the fingertips. We are now using this material for both open and closed keys. The company expects a life span of approximately 25 years, which means much less maintenance work for the keys.

[220] Clarissono GmbH – Werkstatt für Holzblasinstrumente
[221] http://www.resonanzoptimierung.de/ResoProdukte/ProdukteQRP.html (accessed 13.05.2019)
[222] ibid

3.3.2.2. Intonation

(…) the more regular this mentioned pressure curve (referring to measurements of the wind pressure), *the more balanced will be the intonation of the instrument.*[223]
Elisabeth Delker

Intonation on the recorder is a delicate matter, for the pitch is completely dependent on the air pressure. The more stable the air pressure can be on a chromatic scale up and down, the more balanced the instrument will be tuning-wise. To achieve this means that all finger holes need to be placed in relation to the (in this case) wide bore which would require developing a key system for the entire instrument like for the Boehm flute. I have already explained that we wanted to build on our knowledge of an existing system and to keep seven open finger holes for all the advantages the instrument gains through these seven open finger holes: a wide range of alternative fingerings, all sorts of ornaments with shaded finger holes and sliding finger movements, as well as variation in multiphonics and microtones. Here is our approach to creating a well-balanced recorder with seven open finger holes while accepting slight compromises.

a) Basic tuning pitch

Many recorder players struggle with the basic tuning pitch for several reasons. First of all, the instruments react a lot to temperature and humidity. Besides that, the material can impact the basic tuning pitch, for example, African blackwood raises the pitch. Furthermore, the instrument has to be flexible while being tuned either to a piano, a string quartet or other settings, which all require different tuning systems. German flutist Maximilian Schwedler already recommended in 1910 *to adapt the instrument so that at about 3mm pull-out height of the tenon, the basic tuning pitch is reached.*[224] Therefore, one is able to tune to even higher tuning systems independently of certain conditions and circumstances. The tuning pitch in Europe today is around 443Hz and because we are using African blackwood, Erik Jahn and I agreed on 2mm pull-out height.

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[223] = *(…) je gleichgleichmäßiger die erwähnte Druckkurve* (bezieht sich in diesem Fall auf die Winddruckmessung) *verläuft, desto ausgeglichener verhält sich das Instrument hinsichtlich der Intonation*; in: Elisabeth Delker: *Ansätze zur Untersuchung dynamischer Ausdrucksmöglichkeiten auf der Blockflöte* (Celle, 1984)

[224] = *sein Instrument so einrichten zu lassen, daß erst bei etwa 3mm Auszug des Stimmzuges die Normalstimmung erreicht ist*; in: Maximilian Schwedler: *Flöte und Flötenspiel. Ein Lehrbuch für Flötenspieler* (Leipzig, 1923), p. 35f

b) Metal tuning slide

Making the instrument lower in pitch by slightly pulling apart the head joint from the middle joint has a negative side-effect on the general tuning. The hollow that emerges between these two joints causes the first octave to become lower than the second octave and the instrument becomes strongly imbalanced. Instrument makers and musicians have been well aware of this problem for quite some time. Late 17th century solutions included the use of tuning sleeves or traveling with different middle joints so that the instrument could be adjusted to different tuning systems in various countries and cities. Because this was quite expensive and impractical, the tuning slide was developed in an early stage version by Johann Joachim Quantz,[225] perfected in the mid-19th century[226] and used for flutes, oboes, fagots and csakans. This mechanism allowed a tuning range difference of a quarter tone, which in this case was approximately 435Hz to 446Hz (depending on temperature) and had little negative impact on the general tuning and attack. A tuning slide made out of metal has the positive side effect of greater sound projection. Theobald Boehm chose to remove it *because long experience convinced* him *that the metal parts (...) give the tone a hardness, which many consider as strong, but steal the actual sonorous, singing sound.*[227] In contrast, it is quite an enrichment for the Helder Tenor. A small incident occurred shortly after the metal slide was first fitted – the tenon became loose after playing for a few weeks, but we resolved the problem by using two-phase-glue for a final firm hold.

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Photo 77: *tuning slide of the Helder-Jahn Tenor*

[225] Johann Joachim Quantz: *Versuch einer Anweisung die Flöte traversière zu spielen* (Berlin, 1752), p. 28

[226] Anton Bernhard Fürstenau: *Die Kunst des Flötenspiels* (Leipzig, 1844), p. 6f.

[227] *= da mich eine lange Erfahrung zur Ueberzeugung brachte, dass die metallenen Auszüge (...) dem Ton zwar eine, von Vielen für Stärke gehaltene, Härte geben, ihm aber den eigentlichen sonoren, singenden Klang rauben*; in: *Theobald Boehm's neu konstruierte Flöte* (München, ca. 1834), p. 16

c) Positions of the left-hand finger holes

On the standard model, the balance of the upper first register was not as good as it should be. Therefore, Erik Jahn changed the positions of the thumb hole and the upper two tone holes (left index and middle finger) to bring more balance to b1 (0 1), c2 (0 2), c#2 (12), and d2 (2), which also helps the tuning and balance of following alternative fingerings: b1 = 023, c2 = 123 and c#2 = 0.

Photo 78: *upper finger holes of the Helder-Jahn Tenor in comparison with the standard model (left)*

d) Longer foot joint

The proportion of the foot joint is important for many aspects of the instrument. It especially impacts the balance in the lowest register, overall intonation, and tuning in the third octave and the extended registers. On the standard model, the second register is slightly too high, and one therefore needs to add the extension key (8) for a better tuning of the pitches c2, c#2 and d2. This is not as comfortable and logical as it should be. The longer foot joint now allows one to produce pure overtones on the first five low notes. More information on the shape and measurements of the foot joint follow in the next chapter.

3.3.2.3. Mechanics

Nowadays instrument makers are benefiting from the technical progress of machines and materials and the mechanical components of instruments have therefore become increasingly better. This was why we critically examined what we could technically improve and how we could improve it.

a) Lip control

While learning one of the first pieces written for me and the Helder Tenor,[228] I became aware of the fact that I could only use the lip control in the standard position of the block. As soon as I tried to use it in a wide or narrow block position, the block became either too stuck (within the wide position) or too loose (within the narrow position). This was quite limiting in comparison with the flexibility in dynamics and timbre one gains through the lip control in the standard position of the block. While experimenting, Erik Jahn was able to reduce the general air pressure and therefore gain more flexibility with the lip control by reducing the height of the lower half of the underside of the block exactly at the spot where the piece of soft rubber is placed. Since this was not far enough, Erik Jahn finally managed to maintain the flexibility in all block positions (narrow, standard and wide) through a spring, which is attached at the underside of the block, at the upper side of the soft piece of rubber. Depending on the physical condition of the player, as well as the respective repertoire, one can now freely choose the strength of lip pressure. In my experience with this modification so far, it finally feels natural to use the lip control through the adjustable spring in combination with the thinner and slightly curved mouthpiece.

Photo 79: *spring built at the underside of the block*

[228] Sebastian Elikowski-Winkler: *termini spezzati I* (2013/17), more information in APPENDIX: 8.3. Analysis sheets, 8.7. Video recordings, 8.8. Recital *recorder evolution I*

The material of the spring will need to be changed, since it has already shown signs of use after a few weeks of playing and it broke twice after approximately five months of intense playing. We of course want to guarantee efficiency and long durability, so I am now testing a stainless-steel spring and hope for an improvement. This is also the case with the block screw made of brass. For now, I try to reduce the formation of patina by removing the screw right after playing and maintain the brass with key oil. It is important to regularly remove the screw and let the system dry out. One must remember to lay down the block on the side, otherwise the mechanism is closed and can't dry out.

b) Material of the Sound Unit

The former material caoutchouc discoloured after a while because it absorbs liquids. We are therefore using another synthetic material called Delrin, a material with highest density and elasticity, mechanical stability and durability, which in addition doesn't absorb liquids. We are also using this material for a "combi-block" (Synpor in combination with Delrin) which is recommended for repertoire where one uses the lip control extensively. In my experience, the pure Synpor block shows signs of use very quickly when one frequently uses the lip control because the teeth move the block. I therefore wanted to find a proper solution. The only disadvantage with the combi-block is, that the Synpor part needs to completely dry before being used again, otherwise the sound quality becomes quite dirty and noisy. The new curved form of the block might even avoid the abrasion of the material because of the comfortable fit of the lips, but this still needs to be tested long term.

Photo 80: *Sound Unit of the Helder-Jahn Tenor in comparison with the standard model (left)*

c) Piano key with sickle shape

I have already mentioned above that the piano key was changed from a metal pin to a leather pad when Maarten Helder started to collaborate with recorder company Mollenhauer. This simplification had one big negative side effect: the change in sound and dynamics from a closed to an open hole became quite audible. In addition, the former version which included the pin, couldn't be used effectively throughout the range of the instrument. For example, it had less effect on the lowest register and was only used as a register key in the third octave. Erik Jahn came up with the idea of a different shape for both the key and the hole, which showed positive results immediately. Instead of a round key, there is now a sickle shaped key, which closes a long slot instead of a round hole. This enables one to gradually open and close the hole and therefore avoid sudden changes in the sound quality. Because of the wider opening angle and the bigger volume in general, this key has now a bigger impact on the pitch and therefore enables different opening and closing positions, of course still depending on the register.

Ergonomically it is important that this key lies flat and entirely on the left index finger, because this gives most control over that kind of mechanism. Our idea is to adapt its form and angle to different hand sizes by bending and turning the extension into the respective position. A further idea for big hands is to put a palm key riser, which is normally used on the saxophone. But this still needs to be tested over a long-term period by different players.

Photo 81: *piano keys in comparison*

Maarten Helder, Mollenhauer, Helder-Jahn

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Photo 82: *palm key riser for the piano key*

d) New key arrangement of the right hand

The standard model was built with a diatonic key system. This means that the key for c1 is the outside key and open while not in use (0 123 456 ½7), and the key for c#1 is the inside key and closed while not in use (0 123 4567). Although knowing that the response of b2 and c3 was thereby limited, Maarten Helder saw this as a great potential to have a better grip on the c1 and to be able to finger d3 with Ø 13 46. However, I experienced this as a big hindrance because I was trained on copies of early music instruments (especially baroque recorders) and was therefore used to a chromatic finger movement upwards (c1 = 0 123 4567; c#1 = 0 123 456 ½7). I had the feeling that I lost time and musicality through the extra thinking process. And although I was able to perform with both key systems within one concert, I was not as free and open as I should be while performing a piece of music. On the contrary, I was mainly busy with incredible brainwork. Timing-wise this is manageable while performing solo repertoire, but as soon as I am performing with an ensemble, I must have quicker response.

After several discussions with other recorder players and makers, Erik Jahn and I have decided to change the closed key system into the chromatic key system, which corresponds with the c-foot of early Boehm flutes and which was built by Friedrich von Huene already in the 1960s. Some of the fingerings in the third octave have now to be fingered with 7ac instead of 7ab. Some forte fingerings in the second register have now to be fingered with 7a instead of 7ac – both being an advantage in my opinion.

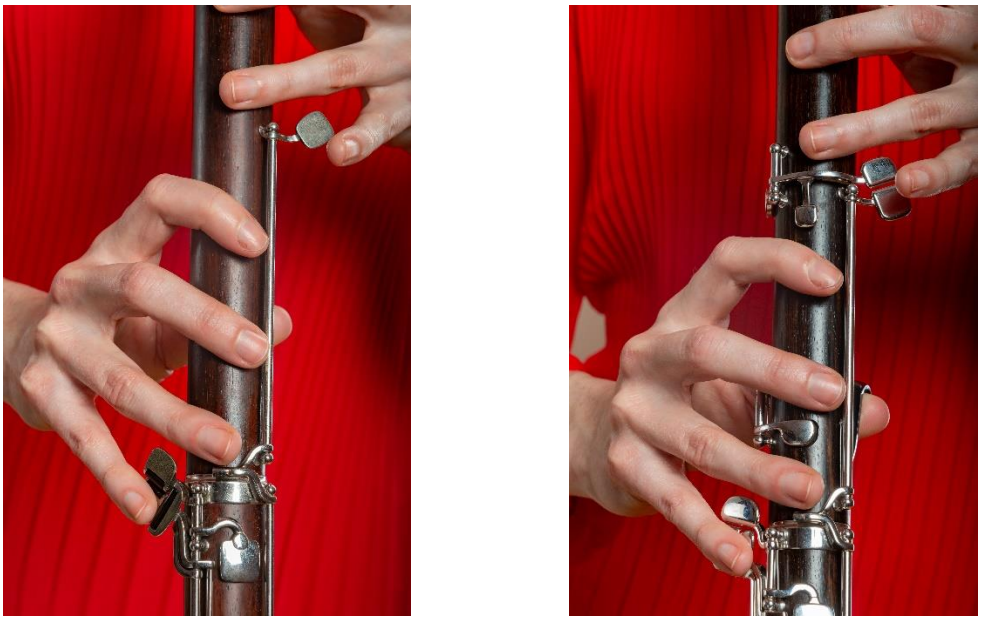

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Photo 83: *new key arrangement of the right hand on the Helder-Jahn Tenor in comparison with the standard model (left)*

e) Connection to foot joint

On the standard model the connection from the middle joint to the foot joint was quite instable because of the relatively short tenon. Thus, the foot joint was slightly tilted, and this created a certain degree of insecurity. Erik Jahn has now made a longer tenon, which stabilizes the instrument and brings it into physical balance. This positively affects the essential airtight fit and therefore the stabilization of the air column.

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Photo 84: *long and short tenon in comparison*
standard Helder Tenor and Helder-Jahn Tenor

3.3.2.4. Ergonomics

The idea was to improve the playing position and to create more comfort and flexibility while playing. For me it was difficult to stay in an upright posture while playing on the Helder Tenor. This had some negative effect on my sound as well as on my back. Besides that, I tended to tighten my fingers of both hands, especially the left ring finger (because of the big stretch between hole 2 and 3) and my right thumb (because of the small holding angle), right ring and pinkie finger (because of the position and arrangement of the keys). Playing on an instrument which uses the technique of leaking fingerings in the third octave, one needs to feel the resonance underneath the fingertips. Therefore, it is important to have as little tension in the fingers as possible. This helps one know which finger must shade a specific finger hole a little more or a little less.

After critically examining the whole instrument, knowing that several factors are related to each other and will influence each other, we came up with following improvements:

a) A **bent head joint** for an upright playing position and less stretch in the right arm. This helps to prevent unnecessary tension and pain within the fingers of the right hand and the right arm. Bent recorder head joints have been commonly used for bigger sized recorder models since the 1930s. The advantage here is to balance a recorder with more weight and to blow directly into the instrument's mouthpiece instead of a tube.

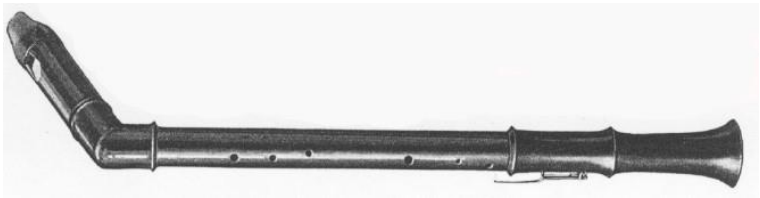

Photo 85: *bent (knick) bass built by Johannes Adler (1937/38)*

We experimented with different angles and were confronted with various negative side effects, like for example a narrow arm position, which closes the chest and creates tension in both wrists. We finally got our inspiration from the soprano saxophone, which occasionally comes with two different necks – one is straight,

and the other is a little bent. While the bent version affects the sound on the saxophone, this has no impact on the recorder.

© Susanne Fröhlich

Photo 86: *experiments with bent head joint*

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Photo 87: *playing position of Helder-Jahn Tenor in comparison with standard Helder Tenor (left)*

Another advantage is the short distance from the upright playing position to the playing position into the window. This might help for some pieces, where this movement has to be quite quick. With the bent head joint, one only needs to turn

the wrists instead of both arms plus instrument into the playing position of a modern flute.

© Markus Berdux

Photo 88: *playing position while blowing into the window on the Helder-Jahn Tenor*

b) A **thinner and slightly longer mouthpiece** for more comfort in the embouchure and a different angle of lip pressure for a better leverage effect on the lip control. The blowing angle must be as frontal as possible to have most control over this mechanism. We had to decide how far we could go, for at a certain point the material would be too thin and therefore too fragile to withstand greater pressure. In the end we reached the best result by also changing the underside of the upper part of block to a slightly curved form. This enables one to use the lip control not only by putting the lips over the teeth and therefore changing the general playing position, but also by just pressing the lips together.

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Photo 89: *beak of the Helder-Jahn Tenor in comparison with the standard model (left)*

© Markus Berdux

Photo 90: *three blocks in comparison*

standard Synpor, Combi block, curved Synpor

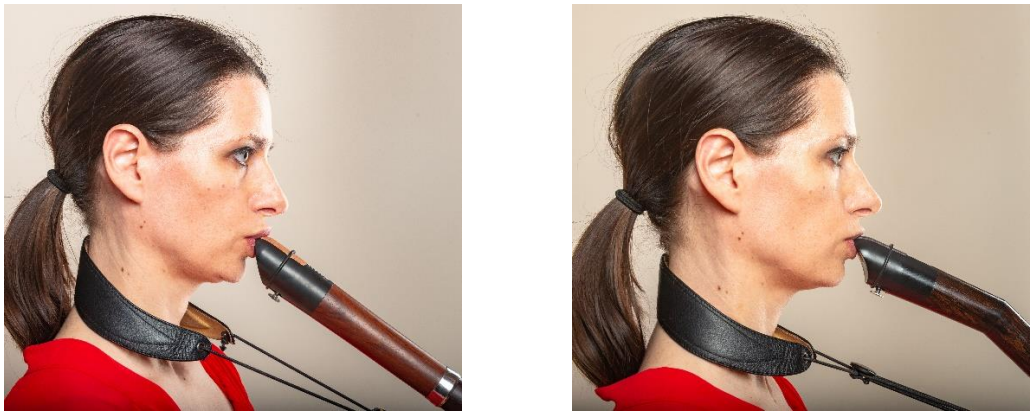

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Photo 91: *lip positions in comparison, also while using the lip control (below)*

Standard Helder Tenor (left) and Helder-Jahn Tenor

c) A **thumb bushing**, which is slightly raised on the inside to avoid condensation running into the thumb hole. This can happen both in rehearsal and during a performance and complicates playing in high registers. This problem doesn't only affect recorder players and we based this idea on oboe and clarinet register keys.

In general, a thumb bushing helps to reduce abrasion of the thumb hole. It is used quite often today, although rarely with the raised inside for recorders.

© Markus Berdux

Photo 92: *thumb bushing of the Helder-Jahn Tenor*

d) A **neck strap** made from rubber for a flexible playing position along with free and natural movements with the instrument. The position of the hook is now higher than before. That way the instrument stays in balance also while hanging on the strap. This is quite useful, as soon as one needs to take notes on the score and doesn't have time to put the instrument away. Saxophones and clarinets do have this higher position as well.

© Markus Berdux

Photo 93: *position of the neck strap's hook of the Helder-Jahn Tenor in comparison with the standard model (left)*

e) The **position of the third finger hole** is shifted outwards even more towards the left ring finger to prevent unnecessary tension and to provide more flexibility for the left hand. This is quite common in recorder making (especially on larger instruments) but is sometimes left out completely or only built with a slight shift for aesthetic reasons.

Photo 94: *position of the third finger hole on the Helder-Jahn Tenor in comparison with the standard model (left)*

f) A **thumb rest** which is adjustable in height and angle so that one is flexible to choose a new position every day. In addition, we lifted the thumb rest so the distance between right thumb and the upper fingers is bigger. This means less tension on the right hand in general as well as more flexibility and speed for the upper right-hand fingers. This thumb rest is normally used on the saxophone, now being extended with a plinth for the Helder. On my standard Helder Tenor I am using a thumb rest of the clarinet made out of rubber on top of the metal hook.

Photo 95: *thumb rest of the Helder-Jahn Tenor in comparison with the standard model (left)*

g) A **curved shape for each key** to be able to move easily from one key to the other without rollers. On the one hand this means less noise and less maintenance work. On the other hand, it requires a different playing technique. Here it is important to use as little pressure as possible and to use a sliding action from one key to the other. Through my growing playing experience on this model, I've realized that we still need to find a better connection from key 7a (d#) down to 7b (c#). We can probably solve this by curving 7b even more, but this needs to be matched with the finger movement upwards. Besides that, the combination of key 8a (g#) and 8b (b) is critical. The motion sequence of 8a is fixed, whereas the motion sequence of 8b is variable through the connection to the foot joint. As soon as one changes

this position, the height of key 8b changes and therefore also the height of movement. Since both keys are rarely used together, it is not that urgent to find a solution right away, but it would certainly be worth looking into this displacement in the future.

Photo 96: *shape of the keys of the Helder-Jahn Tenor in comparison with the standard model (left)*

4. Exploration of a new potential of the recorder in an aesthetic and technical sense

Not without reason does one call making music "playing". The real play is insolubly connected with the creative risk of experiment.[229] Michael Vetter

When I began this research project, I only had a small idea of what exactly the new potential of a recorder in the 21st century could be. Since no one has ever attempted to examine this incredibly broad area in all its details, I was keen to explore the full potential of the Helder Tenor and document as much as possible. Recorder player Johannes Fischer gave me the initial impulse through his own research on this instrument which he began in 1995. From there I could begin my own journey and trace the recorder's new and contemporary voice. Ideally, I wanted to look at the Helder Tenor from as many angles as possible, so I have chosen a case study approach which I divided into four categories: original repertoire, repertoire for regular tenor recorder, transcriptions of pieces for contemporary woodwind instruments and new commissions. In each respective case study, I focus on both solo and ensemble pieces.

4.1. Helder Tenor repertoire

The recorder is undergoing an emancipation process. The instrument is revolutionarily modernized, and there is more and more repertoire.[230] Frits van der Waa

This chapter is focussed on original Helder Tenor repertoire, from its beginnings until today. My main goal is to give an overview of what already exists and what we can build our future repertoire on. Since 1995 there have been 67 works[231] written by composers from 16 different countries, including 28 solo pieces (eight pieces with electronics, six

[229] = *(…): nicht umsonst nennt man die Praxis des Musizierens „Spiel". Mit dem wirklichen Spiel unlösbar verbunden aber ist das produktive Wagnis des Experiments*; in: Michael Vetter: *Il flauto dolce ed acerbo* (Celle, 1969), p. 8

[230] = *De blokfluit ondergaat een emancipatieproces. Het instrument wordt revolutionair gemoderniseerd, en er komt steeds meer repertoire*; in: Frits van der Waa: *De blokfluit begint nu echt modern te worden* (Volkskrant 01.07.1998)

[231] A list of all pieces can be found in the APPENDIX: 8.2.1.

pieces with dance), 38 ensemble works (from duet to nonet) and one orchestra work. All pieces were dedicated to or written in close collaboration with a recorder player; Rachel Barnes (2), Johannes Fischer (24), Carolin Elena Fischer (2), Susanne Fröhlich (17), Joseph Grau (3), Marie Kalender (2), Paola Muñoz M. (10), Dorothee Oberlinger (2), Emily O'Brian (3), Gudula Rosa (1) and Walter van Hauwe (1). The result of this kind of collaboration depends very much on the generation, background, country, cultural imprint, expertise, style and taste of the composer and the performer. The closer the collaboration, the stronger the outcome of a piece written specifically for the Helder Tenor. But what exactly does this mean and how is this different to any other contemporary recorder piece?

4.1.1. Analysis sheets in comparison

To answer these questions, I developed an analysis sheet[232] to evaluate the Helder Tenor repertoire, as well as to learn more about a new performance practice and new playing techniques. Each sheet includes information on one piece written for the Helder Tenor, a detailed description of the techniques used, followed by a conclusion.

A short explanation for each category is listed here:

- *range*: to find out how much the extended range is being used, starting from b0 up to notes higher than g3.
- *use of extended second, third and fourth registers*: to find out how much the extended registers can be used. They are important for musical phrasing, chromatic lines, legato playing, wide intervals, glissandi, trills and tremolos. Never notated, the performer can choose freely when to make use of the them. The first three are the most common, but the higher registers are slightly extended as well (see my list for trill combinations in chapter 3.1.1).
- *dynamics:* to find out how they are used in general throughout the piece, as well as within quick changes and in the first and third octave (the border areas).
- *timbres*: to find out about the Helder Tenor's new dimension in timbres through its new bore, extended key system, extra piano key and the new block system. Only a few composers define specific fingerings for an alternative instead of the

[232] All sheets can be found in the APPENDIX: 8.3., their summary in the APPENDIX: 8.2.2.

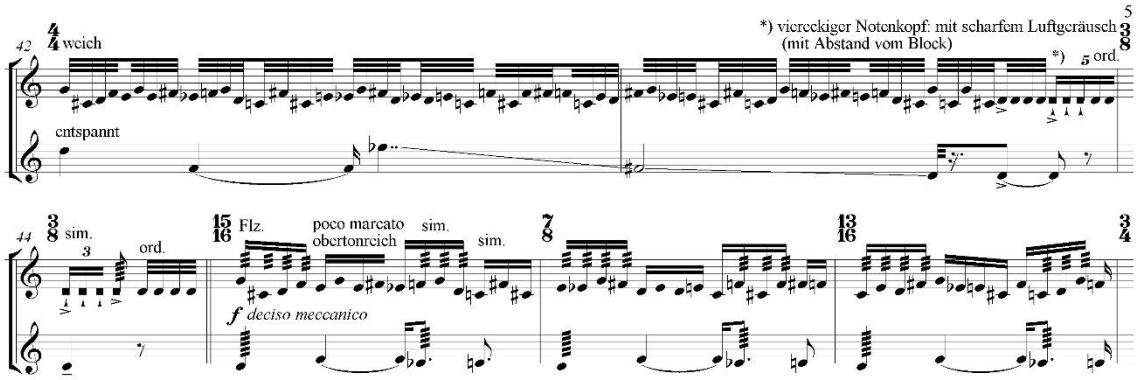
standard fingering, so in most of the pieces the performer has a free choice of colour fingerings.

- *ornamentation:*[233] to find out which ornaments are used and possibly extended through special Helder Tenor features.
- *glissandi*: to find out if they are being used throughout the range and therefore through the extended registers of the Helder Tenor or for small intervals through the piano key.
- *multiphonics:* to find out if specific fingerings are being used and if the different qualities are explored and mentioned.
- *microtones:* to find out if specific fingerings and the piano key are being used.
- *air sounds*: to find out if there is an increase in the types of air sounds used due to the new block system.
- *vibrati*: to find out how they are used and maybe extended through special Helder Tenor features.
- *circular breathing*: to find out how and if this technique is being used, and very importantly, in which octave and in which dynamics.
- *articulation*: to find out if there are new types of articulation due to the new block system.
- *legato playing*: to find out if it is being used throughout the range and therefore through the extended registers.
- *flutter tongue*: to find out if the different types are mentioned and if there is further development through the new block system.
- *preparation*: to find out if different block positions have been suggested.

Through my analysis of this repertoire, I was able to summarize information about the musical material, performance practice and playing techniques and conclude the following:

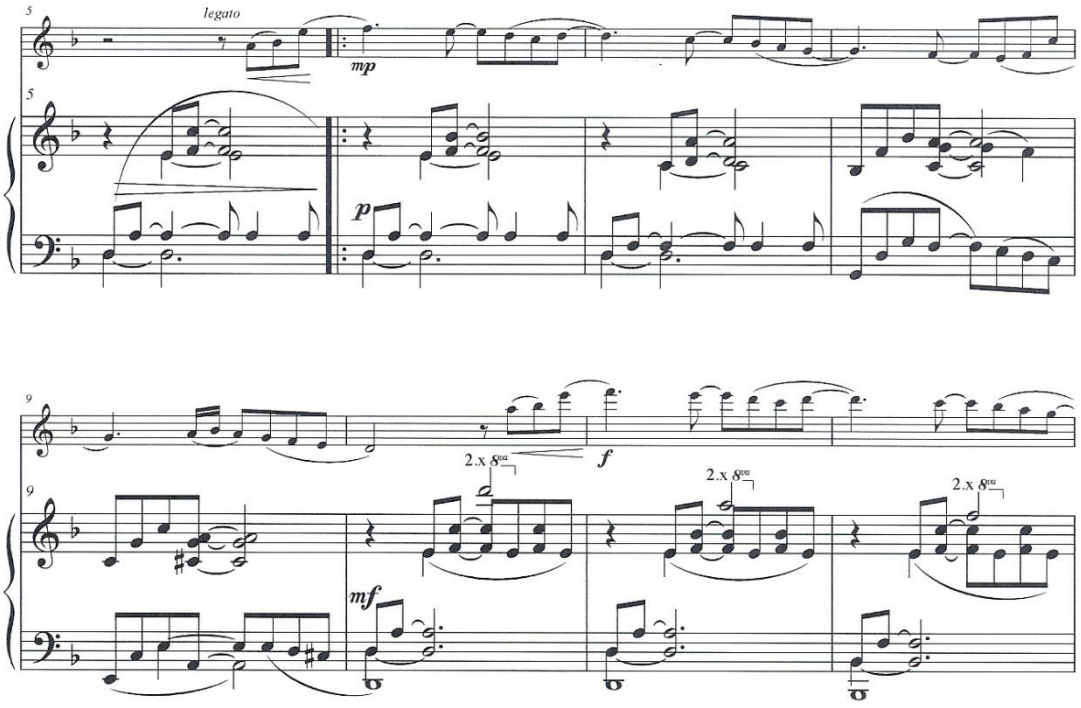
Five of the 67 works were not specifically written for the Helder Tenor even though they were premiered on this model. Because these five pieces don't make use of the extended range and registers, extreme dynamics or specific playing techniques, they are not included in my calculations below.

[233] Any kind of ornamentation, from traditional up to the present day.



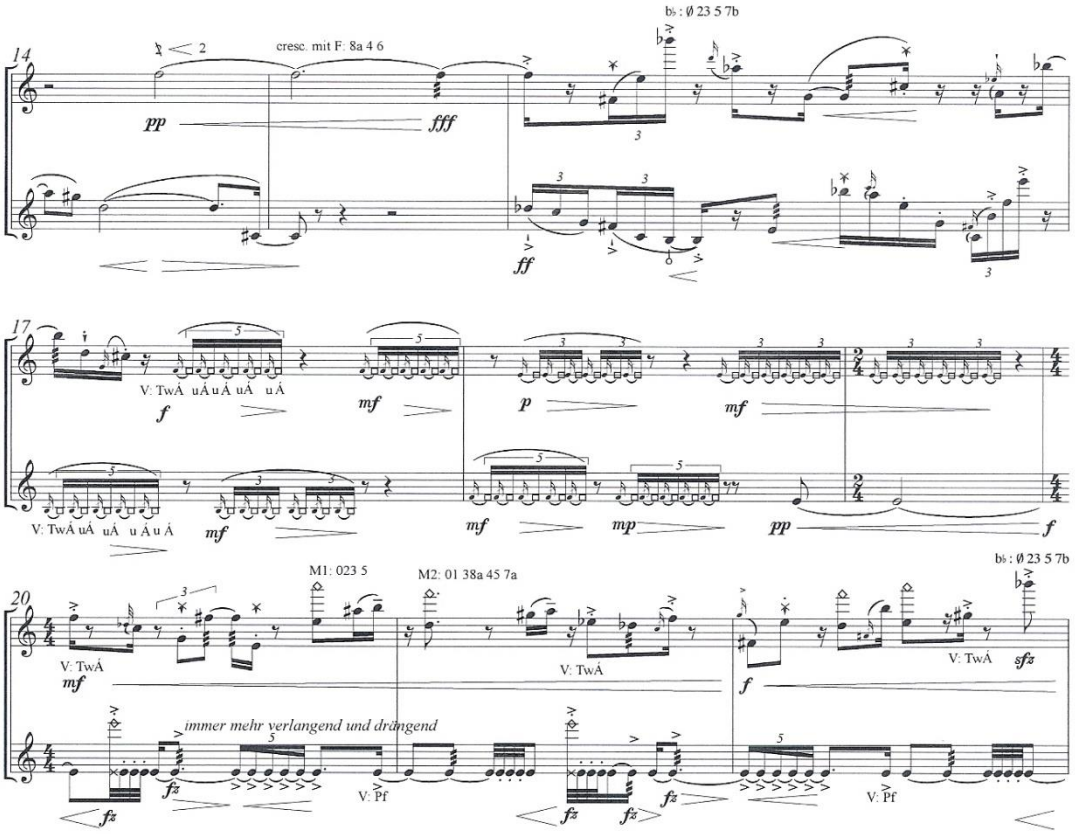
Jorge Sánchez-Chiong: "final girl – the beginning" (2008)

Another five of the 62 remaining pieces could also be performed on other contemporary tenor recorders but would lack a variety of expression and are therefore included in my calculations below.



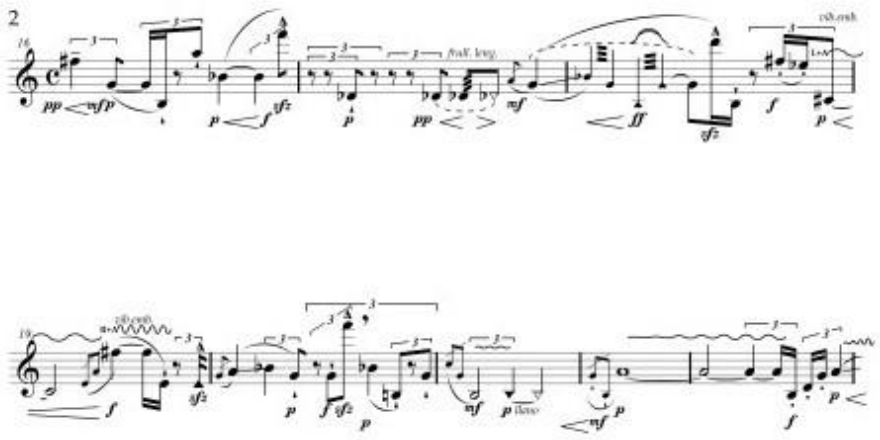
Peter Przystaniak: "On the Ocean" (2009) for Helder Tenor and piano

A few pieces were written for the Helder Tenor without mentioning this instrument in the score. This is quite common as composers want to ensure that their music is being performed as much as possible. They chose to accept performances on any recorder model and therefore accept compromises in the performance.



Karel van Steenhoven: "Sturm und Drang" (2014) for Helder Alto and Tenor

In most of the recorder repertoire we know to date, this freedom to choose an instrument doesn't cause too many problems. However, the pieces written specifically for Helder Tenor will work on the Helder Tenor only. Its new potential and special features were used from the first pieces onwards and continued to grow with the evolving expertise on this instrument.



Esteban Correa Astudillo: "Y de un brote otra plegaria" (2007)

It is striking, that the focus on expression and its true realisation is generally quite high in the Helder Tenor repertoire. In 89% the extended range and in 90% the extended registers are used throughout. In 97% extreme dynamics play an important role, including examples such as *forte/fortissimo* (and more) within the first octave, *piano/pianissimo/niente* in the third octave, quick changes like *ff-pp*, and strong/fast *crescendi* or *decrescendi*. Even though extreme dynamics might be notated in other pieces for standard recorders, recorder player and composer Benjamin Thorn specifically points out that *far too many composers write for the recorder as if it was a flute and then wonder why this music doesn't work.*[234] Although this clearly happens often, some of these works should be viewed differently as they are visionary and boundary breaking. The new potential and special features of the Helder Tenor have been used in 58% of these pieces with a gradual rise in use. These different forms of expression are often impossible to realize on copies of original recorder models. Having an instrument on which one can actually perform what is written in the score and even being able to add a few more special features, is very satisfactory for the performer and enriches the whole performance and its overall perception. Thus, it expands contemporary recorder performance practice due to the following features:

- The *principle of pure harmonics* means that the instrument is well-balanced throughout the whole range. One can use pure harmonics to extend the second, third and fourth registers, as well as play softly within the third octave.

[234] Benjamin Thorn: *"New" sounds from old pipes* (The Recorder No 10, 1989), p. 5

- The *flexible block system* allows one to instantly perform with different voicings on only one recorder by moving the block up or down to change the size of the windway. One can also change the voicing by experimenting with different shapes and materials of platelets and blocks. This is a big shift for recorder players who are trained to perform on a variety of recorder models, which differ in design, size, material and tuning.
- The *lip control* is revolutionary and brings a new dimension to timbres, soft dynamics and the shaping of note endings.
- The *piano key* enables one to perform smooth dynamics and to stabilize the third octave.
- The *extended key system* offers a well-balanced, chromatic low register and a big variety of colour fingerings throughout the range.

In total, I have found 15 new specific playing techniques on the Helder Tenor. A detailed description can be found in chapter 4.5.3. They are listed here in order of chronological appearance and include my latest findings as well:

- *pure harmonics* in "Ssi" by Eun Jung Kong (1995)
- use of *lip control* in "Lob des Schattens" by Christopher Dell (1996)
- *circular breathing with lip control* in "Voices-faces-nowhereland" by Toni Völker (2000)
- *wide windway* in "Voices-faces-nowhereland" by Toni Völker (2000)
- *Rauschton* or *white noise tone* in "Link" by Jörg Partzsch (2000)
- *lip vibrato* in "Owl Woman" by Valerie Mainwood (2001)
- *quiet multiphonic* in "Opera MESAS" by Sebastián De Larraechea (2008)
- *fade in fade out-articulation* = <> in "BecAvec" by Cristian Morales Ossio (2011)
- *block clicks* in "Die gläserne Flöte" by Gerhard Braun (2013)
- *narrow windway* in "termini spezzati 1" by Sebastian Elikowski-Winkler (2013/2017)
- *granular tones* in "Matters of fact" by Cristian Morales Ossio (2015)
- *hiss articulation* in "Immagine fenicia" by Salvatore Sciarrino (2000/2017)
- *different shapes and materials of the block* in "Semaphor" by Susanne Fröhlich and Gerriet K. Sharma (2018)

- *different shapes and materials of the platelet* in “Semaphor” by Susanne Fröhlich and Gerriet K. Sharma (2018)
- *breathing out through the mouthpiece with closed windway* in “Semaphor” by Susanne Fröhlich and Gerriet K Sharma (2018)

In the following sections I discuss the Helder’s new technical and aesthetic potential in more detail. Though, for a better understanding, I will first introduce you to my notation system which I have specifically developed through my research and in consultation with other recorder players. This enables me to fully grasp the new system and to make annotations quickly and immediately.

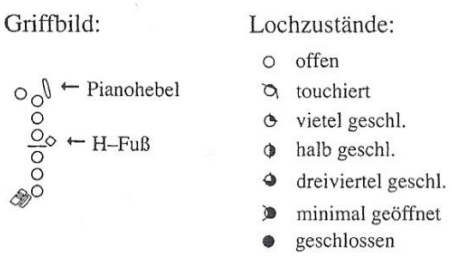
Lip control = +lip or –lip
Piano key = +Ⓟ or –Ⓟ
Thumb hole = 0
Left index finger = 1
Left middle finger = 2
Left ring finger = 3
Left pinkie finger = 8 or 8a (g#) and 8b (b) for Helder-Jahn Tenor
Right index finger = 4 or 4a (g#) for Helder-Jahn Tenor
Right middle finger = 5
Right ring finger = 6 or 6a (f#/f) for Helder-Jahn Tenor
Right pinkie finger = 7a (d#), 7b (c) and 7c (c#) or 7a (d#), 7b (c#) and 7c (c) for Helder-Jahn Tenor
Bottom hole = 9
First register = I
Second register = II
Third register = III
Fourth register = IV
Fifth register = V
Sixth register = VI
Seventh register = VII

Block position = 12h (standard windway[235]); +6h (wide windway[236]); -3h (narrow windway[237])
Forte fingering = +
Alternative fingering = x

4.1.2. Gerhard Braun – *Grenzgänge* (2006) for solo Helder Tenor

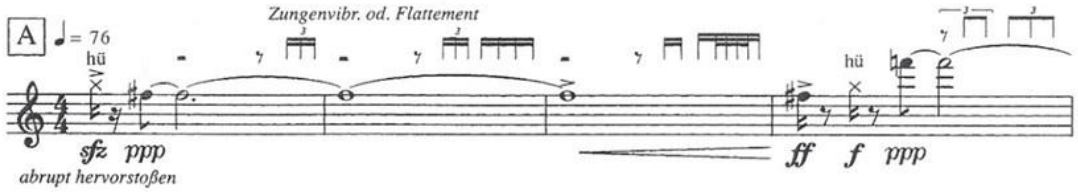
Besides his career as flutist and composer, Gerhard Braun was also a recorder player and one of the first pioneers and explorers of contemporary recorder music and contemporary playing techniques. He has left an incredible oeuvre which includes works for different playing levels, recorder models and settings. In the preface for his piece "Grenzgänge" he points out the main differences between recorder models, which were built after baroque models in the first half of the 20th century, and the Helder Tenor, which was still quite new at that time. He was especially interested in its extended range, dynamic range in all octaves, and variety in multiphonics. Trying to push forward into the border areas of this new instrument, he collaborated with recorder player Johannes Fischer, who has been exploring the Helder Tenor ever since its development. His recording made for Gerhard Braun's second portrait CD on "Skywalk records" is included in the appendix.[238]

Looking more closely at the score, the instruction page[239] already indicates that something is different with this instrument. The specific Helder fingerings, including the piano key and the two extra keys for b and d#, as well as the precise description of seven different closing positions of a finger hole which one needs to perform this piece, literally show its advancement and new potential.

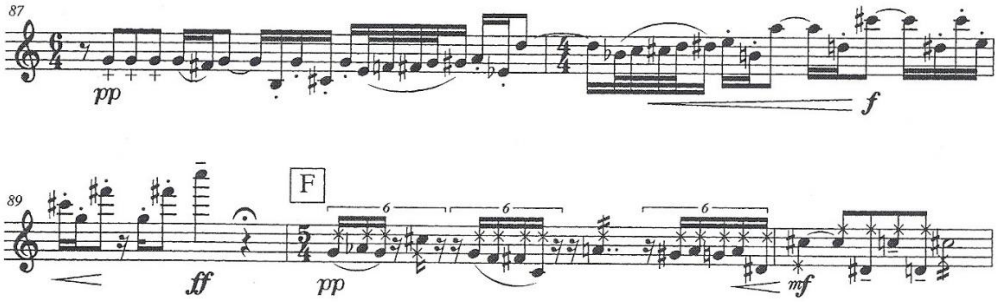


[235] This will differ from player to player and instrument to instrument.
[236] Half circle turned clockwise.
[237] Three quarters turned counterclockwise.
[238] APPENDIX: 8.3. Analysis sheets
[239] Score "Grenzgänge" (Edition Gravis, Berlin, 2007), p. 2

Looking at the first line on the first page of the piece,[240] one immediately enters the new sound world of the Helder Tenor: the performer must play f#'' from "ppp" to "ff" followed by f''' in "ppp". Musicians performing on classical contemporary instruments won't be impressed by that at all, but for recorder players this is absolutely revolutionary to perform.

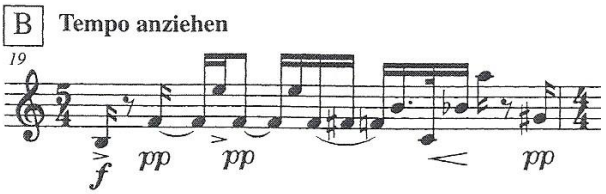


In general, Gerhard Braun works with an extended range from b0 to c4. While c4 only sounds once at the very climax of the piece (bar 89), b0 is used quite regularly in various dynamics, at the beginning or ending of phrases, within a wide interval or as a cambiata, repeated, accentuated, staccato or slurred.



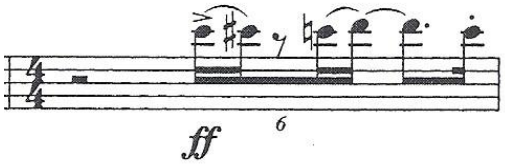
Although not specifically requested by the composer, one can make use of the extended second, third and fourth registers:

- to make wide intervals sound as smooth as possible

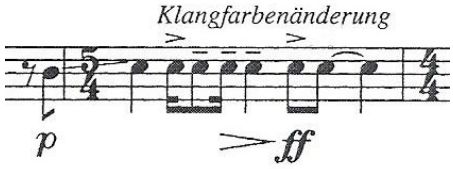


[240] Score "Grenzgänge" (Edition Gravis, Berlin, 2007), p. 3

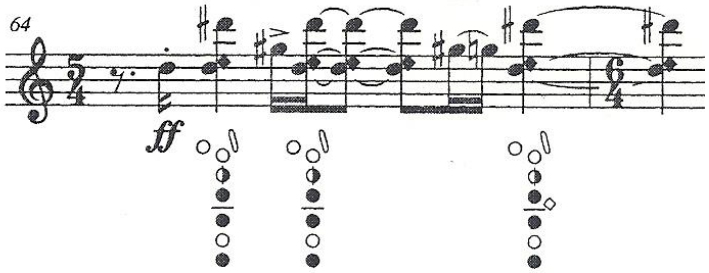
- to play legato despite a register change



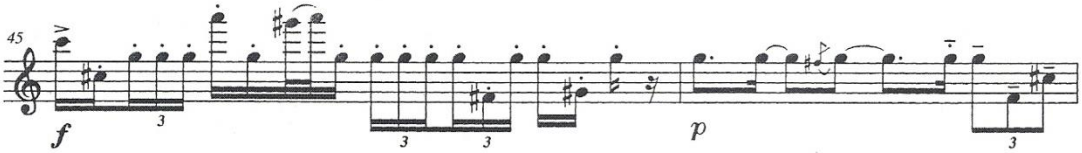
- to vary timbres



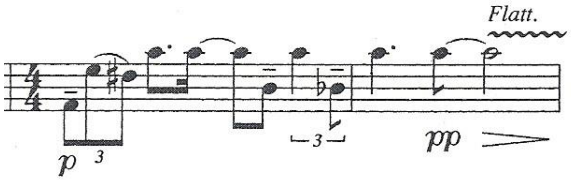
- to maintain the same dynamics and energy



- to change dynamics



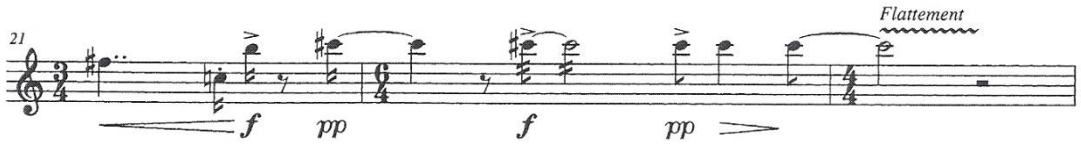
- to play with the lip control



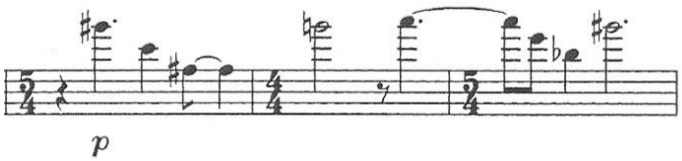
Regarding dynamics, Gerhard Braun uses quite an extreme range throughout the piece, challenging both performer and instrument. I want to especially highlight the quick changes, as well as the very soft dynamics in the third octave. For regular tenor recorder models this is impossible. For the Helder Tenor, it is still quite difficult to perform, but

manageable through a combination of lip control, piano key, extra keys and the principle of pure harmonics. Here is a brief overview:

- dynamics in general: ppp – ff
- quick changes: sfz-ppp, f-p, ff-pp
- dynamics in the first octave: ppp – f
- dynamics in the third octave: ppp – ff



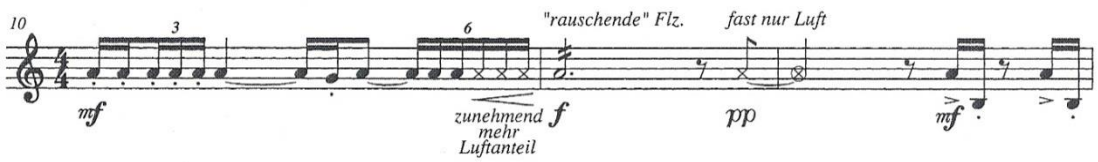
quick changes



soft third octave

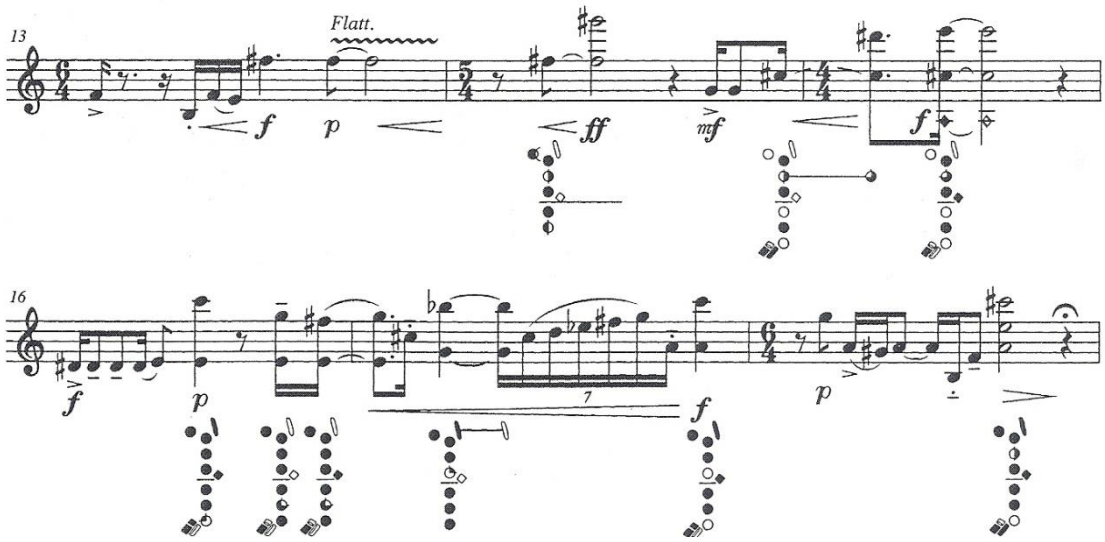
Within the score I have found a few special features, which are listed here in order of appearance:

- *white noise tone* on a1, which is nicely embedded between an airy flutter tongue on a1 and a crystal clear, accentuated a1. On a regular recorder one is only able to create the air noise outside of the instrument at the windway entrance. Through this technique the air noise blends very well with the pitch and the volume can be regulated by the tongue.



white noise tone

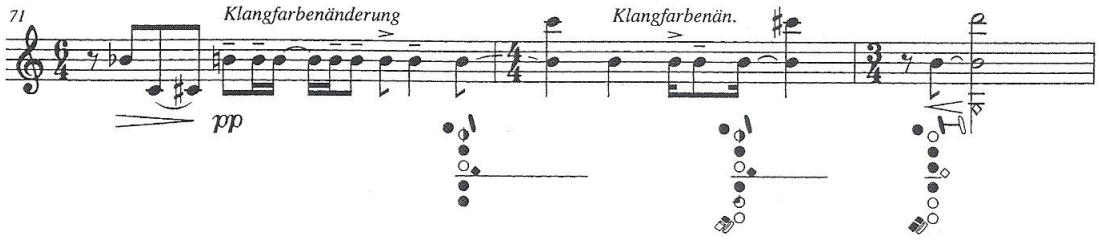
- playful variations between *harmonic* and *disharmonic multiphonics*, which are slickly integrated into the music. The main difference lies within the tonal structure of the multiphonics: *Harmonic* means a wide and rich spectrum of overtones produced by overblowing; *Disharmonic* is also known as *beating multiphonic*, which means that a dissonant note is added to the bottom note by overblowing a certain fingering and therefore a vibration starts to sound between the two dissonant pitches (very often a sept or none).



harmonic and disharmonic multiphonics

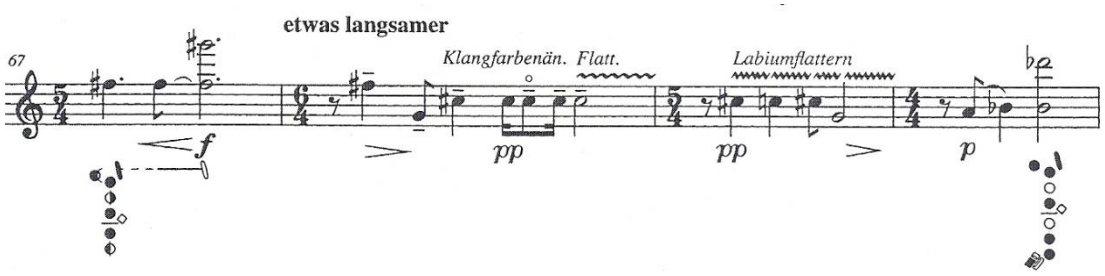
- *colour fingerings* are one of the most interesting, special features of the recorder[241] because of their many variations and clear audible nuances. On the Helder Tenor one can produce more extreme differences from d1 upwards because of its new bore and the extra keys, including the piano key. One needs to be careful though on the three keyed bottom notes – here variations are only possible through the lip control and the piano key. Gerhard Braun uses this sound quite effectively in contrast to melodic expressive lines and multiphonics or in combination with flageolets, finger vibrato[242] and air flutters.

[241] Any recorder with open tone holes.
[242] Here called *Flattement.*



colour fingerings

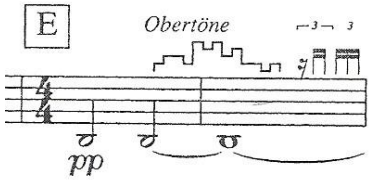
- *air flutter*[243] is an effect, which can be produced on any recorder by putting one of the right fingers slightly above the window at the lower end of the windway. One can only perform it by using soft dynamics and by fingering one half tone higher than notated to keep the actual pitch. With the Helder Tenor one can keep the notated pitch by pressing the piano key instead.



air flutter

- *overblow into pure harmonics* can be only used on recorders which are based on the principle of pure harmonics. This effect is used here in a distinctive moment, close to the end of the piece after a long silent fermata (the first one in this piece) and just before the build up towards the climax. Because this passage is, slurred one needs to be careful with slightly changing the fingertips[244] in combination with the slight raise in air pressure. The tongue position should change from dark vowels like “o”, “u” and “a” to lighter vowels “e” and “i”.

[243] Here called *Labiumflattern.*
[244] See my list for harmonic fingerings in APPENDIX: 8.1. Fingering charts



pure harmonics

4.1.3. Marko Zdralek – ***Strandgut*** **(2018)** for Helder Tenor, violin, baritone and piano

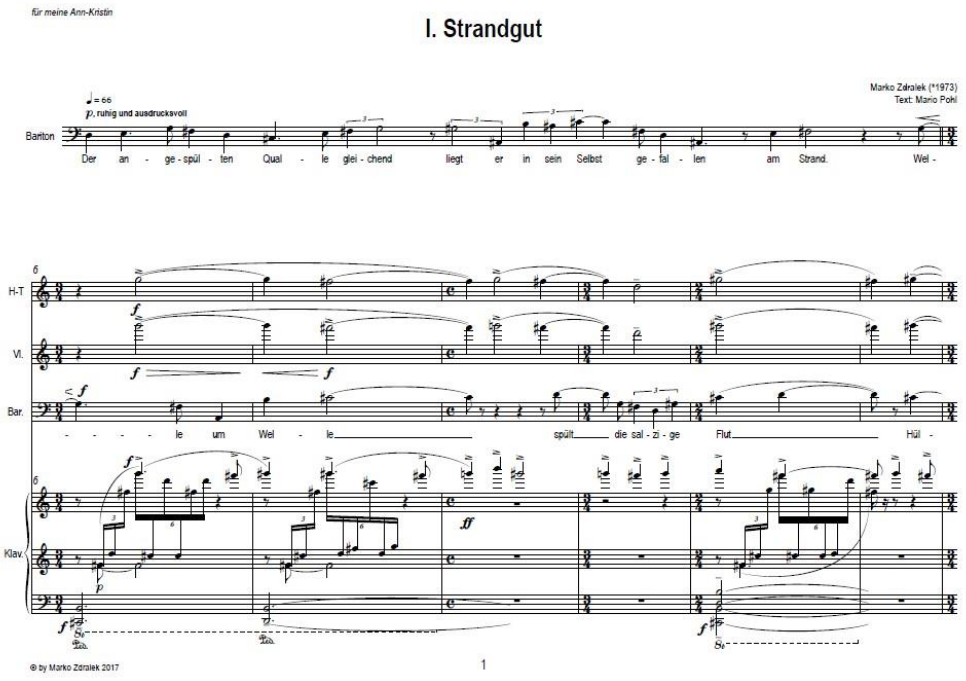
This piece was written for the Fischer family[245] and premiered[246] at the festival of contemporary music "Zeitströme" held at the Akademie für Tonkunst Darmstadt, where both Johannes Fischer and Marko Zdralek teach. This tense work full of strong and colourful contrasts, is based on three rough, partly absurd, pictorial poems written by Mario Pohl. They are part of his poetic collection "Strandgut"[247] written for his father in law Johannes Fischer. Thematically these poems are linked to each other through one motive, which appears in all three texts, representing different dimensions of water, from its destructive power to its purifying effect.

The setting of a classical music ensemble plus (Helder Tenor) recorder is still quite exceptional today and therefore the reason for this analysis. Throughout the whole work the composer uses the colourful richness and dynamic impact of all instruments to support his interpretation of the poems. Just by looking at the score it is remarkable how much they are treated as equals, especially the Helder Tenor part, which is written like a duet with the violin in all three movements.

The first movement called "Strandgut" is about transience and elaborates the destructive side of the water. While the singer tells the story and describes a certain image at the seaside, the piano takes over the multi-faceted flow of water, and both top parts (recorder and violin) express the big drama of the story. Long lines played in octaves (recorder as the lower octave) in constant "f", deeply expressive, broad spanning cantilenas in "pp" within two octaves that blend with harmonics on the violin, "fp" accents within three

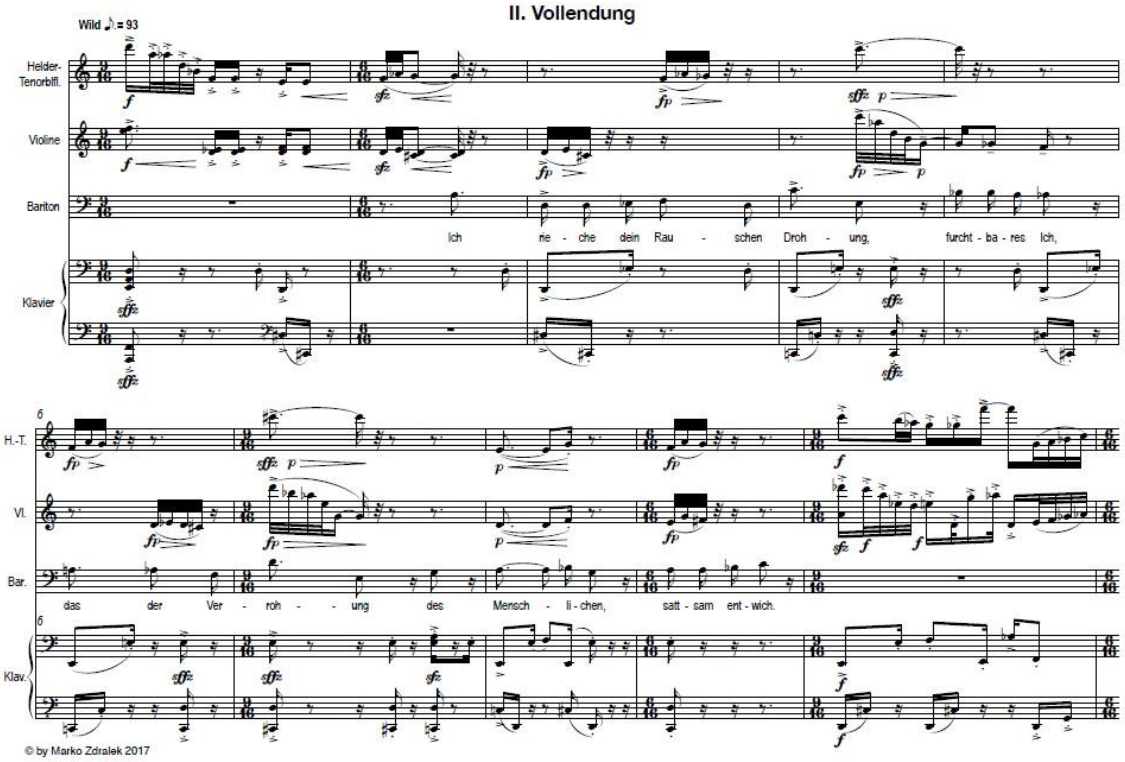
[245] Christian Fischer (baritone), Johannes Fischer (Helder Tenor), Sophia Fischer (violin) and Adrian Fischer (piano)
[246] A recording of the premiere can be found in the APPENDIX: 8.3. Analysis sheets
[247] = *flotsam and jetsam*

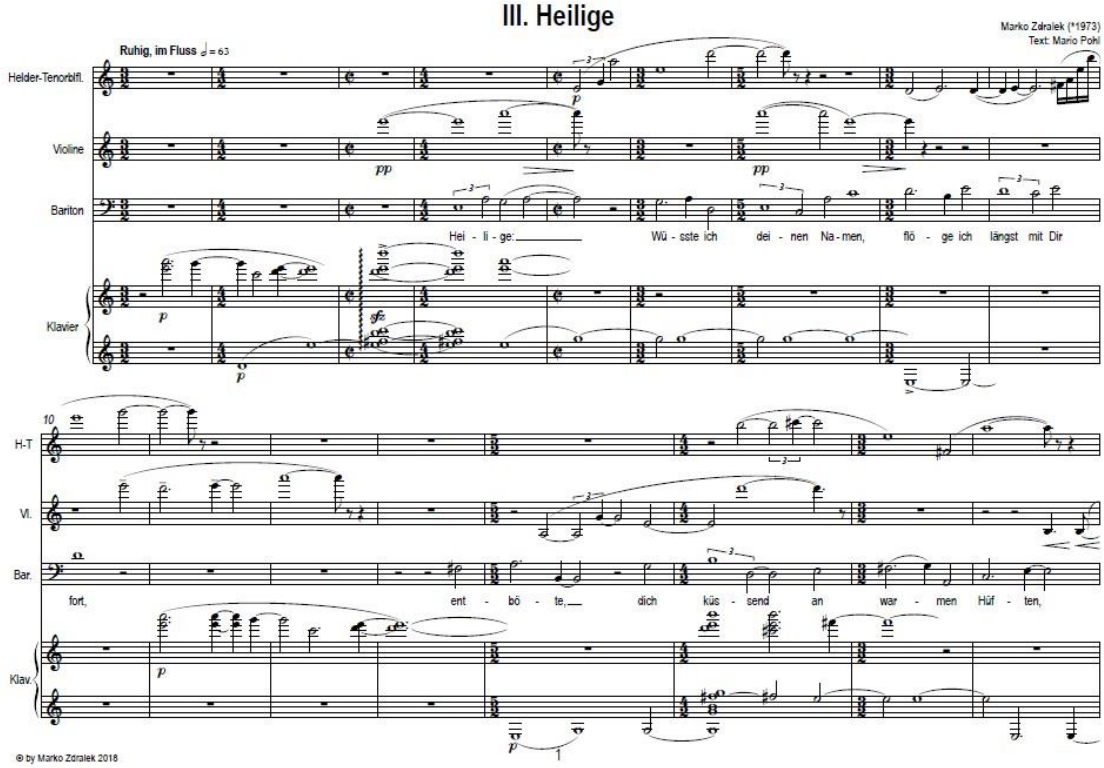
octaves that run into the middle of nowhere and a super soft f#3 on the Helder Tenor, and blending into repetitive movements of the piano in the same register.



The second movement called "Vollendung"[248] is quite apocalyptic and therefore the most virtuosic movement. This wild and threatening dance full of suspense requires a well-balanced chromatic range of three octaves on the Helder Tenor and a wide dynamic range (from "p" to "ff"). Like the first movement, the recorder and violin express the big drama. Hand in hand they share the same musical material and support the story of the singer, but this time they are also very much accompanied by the piano. Their parts consist of accentuated "f" notes within three octaves, short and long slurred lines used throughout different registers on the recorder (scale-like but also using wider intervals), "sffz-p-decrescendo" sustained tones, trills and tremolos (including register jumps on the recorder), repetitive notes juxtaposed against the piano finally ending "uni rhythmico" altogether.

[248] = *completion*


II. Vollendung
Wild ♪. = 93
Helder-Tenorblfl.
Violine
Bariton
Klavier
Ich rie - che dein Rau - schen Droh - ung, furcht - ba - res Ich,
H.-T.
Vl.
Bar.
Klav.
das der Ver - roh - - ung des Mensch - li - chen, satt - sam ent - wich.
© by Marko Zdralek 2017


III. Heilige
Marko Zdralek (*1973)
Text: Mario Pohl
Ruhig, im Fluss ♩ = 63
Helder-Tenorblfl.
Violine
Bariton
Klavier
Hei - li - ge: Wü - sste ich dei - nen Na - men, flö - ge ich längst mit Dir
H-T
Vl.
Bar.
Klav.
fort, ent - bö - te, dich küs - send an war - men Hüf - ten,
© by Marko Zdralek 2018

At the beginning of the third movement called "Heilige"[249] the big drama from before shifts to a more peaceful state and it is not made clear if somebody is speaking to the saint or if somebody is calling the saint. The whole movement is about a deep longing which is presented through upwards seeking phrases. The Helder Tenor part is again very close to the violin part and they imitate and complement each other, playing duet-like phrases. The first three pages are played in constant "p" combined with a few decrescendi and crescendi, heating up the waves of passion, which become more and more developed and rhythmic towards the very end and climax of this movement (bars 52-56).

To get a clear overview, I would like to briefly summarize the special Helder Tenor features used in this piece:

- use of extended range up to b3 (only in second movement, but in general the range often extends to f#3 and g3)
- use of extended second, third and fourth register
- extended dynamic range requiring special dynamic fingerings: "pp" within the third octave, "fp" in first and second octave, "p" in three octaves, "f" in three octaves
- use of piano key
- use of lip control

4.2. Repertoire for regular tenor recorder (after 1985)

My goal in this chapter is to give an overview of the repertoire which we can also use for contemporary recorder models, especially the repertoire which will benefit through a performance on contemporary recorder models – in this case the Helder Tenor. Of course, this repertoire will eventually grow and will vary from performer to performer.

[249] = *saint*

4.2.1. Background analysis

In this analysis I have focused on works written for tenor recorder solo (including live-electronics) and chamber music settings from about 1985 onwards – a time when modern recorder models started to be developed more frequently. I include works written for keyed tenor recorders as well as works not specifically written for a certain tenor recorder model. I have chosen pieces that will gain through a performance on the Helder Tenor recorder, especially when it comes to timbre (particularly in chamber music settings), expression (variation in articulation, dynamics, timbre, etc.), dynamics (more flexibility within the border areas), timbres (more flexibility throughout the whole range) and balance (throughout the whole range).

According to the catalogue on www.blokfluit.org, 303 works have been written for tenor recorder since 1985,[250] consisting of 157 solo works (including live-electronics) and 146 ensemble works. In the following two charts I have focused on pieces which were written for one recorder player performing on a maximum of two different recorder models. The level of difficulty is a 3 or higher (6 being the highest and 1 being the easiest performance level).

Further sources being used in both charts:[251]

- www.edition-tre-fontane.de
- https://core.musicfinland.fi
- www.universaledition.com
- https://de.schott-music.com
- www.recorderhomepage.net
- www.moeck.com

In solo works composers leave the interpretation very open to the performer and it can be said that the instrument one uses is less important than the performer interpreting the piece. However, while the works listed here will work on many tenor recorder models, they will certainly gain by using the full potential of the Helder Tenor recorder.[252]

[250] Accessed 30.05.2018
[251] Accessed 30.07.2018
[252] APPENDIX: 8.2.3. Contemporary Music Repertoire

In chamber music settings the balance between the instruments and the overall blend and mix of the instruments is very important. Although it can be quite an interesting challenge to combine early music recorder models with modern instruments, one gains even more possibilities when writing for instruments which share the same range of possibilities. Otherwise there will be too many restrictions and compromises, and totally different border areas to search for.[253]

4.2.2. Isang Yun – *The Visitor of the Idyll* (1993) for recorder

While this piece has become a classic in the recorder repertoire, it presents great challenges for recorder players. In 1993, Walter van Hauwe commissioned Isang Yun to write a solo piece for the recorder. Yun, already in his late creative period in which music itself was more important than the specific colours of a specific instrument, came up with a cycle of four different solo pieces called “The Chinese Pictures”. They are based on idioms of different east Asian types of flutes as well as Buddhist dramaturgy. Depending on the range and the musical material, Walter van Hauwe could choose the instruments himself, finally using a tenor recorder for the first, a bass recorder for the second, a modern Ganassi soprano recorder for the third and a modern Ganassi alto recorder for the fourth part. In the first movement "The Visitor of the Idyll", the dynamics especially within the lowest register, are written quite inconveniently for a regular tenor recorder. In fact, there are recorder players who, for that reason, do not want to perform this movement anymore. Having played this piece on a Yamaha Tenor in the past, I now feel much more satisfied to play it on the Helder Tenor because I can finally implement what is written in the score.

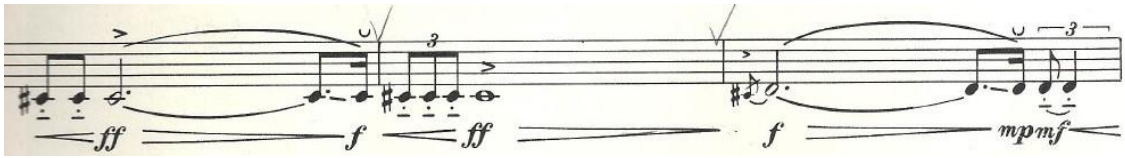
I have included four recordings for this case study in the appendix: the first one is a comparison between the Yamaha Tenor and the Helder Tenor (excerpt bar 11 to 26),[254] the second one is a video recording[255] performed on the Helder Tenor with a different foot joint (excerpt bar 1 to 26),[256] the third one is a video live-recording with the Helder-Jahn Tenor,[257] and the fourth one an audio CD recording performed on the Helder-Jahn

[253] APPENDIX: 8.2.4. Contemporary Music Repertoire
[254] APPENDIX: 8.6. Audio recordings
[255] Made for a promotion video of the KUG by Felix Breisach.
[256] APPENDIX: 8.7. Video recordings
[257] APPENDIX: 8.8. Recital *recorder evolution II* (from approximately minute 8.10)

Tenor.[258] While listening to these recordings, I would like you to focus on following aspects:

- dynamics within the low register
- colour fingerings (used for colouring certain notes as well as for creating dynamics)
- use of the piano key
- use of the lip control
- extended 2nd and 3rd register
- different timbres through different block positions

The first section of the piece is centred in the *low register* and demands a lot *dynamically* from the instrument. Isang Yun works with various nuances starting from "pp" up to "ff", mainly on the notes c#1 and d1 which are not the strongest notes on regular tenor recorders. Besides that, he adds quarter tone bends which are written in relation to the dynamics, meaning that the player must raise the pitch by getting louder and lower the pitch by getting softer. However, because this part is written for the low register, these bends are almost inaudible when air pressure only is used. In contrast, one can make this passage work well on the Helder Tenor through the use of the piano key in combination with shading the bottom hole. Although the Helder Tenor offers quite a balanced low chromatic register, I was waiting for the first prototype foot joint of the Helder-Jahn Tenor to make the first recordings. The new key arrangement, as well as the new bore, allowed me to perform this part with good resonant sound quality pared with flexibility.



strong dynamics in low register

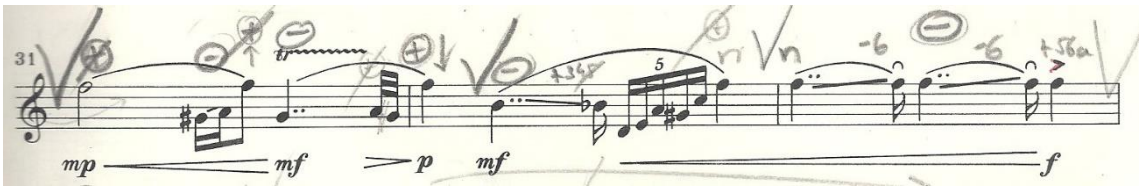
As mentioned before, the *colour fingerings* are one of the strongest features of the recorder. Through these fingerings, the recorder can produce a lot of timbral variations and can therefore sound like many different voices within one instrument. In the first

[258] APPENDIX: 8.5. Debut CD

register, there are a few very good forte fingerings with strong sound potential[259] which I use in this piece for g1 (0 123 7b) and f#1 (0 123 47b). These fingerings are mostly connected with strong dynamics and make the tones very rich and colourful. Therefore, one can call these fingerings "dynamic fingerings" or "forte/piano fingerings". They can be used on any recorder, but in general one can say: the longer the bore and the bigger the finger holes, the more effect these fingerings will have on single notes. The Helder-Jahn Tenor adds a few more options through the two extra keys for g# and f#.

use of forte fingerings

When it comes to dynamics, it is always a question of what to use when and how much. With the additional *piano key*, which is controlled by the lowest part of the index finger, playing dynamics definitely becomes easier and more varied. Of course, this playing technique has to be trained and integrated in ones' performance practice as any other technique and has to be balanced quite precisely with air pressure and additional finger movements, depending on how much dynamic variation one wants to use. In this piece I use the piano key in 52 out of 55 bars, meaning that I use it from the first through to the fourth register in various dynamics. I would like to point out that the Helder-Jahn Tenor offers three ways of using the piano key. One can either open it completely or only halfway which helps a lot with creating different nuances. Besides that, one can also open and close it gradually.



use of the piano key

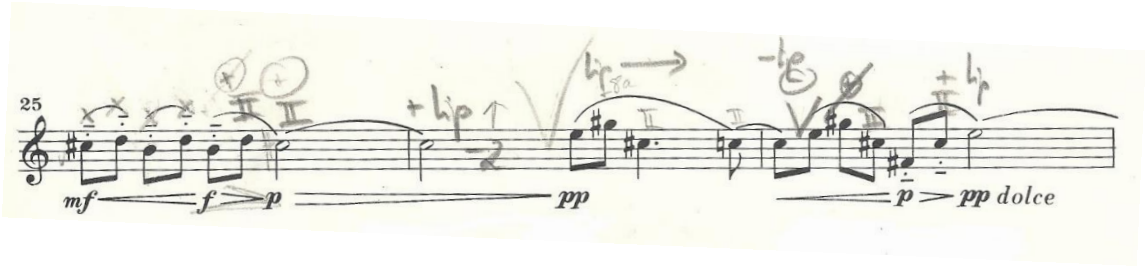
[259] Further explanation in chapter 3.2.1.

The *lip control* is revolutionary and enables one to experiment, for example, with the beginning and ending of a note. Normally these moments are quite obvious on a recorder and can be seen as an advantage, especially when it comes to articulation, precision and tightness. However, the lip control literally turns everything upside down and opens a completely new chapter in recorder performance practice. Not only for more subtle beginnings and endings of notes, but also for dynamics in general, especially soft dynamics in the third octave which can be performed through this new mechanism.

Here a short overview of the five elements one needs to balance while using the lip control:

1.) diaphragm: needs quite a lot of tension to control the air stream
2.) palate: requires an open and high position for a clean and fast air stream like the position used for singing in head voice
3.) tongue: is shaped in a downwards curved position in order to turn the lips inward
4.) lips: are turned inward with a lot of tension in order to be able to press the block upwards
5.) fingers: have to be quite relaxed in contrast to the diaphragm and lips; the more fingers on the instrument the better this technique works; there are mainly one or two fingers, which are responsible for the lip control to work in the third octave[260].

The new shape of the Helder-Jahn Tenor mouthpiece makes it much easier to use the lip control. First of all, the position of the inwards rolled lips is naturally found through the curved shape[261]. Secondly, the tension of the lips is much less than before. Last but not least, the mechanism reacts faster with the additional spring underneath the block.



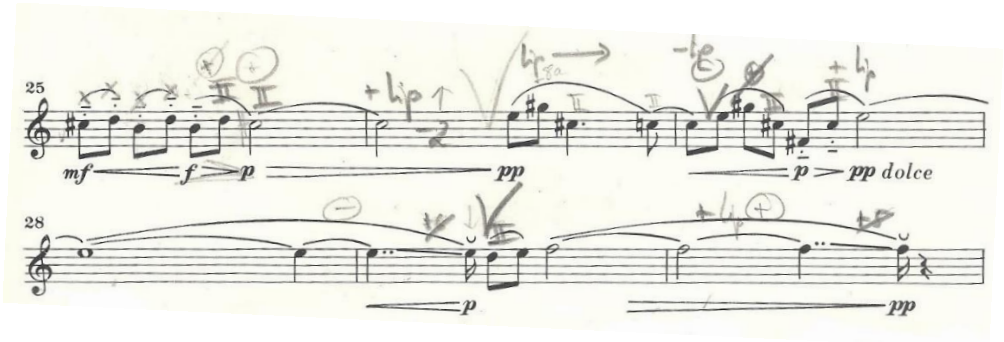
use of the lip control

[260] Fingerings can be found in my lip control fingering chart in the APPENDIX: 8.1.
[261] This can be adapted for everybody individually.

Extended registers are very helpful when it comes to musical phrasing, chromatic lines, legato playing, wide intervals, glissandi, trills and tremolos. This makes the Helder Tenor a well-balanced sounding instrument. By entering the next register one can usually hear a clear change in sound colour and dynamics going for example from note II'' to III''[262] (d2 to e2 on a tenor recorder) or from note VI'' to VII'' (a2 to b3 on a tenor recorder). The reason is that fingerings change from open to closed and vice versa. Additionally, the air pressure must be adapted. Through the extended registers one can now stay longer within one register and therefore finish a musical phrase or a legato line. In this piece I use the extended registers[263] quite a lot for the following pitches on the Helder-Jahn Tenor:

- b1 = 0 12 (3/4)3 8 4567b
- c2 = 0 1 (3/4)2 3 4567b
- c#2 = 0 1 (3/4)2 3 4567c
- d2 = 0 (3/4)1 23 8 456
- a^{b}2 = Ø 12 8 567b
- a2 = Ø 12 (1/4)4 567b
- c#3 = Ø 1 45 7a

use of the extended third register within a wide interval



use of the extended second register for musical phrasing

[262] I have left out sharps and flats and microtones to make it clearer.
[263] Fingerings can be found in my extended registers/trill fingering chart in the APPENDIX: 8.1.

Inspired by the fact that Isang Yun suggested this piece also could be played on modern flute,[264] I chose to experiment with *different block positions* as well first with a wide windway to get closer to the airier flute sound, and then with a slightly narrow windway (block position 12h -9h[265]) which I found more effective. While the position of the block will be a very individual decision, I realized during this case study that the Helder Tenor is dynamically more flexible, and that one can create more shades of timbre if the windway is not too wide. This is due to the fact that a faster air stream (automatically generated by a narrow windway) is not only easier to control but also enables a wider range in volume and timbre than a slow air stream (automatically generated by a wide windway).[266] Since my Helder-Jahn Tenor is equipped with three blocks and five platelets, I could experiment with different combinations until I found the right one for me. This is again an individual choice and works differently for everybody.

4.2.3. Joep Straesser – *Points of contact I* (1987) for tenor recorder and percussion

The piece was written by the Dutch composer Joep Straesser in 1987 and is dedicated to Dutch recorder player Walter van Hauwe and Japanese percussionist Keiko Abe. Divided into sixteen sections, the two instruments, tenor recorder and percussion (predominantly marimba), repeatedly make “contact" with each other, partly polyphonically entangled, partly united in unison, eventually drifting apart again. In some passages one can hardly distinguish which instrument is performing which line. It is a conversational and metrically intricate duet, in the constant alternation between tension and relaxation, emotional outbursts and calm passages, pushing the recorder part to its very limits, far beyond the potential of a regular recorder model. A wide dynamic range used throughout chromatic lines presents an especially big challenge which is why I have chosen this piece for detailed analysis.

Joep Straesser focused a lot on expression and energy, but also on subtlety and balance. Therefore, the combination with the marimba almost feels like entering the ring, fighting

[264] During a short interview with Walter van Hauwe, I learned that after Isang Yun’s death, the editor incorrectly published the cycle for the modern flute. In the corrected version, the modern flute is mentioned in the score as another option of instrumentation.
[265] from the standard position a quarter turn back counterclockwise.
[266] Also addressed in chapter 3.1.3. with reference to how one needs to technically react to the instrument.

against Goliath. With regards to the musical material, both parts are treated as equals, so the more the recorder can overdo these contrasting parameters in relation to the percussion, the more fun it will be to participate the game. At the same time, since the marimba has a lot of power and an incredibly wide range of dynamics, the marimba player will always need to adjust dynamic levels and choose his or her mallets to suit the ensemble partner he or she is performing with. It's just a matter of questioning how much adjustment needs to be made so that the intensity of the music is not lost.

In general, the dynamics used range from "ppp" to "fff" for the recorder, and from "ppp" to "ff" for the percussion part. This is already a sign for the percussionist not to perform with the outmost energy to avoid covering the sound of the recorder. Regarding the recorder part only, the first octave is written from "ppp" to "ff", while the second and third octave is written from "pp" to "fff". Although this is still quite challenging for a regular tenor recorder, the composer was quite aware of the recorder's general potential, writing different dynamics for different octaves. The biggest difficulty though lies in the short or long crescendi and decrescendi used chromatically within a wide dynamic range lasting from "p" to "ff", "mf" to "ff", "mf" to "pp", "f" to "p" or "mp" to "ppp". Derived from baroque performance practice, recorder players are mainly accustomed to terraced dynamics. Therefore, gradual changes in dynamics are unusual and also barely workable. On a regular recorder one can create dynamics through incredible finger work, by using alternative fingerings or opening and closing (additional) finger holes while adjusting the air pressure. This is very much dependent on the registers and scales as well as the tempo.

"Points of contact I" was premiered on a Yamaha Tenor, which is still the model mainly used for contemporary recorder repertoire. Although this instrument comes with several advantages like a powerful sound, strong low notes and extended second and third registers, I would certainly miss the extra potential of the Helder Tenor such as the lip control, the piano key and the well-balanced chromatic range. I would like to describe this in more detail now.

The whole piece is based on two short motives which are introduced right at the beginning. The concise call-like first motive is characterized by a dotted major seventh, followed by a perfect fourth, which is repeated several times, slowing down at the end. The second motive is rhythmically freer than the first one and consists of a minor second and a minor third, also combined in octaves. Based on both motives, the tonal material is

quite chromatic and therefore requires a well-balanced, dynamically flexible chromatic range of both instruments. A regular recorder model with keys only for the two bottom notes (I and I#) certainly lacks in sound quality when it comes to chromatic lines. The tones d#1, f#1, g#1, b^{b}1 as well as e1 and f1 are the weakest notes, but are used quite often in various dynamics. I would now like to take a closer look at the score where I'll concentrate on a musical phrase per section and discuss different options of playing techniques on the Yamaha Tenor (YT), the Helder Tenor (HT) and the Helder-Jahn Tenor (HJT). Comparisons can be made by listening to audio recordings in the appendix[267] where short excerpts of each section are performed on these three instruments. Live video recordings of performances on both the Helder Tenor and the Helder-Jahn Tenor are also included in the appendix.[268]

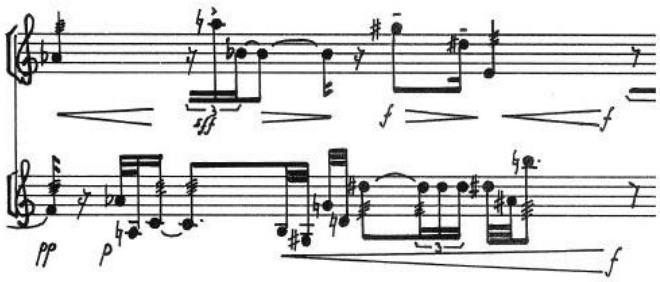
Playing expressively on the recorder is always a question of how one wants to interpret the music which depends on the context, the musical material, the tempo and the instrument's potential. In terms of playing techniques, there are various options through the breath (air pressure, air speed, air manipulation), the tongue (many different kinds of articulations varying in strength, length, noise and consonants) and the fingers (manipulating the air column through shading, closing and opening finger holes including the bottom hole). On the Helder Tenor one more sound option is gained through the flexible block system (lip control, different positions of the block), and two more variations for finger technique are gained through the piano key and the extra keys (two more on the HT and four more on the HJT). For this piece, one can make use of this extra potential quite a lot as described below:

<u>Section 0:</u> this chosen passage contains an a^{b}1 in "f" including a crescendo, a strong b^{b}1 with a decrescendo and crescendo on e1 up to "f". While this will be quite difficult to perform on the YT and would need to be exaggerated through extra breath sounds and extra strong flutter tongue, I can use the following options on both Helder Tenors:

- stable fingering for a^{b}1 through the extra d# key = 0 12 4567a (on HT and HJT) or the extra g# key = 0 123 8a (on HJT)
- stable fingering for b^{b}1 through the forte fingering 0 13 457a (on HT) or 0 13 457ac (on HJT)

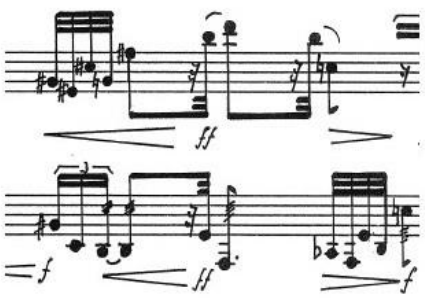
[267] APPENDIX: 8.6. Audio recordings
[268] APPENDIX: 8.8. Recital *recorder evolution*, Recital *Recorder 2.1* (from approximately minute 40.20), both performed with Matthias Engler on percussion

- stable fingering on e1 through the forte fingering 0 123 457ac (on HT – still a little too weak) or 0 123 457a (on HJT)
- more dynamics through the use of the piano key (more exaggerated on HJT)



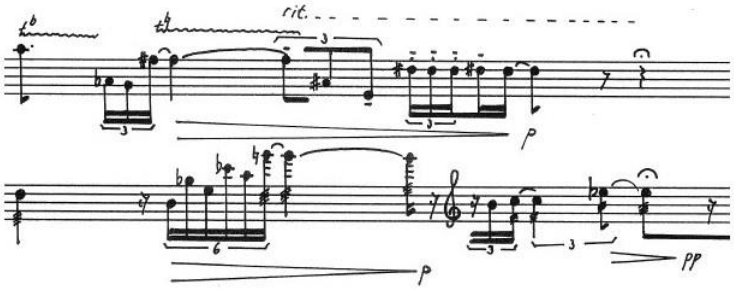
Section 1: this chosen passage consists of an ascending figure which includes a crescendo with a climax movement towards d3 and a counter movement to c2. Although I can find quite a convincing solution on the YT, I still have a few more options on both Helder Tenors:

- stable fingering for g#1 through the extra d# key = 0 12 4567a (on HT and HJT) or the extra g# key = 0 123 8a (on HJT)
- no overblow on e#1 through the extra f/f# key = 0 123 456a (on HJT) and in addition with extra d# key = 0 123 456a7a for more stability and strength
- bigger sound on f#2 with the extra f/f# key = 0 123 46a (on HJT)
- crescendo on f#2 with extra tuning finger ¼6 (on YT and HT) and finger ½5 (on HJT)
- forte fingering on b2 = 0 12 4567a (on HT and HJT)
- using the extended second register for c2 and the lip control for a balanced sound and a bigger decrescendo

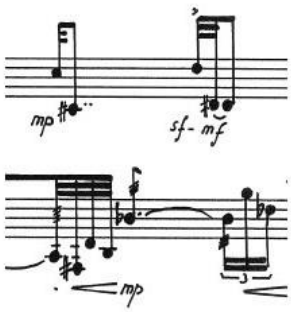


Section 2: this chosen passage is a mixture of both motives which slow down and become softer at the end for a short moment of rest. Since one can perform dynamics here with shading finger movements towards the end, this passage works satisfactorily on the YT. However, on both Helder instruments I can add a few extras:

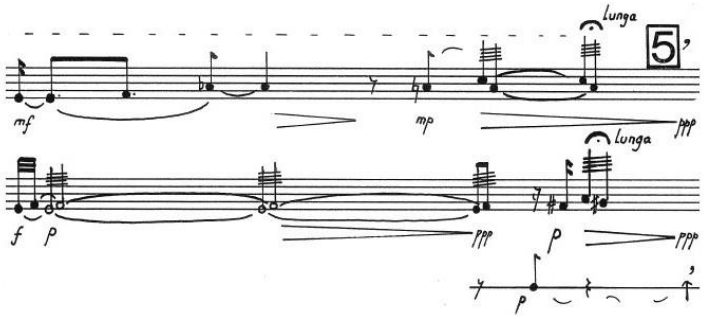
- stable fingering for $a^{b}1$ through the extra d# key = 0 12 4567a (on HT and HJT) or the extra g# key = 0 123 8a (on HJT)
- forte fingering on g1 with 0 123 7b on HT and 0 123 7c on HJT
- stable fingering for f#2 trill through the extra f/f# key (on HJT), trill with fingers 46a
- stable fingering for d#2 through the extra d# key = Ø 123 4567a (on HT and HJT)
- use of the piano key until the end of this passage (on HT and HJT)
- use of lip control at the very end of this passage for a smooth blending with the marimba (on HT and HJT)



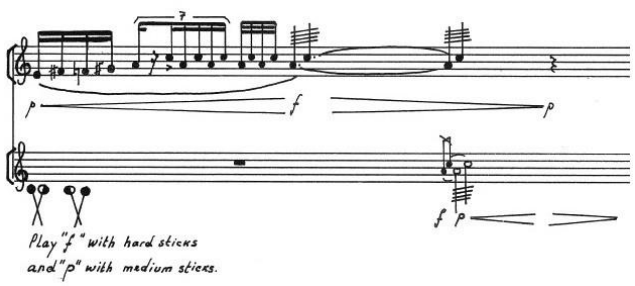
Section 3: this short passage consists of two quick downward movements towards the low notes c#1 and d#1. While the c#1 is not a problem at all for the YT, the d#1 is quite instable and weak in comparison to the other notes. On both Helder Tenors I can play the d#1 with the extra d# key = 0 123 4567a. I can play the c2 in "mp" in the second register for a bigger contrast to d2 in "sf" on both Helder Tenors.



Section 4: this chosen passage is another melting moment, but also a moment of rest after quite an expressive dialog beforehand. This can be very mysterious if both instruments go into extreme soft dynamics as composed, namely into “ppp”. Like with any other recorder model without lip control, I will also reach the point with the YT, where I cannot play softer without dropping the pitch completely. Opening the thumb hole will help, but at a certain moment I will need to stop the note and therefore won’t be able to blend and fade out as much as using the piano key in combination with the lip control (on HT and HJT). For a well-balanced chromatic line, I use the extra d# key for e1 = 0 123 457a, the extra f/f# key and d# key for f1 = 0 123 456a7a and the extra g# key for $a^{b}1$ = 0 123 8 (on HJT). To exaggerate the mysterious atmosphere, I added the white noise tone-effect on the HJT while playing the tremolo on a1/c2.

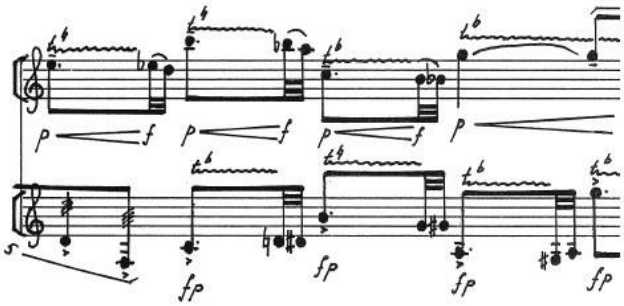


Section 5: this short solo moment of the recorder, again ends with a blend into the marimba tremolo. Because it’s the beginning of a new idea, it is not as extreme as before but has to go into a certain drive while still ensuring this overlap is as smooth as possible. Before this moment, the tremolo on a1/c2 goes into a crescendo starting from the chromatic upbeat-like figure. Going from “p” to “f” is difficult on the YT, since the a1 tends to overblow into a multiphonic as soon as I start adding right hand fingers to stabilize tuning while adding air pressure. On the HT I can use the forte fingering 0 12 8 57b, on the HJT the forte fingering 0 12 8b 57c in combination with the piano key and therefore can exaggerate the crescendo and decrescendo.



Section 6: in this chosen passage, a few compromises need to be made pitch-wise on the YT. Some of the trills in combination with the turn (Nachschlag) don't exist on such an instrument: e#1/f#1, e2/f2 and g2/a^{b}2. I can find solutions through alternative fingerings (in this case fork fingerings), but since these trills are composed with a crescendo towards "f", this would cause problems dynamic-wise. Here are my options for both Helder instruments:

- use of piano key for every figure (on HT and HJT)
- stable fingering for e#1 trill through the extra f/f# key = 0 123 456a, trill with finger 5 (on HJT)
- stable fingering for the e2 trill through extra f/f# key, trill with finger 6a (on HJT)
- stable fingering for b^{b}1 through the forte fingering 0 13 457a (on HT) or 0 13 457ac (on HJT)
- stable fingering for the g2 trill through the extended third register, using Ø 123 8 567b and trill with 8 (on HT) or Ø 123 8b 567c and trill with 8b (on HJT)



Section 7: this section is based on polyrhythmic variations of the first motive. The chosen passage works on all three instruments, although on the YT one cannot play as expressively as on both Helder Tenors. This is due to the fact that the strong notes have to be in relation with the weaker notes and therefore dynamics need to be adjusted.

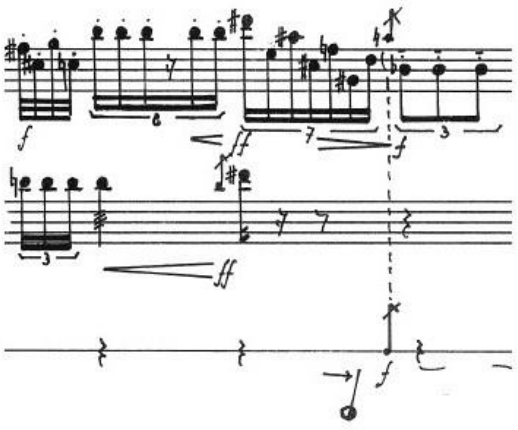
On the HT I would suggest following solutions:

- c#2 played with extra tuning finger 5
- c2 played with extra tuning fingers 45
- b2 played with forte fingering Ø 12 4567a, closing the thumb hole for the crescendo on the last two b2s

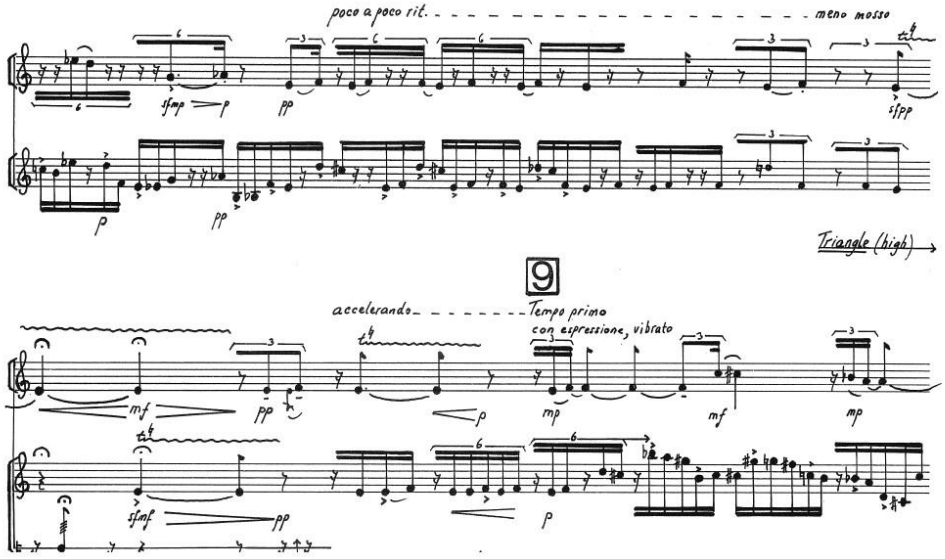
- d#3 played with closed thumb hole 0 + 123 67c
- e2 played with extra tuning finger ½6
- c#2 played with closed thumb hole only
- g#1 played with extra d# key = 0 12 4567a
- b^{b}1 played with forte fingering 0 13 457a, but in combination with a slightly open piano key to create a decrescendo while playing a note that still resonates well in "f".

On the HJT I would suggest these solutions:

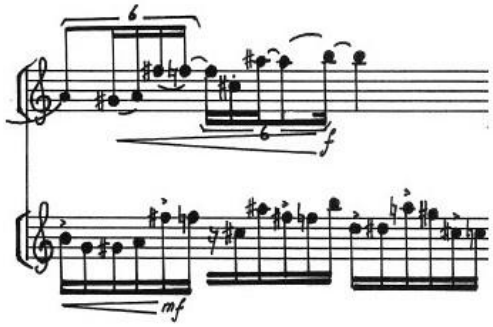
- f#2 played with extra f/f# key = Ø 123 46a
- c#2 played with closed thumb hole only
- g2 played with extra d# key
- c2 played with extra tuning fingers 45
- b2 played with forte fingering Ø 12 4567a, closing the thumb hole for the crescendo on the last two b2s
- d#3 played with closed thumb hole 0 123 6
- e2 played with extra tuning finger ½6 and extra d# key
- c#2 played with closed thumb hole only
- f2 played with extra f/f# key = Ø 123 456a
- g#1 played with extra g# key = 0 123 8a
- a2 played with extra d# key
- b^{b}1 played with forte fingering 0 13 457ac, but in combination with a slightly open piano key to create a decrescendo while playing a note that still resonates well in "f".



Section 8: in this chosen passage, I can only work with a shaded thumb hole on the YT, which changes the timbre of the notes and doesn't blend so well with the marimba's unison pitches. In contrast, I can use the piano key and lip control on both Helder instruments for a subtle sound to shadow the marimba. Furthermore, I can make use of the extra f/f# and d# key = 0 123 457a, trill with finger 6a (on HJT) to have a stable trill on e1. On the YT and the HT, I need to decide to either go for tuning (fork fingering trill) and less dynamics, or a compromised pitched trill (on e1 with a trill on finger 5) with more dynamic flexibility.

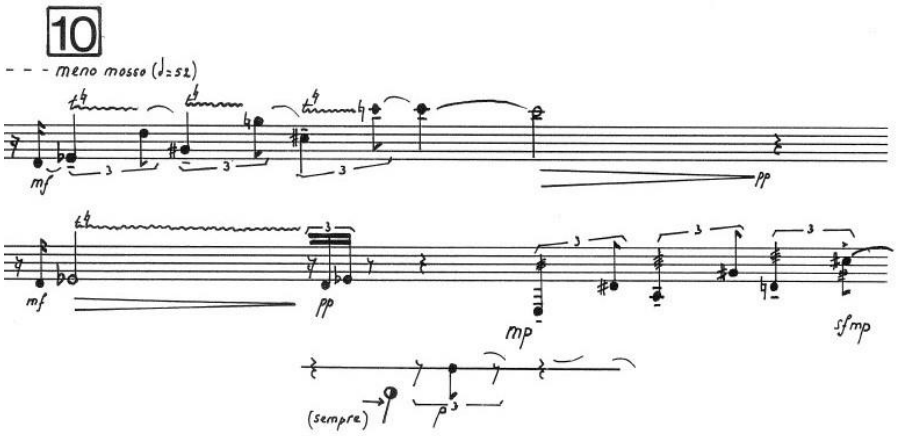


Section 9: this chosen passage consists of a chromatic wave-like ascending movement ending in a strong b2, which is more in balance when the extra g# key is used for the g#1 and the extra f/f# key is used for f#2 and f2 on the HJT. The c#2 can be played with only the thumb hole closed on all three instruments. On both Helder Tenors I can use the forte fingering 0 12 4567a for a strong and stable b2, to differentiate from the virtuosic, accentuated 16th note patterns of the marimba.

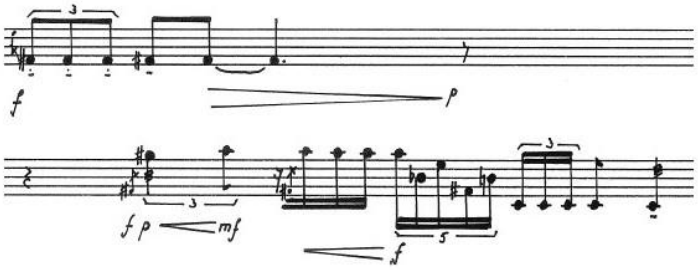


Section 10: inspired by the short wave like figures from before, this chosen passage is an ascending movement which passes through a minor second and two tritones to the c3. To gain an overall better balance in comparison to the YT, I would suggest following options on both Helder instruments:

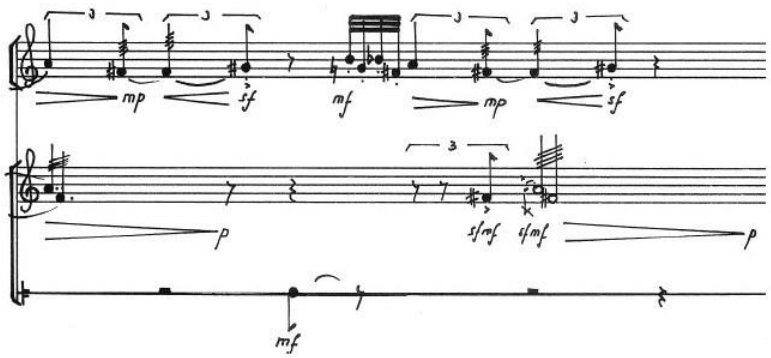
- stable fingering for the $e^{b}1$ trill with the extra d#1 key = 0 123 4567a, trill with finger 6
- stable fingering for the g#1 trill with the extra d# key = 0 12 4567a, trill with fingers 456
- stable fingering for the c#2 trill through the second register = 0 1½23 4567c (on HT), trill with 7c and 0 1½23 4567b (on HJT), trill with 7b
- use of the extended fourth register for the c3, which decresendos towards the end
- use of the piano key for the decrescendo on c3
- use of the lip control for the c3 and its decrescendo towards "pp"



Section 11: this lyrical and rhythmically free section is very much about the two motives being interlinked and both instruments complementing each other. Since the chosen motive, which consists of an appoggiatura and a strong f#1, is played just before by the marimba in a retrograde version, it should be exaggerated as much as possible. The YT is quite limited because f#1 is weak. On the HT I can use the forte fingering 0 + 123 8 47b, and on the HJT either 0 + 123 8b 47c or 0 123 46a7a. In addition, with the two forte fingerings that include the piano key, I can play the decrescendo by shading the thumb hole in combination with the lip control.

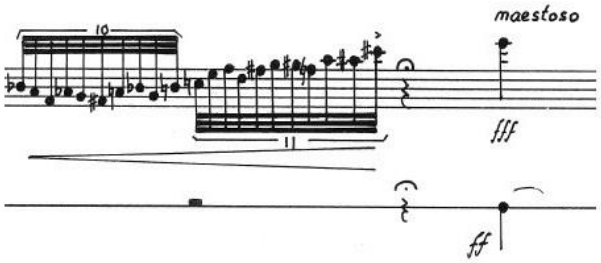


Section 12: this section is a big gesture to calm down the emotions which were developed just beforehand and prepare for the recorder solo section which follows. It is important to keep the energy, especially within the shifting dynamics. The "sfz" is written on the g#1 which is very difficult to perform on the YT. While I can use the slightly more stable fingering with the extra d# key = 0 12 4567a on both Helder instruments, I can use the extra g# key = 0 123 8a for a strong g#1 on the HJT. The crescendoing f#1 can be played with the extra f/f# key and stabilized through the extra d# key = 0 123 46a7a on the HJT.

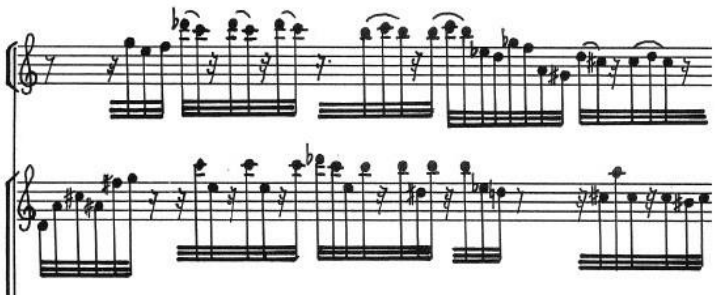


Section 13: this recorder solo, accompanied by the Chinese gong, includes a virtuosic solo cadenza written in "f", which crescendos towards the maximum climax of this piece. On the YT it is almost impossible to begin the crescendo from "f" because at this moment, a few weak notes (b^b1, f1, f#1) are notated within the phrase. I therefore need to adjust the dynamics around this passage. On the HT I can use a stable fingering for a^b1 = 0 12 4567a and a forte fingering for g1 = 0 123 7b, but because of the fast tempo no other forte fingerings. On the HJT I can use the extra g# key for g#1 = 0 123 8a and the extra f/f# and d# keys for the f#1 = 0 123 46a7a and a forte fingering for g1 = 0 123 7c. While f2, f#2 and g#2 also cause problems on the HT, I can use the extra g#, f/f# and d# keys on the HJT: f2 = Ø 123 456a, f#2 = Ø 123 46a7a, g2 = Ø 123 7a, f2 = Ø 123 456a7a, a2 = Ø

12 7a. The last two notes at the end of this phrase I can play with a closed thumb hole on all three instruments. The climax note e3 should be performed with the utmost energy and power and the thumb hole needs to be closed on all three instruments for a strong core sound. To reach this note on the YT, I also need to close the bottom hole which shifts the energy and concentration from where it needs to be – the centre of the body. On both Helder instruments I can use a fingering without stopping the bell (0 123 8 567a on HT and 0 123 567ac on HJT).

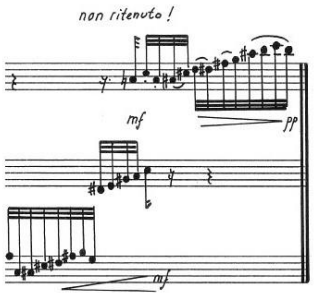


Section 14: in this and the very last section, the two motives are dissolved and *all that remains is a fast, musical motion.*[269] It is a polyphonic virtuosic duet with recurring points of contact between the two soloists. While the last part has to be played with extra energy in constant "ff", this part bears the title "con anima" and should therefore focus on a core, flexible sound quality. The whole section entails a few risks such as the legato motive $d^{b}3$-c3 in the chosen passage. On the YT this change from the fourth to the third register will be quite audible, while on both Helder instruments, this change will be much easier to perform through the use of the piano key (in this case used as a register key). The g#1 is also problematic for the YT and a bit tricky for the HT (although I can play it with the extra d# key = 0 12 4567a). On the HJT I can use the extra g# key = 0 123 8a for a well-balanced g#1.



[269] Donemus Webshop: https://webshop.donemus.com/action/front/sheetmusic/4202 (accessed 13.05.2019)

Section 15: in this section, I am still searching for the right articulation so that I can produce as much sound and attack as possible. I can certainly use the extra g# and f/f# keys in both registers on the HJT, and a narrow block position might help as well. While it is impossible for the YT to be so soft towards the third octave at the end of the section, this passage works very well while using the lip control on both Helder instruments.



"Points of contact I" is one of those visionary pieces that not only challenges recorder players in all of their musical and technical skills, but also provokes both performers and makers to explore the many options an instrument could potentially be built with. I have performed this piece on both the standard Helder Tenor and the Helder-Jahn Tenor. In both performances I was very conscious of making use of the extra potential of these instruments (such as the extra keys for forte fingers, the lip control for very soft dynamics, and the piano key for dynamic phrasing as well as strong dynamic changes) and at the same time really enjoyed this extra potential. I finally felt that the performers are treated as equals in both the musical material as well as in the performance itself. This is that moment when I truly appreciated the well-balanced chromatic range of the Helder-Jahn Tenor. Sound-wise, the extra keys stabilize the notes which were instable and weak (mainly folk fingerings) and match them to the sound quality of the adjoining notes. The new foot joint enables a more balanced chromatic lower register and the extended first register is more in tune and easier to finger. Furthermore, the many ergonomic and mechanical improvements on the Helder-Jahn Tenor (such as the bent head joint, the thinner mouthpiece, the curved keys and the sickle shaped piano key) made the performance of this piece much more organic with less unnecessary tension in my body. This had quite a positive effect on my interpretation as well, since I was no longer busy struggling with my body and the instrument, but rather open and free to interpret the music. That was exactly what I was hoping for when developing the Helder-Jahn Tenor, because this should be the absolute goal for each performance.

4.3. Transcriptions

As performer, it is important to work on repertoire which also extends one's playing techniques. Therefore, in my research project, I not only focused on compositions that were specifically written for the Helder Tenor and standard tenor recorder models, I also considered pieces that were written for other classical contemporary woodwind instruments. This has helped me to push my instrument to new boundaries and forced me to explore the Helder Tenor from a different angle, taking me further than I could have possibly imagined.

4.3.1. Salvatore Sciarrino – *Immagine fenicia* (2000) for amplified solo flute[270]

While searching for repertoire I could transcribe for the Helder Tenor, I knew that I must look for composers who take the specific instrument they are writing for to another level of playing techniques, sound exploration and performance. Knowing that this would be quite a challenge, I took a closer look at the cycle of twelve solo pieces for modern flute, called "L'opera per flauto". These extraordinary pieces were written by Salvatore Sciarrino, one of the leading European composers of our time. He is famous for his way of creating new sound universes, exploring instruments from inside out and letting them shine in a new light. While going through these scores and being aware that Japanese recorder player Tosiya Suzuki has released a CD with six pieces out of this cycle, I decided that there is only one piece that I would dare to transcribe for the Helder Tenor. My choice was dependent on the material Sciarrino used, as well as how he structured this material. The composition is called "Immagine fenicia"[271] and throws both the performer and the audience right from the beginning into a certain scenario, the amazing landscape of Phoenicia. This intense, and as Sciarrino states at the beginning of the score *implacabilmente scandito (tempo non svelto),*[272] character of the music is emphasized through quiet, repetitive, almost hypnotizing motifs and their outbreaks – a language which is quite characteristic of Sciarrino's music.

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[270] This transcription was possible due to the kind authorisation of Ricordi.
[271] = *An image on Phoenicia*
[272] = *relentless examination/scanning (tempo not quick)*; in: Score of "Immagine fenicia" ("L'opera per flauto" Vol. II, Milano, 2001), p. 20

To make this transcription I listened to several recordings of various performers – flutists and recorder players – and I have developed an analysis chart[273] which included the musical material and its description, notation and interpretation. This helped me to compare the different versions, draw conclusions and make my own story.[274] The piece is based on seven effects used as musical elements, six of which work well on the Helder Tenor and three of which are even special Helder techniques.

Recorder techniques:

- *tongue attack* or *tongue ram* is a common technique on both flutes and recorders, although it differs slightly in sound quality depending on the material of the instrument one is using and the playing position one chooses on the recorder. The tongue movement on the recorder needs to be rapidly upwards towards the palate instead of forward towards the mouthpiece, and you pronounce a silent "ht" or "hot". With increasing dynamics, air noise should be included with a strong inhalation at the same time, to have more power and energy. This is also the case with the modern flute, although this effect is created by breathing out at the same time. Through this effect the modern flute reacts like a stopped pipe, which results in the pitch sounding lower than notated (this differs from instrument to instrument). Although one could use the same effect on the recorder by using the window instead of the mouthpiece, this is not recommended in performance as it would take too much time and effort to quickly change playing positions from vertical to horizontal.
- *short harsh attack with a lot of air* offers a lot freedom for interpretation, since Sciarrino only mentions the use of the vowel "a" after the consonant in his description. However, the consonant plays quite an important role in making this effect as strong as possible, and because the attack and strength of overblowing varies from performer to performer, I would suggest a variation between "ka", "kfh", "fh" and "th", depending on the dynamics and the musical line.
- *resonance pitches without air noise* can be produced on the recorder by taking these pitches into the second register while completely opening the thumb hole.

[273] APPENDIX: 8.1. Charts
[274] Live recordings can be found in the APPENDIX: 8.6. Audio recordings and 8.8. Recital *recorder evolution I*

On both the modern flute and the recorder, the sounding pitches depend on the dynamics.

Helder Tenor techniques:

- *white noise tone*, which is used in this piece for *"resonance" pitches with air noise*, is a technique that allows me to make a clear distinction from the effect "resonance" pitches without air noise. Producing this contrast has proven to be quite difficult for flutists, since air noise is present in their general sound, and also recorder players with regular tenor recorder models because it's a struggle to find a distinctive sound which is different from other sounds in the piece.
- *pure harmonics*, which work very well on the Helder Tenor, although some fingerings need to be changed to reach the harmonics which are notated above the basic pitch. Since most recorders are not based on pure harmonics, one can choose between two options on a regular tenor recorder model to make these passages work: either play the upper pitches which are notated and are within the range of the recorder, or overblow the notated notes and leave it open which pitches will sound. The second technique works very well for the glissandi passages, but not for the rest of the piece.
- the *hiss-articulation* was found especially for this piece and is produced by slightly closing the lip control while pronouncing "ht" with a lot of air pressure. It also helps to slightly open the thumb hole and use the principle of pure harmonics for the fingering. This effect is quite difficult on a modern flute and all recorded versions sound quite different from each other. On a regular tenor recorder model, one could close the bottom hole and create a quite clogged sound, but dynamics would then need to be disregarded.

Flute techniques:

- the *jet whistle* is a common flute technique and works on the recorder only on certain finger holes (for example hole 2, while 1 and 3 are closed) and only in soft dynamics produced by a slow warm breath. Since the soft dynamics don't fit the piece's dramaturgy, I would suggest following three options:

1. Overblow on the notated pitch with a harsh "th" articulation, using the notated fingering.
2. "Pfeifton" with the right hand closing the window at different angles to create different overtones.
3. Blow into the window with a harsh "th" articulation, using the notated fingerings. I choose this option to add a different sound to the piece and not create an overblow which could be mistaken as another overblow (harmonic) introduced later on.

4.3.2. Giacinto Scelsi – *Ko Lho* (1966) for flute and clarinet[275]

Sound is spherical, but to the listener it seems as if it possesses only two dimensions: pitch and duration – we know that the third dimension, depth, exists, but it somehow eludes our perception.[276] Giacinto Scelsi

Regardless of the aesthetic discussions on serial thinking during the 1950s, Giacinto Scelsi found his own *revolutionary concept of sound*[277] which completely shaped his final creative period. Through improvisations on the instrument "Ondiola",[278] he developed a compositional style that is entirely based on an inner sound world and explores its dimensions of both depth and motion. Since part of my research on the Helder Tenor involved a similar intensive exploration, Scelsi's enchanting, depth-seeking music inspired me to explore and implement the original flute part of his piece "Ko lho" on the Helder-Jahn Tenor. Both movements are quite similar regarding the musical material and dynamics, so I decided to transcribe the first movement only although transcription is a bit far-fetched in this case as I can play everything that is written in the part.

The piece is clearly based on the note e2 (accompanied by d2) and begins and ends with long sustained tones on both instruments. A sense of calm is created through the use of quarter tones, vibrato and quarter tone trills, as well as special sound effects such as

[275] This transcription was possible due to the kind authorisation of Salabert Edition.
[276] = *En plus, le son est sphérique, mais en l'écoutant, il nous semble posséder seulement deux dimensions: hauteur et durée – la troisième, la profondeur, nous savons qu'elle existe, mais dans un certain sens elle nous échappe*; in: Giacinto Scelsi: *Son et musique* (Rome, 1981), p. 3
[277] = *revolutionären Konzeption des Klanges*; in: Adriano Cremonese: *Die Poetik Giacinto Scelsis* (in: Symposionsberichte: *Giacinto Scelsi: Im Innern des Tons*, Hofheim, 1993), p. 89
[278] = electronic keyboard instrument, which can produce quarter tones. Ensemble Klangforum Wien has done some interesting research on this instrument: https://www.youtube.com/watch?v=USk6UrE8cuI (accessed 13.05.2019)

multiphonics and flutter tongue. I was particularly interested in how the material was blended and balanced between the two instruments in my interpretation. Since the original version is written for a metal flute and a wooden clarinet, I was curious how much my wooden recorder would change the piece. At the beginning of my exploration I tried to get as close as possible to the timbre of the clarinet, which worked, but in the end was less exciting than exploring different sound mixtures. After all, the piece was not written for two similar instruments, so I experimented with various block positions and finally chose a slightly wider windway to differentiate from the sound of the clarinet. At the same time, I was able to add one element of the clarinet's characteristic timbre, in this case the slightly airy embouchure created by very soft dynamics. A recording of the performance can be found in the appendix.[279]

Throughout the piece, I make extensive use of the Helder Tenor's special features:

- the extended second register in almost all passages around the notes c2, c#2/d^{b}2, d2 and d#2/e^{b}2, with a few exceptions such as quarter tones on c and d (bar 7 and 22), melodic figures within the first register (bar 22-32), and timbre and dynamic changes (bar 47-49)
- the lip control in all decrescendi, "pp" and "ppp"
- the piano key in four different ways: completely closed, completely open, half open, and organic opening and closing.

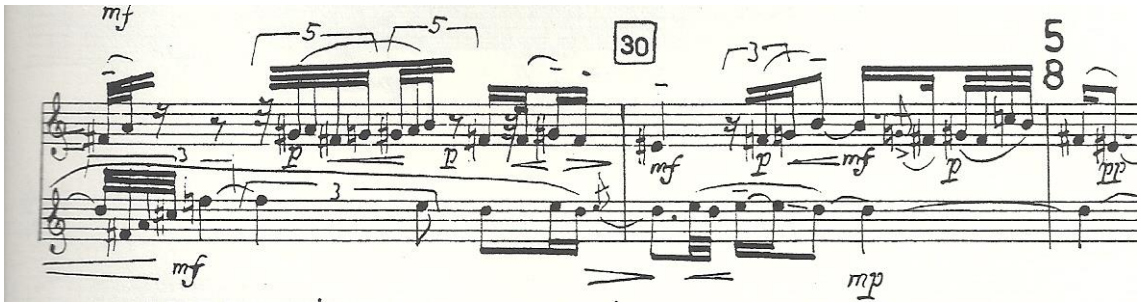
Because I worked on this piece with the Helder-Jahn Tenor, I tested the extra keys for g# and f/f# and achieved quite positive results in both registers. It was important to me to find the best balance in sound and dynamics, but I also realized that the choice of when to use these extra keys depends on practicality. I had to consider the advantages and disadvantages of these new fingerings. To make this clear, I would like to discuss these reflections through two short passages.

<u>Bar 29 and 30:</u>

In the first ascending running figure, I use the standard fingering for the first g#1 (0 12 4567a) and then during the crescendo, I use the second g#1 with the extra key (0 123 8a). I perform the cambiata g#1 that follows with the extra key, and because of the dynamics,

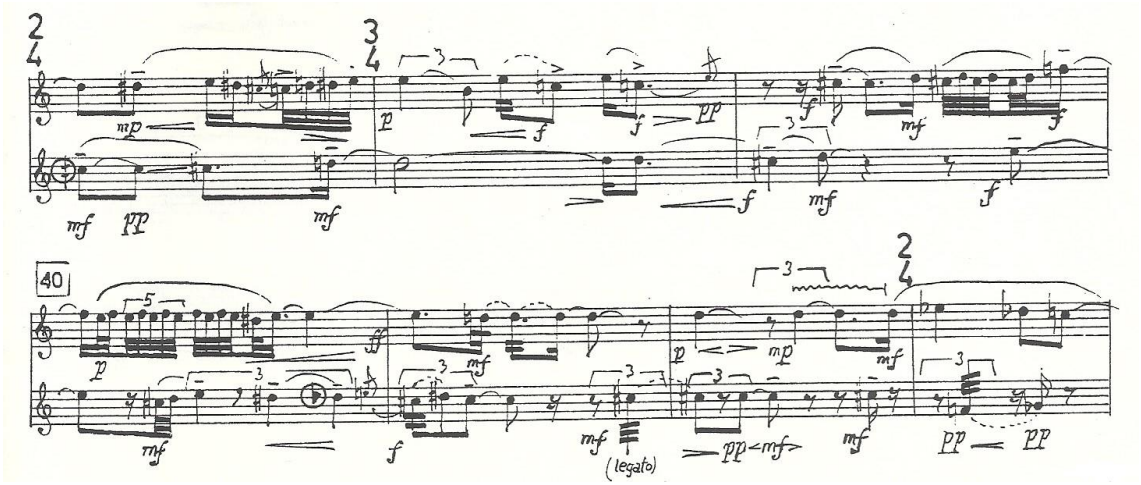
[279] APPENDIX: 8.8. Recital *Recorder 2.1.* with Ingólfur Vilhjálmsson on clarinet (from approximately minute 22.40)

I perform both f#1s with the standard fingering (0 123 56), ending in a e#1 that resonates well played with the extension key (0 123 8b 467c). This cambiata could also be played with the extra f/f# key, but then the e#1 is not as resonant as when performed with the forte fingering.



Bar 39 and 40:

To perform a strong sounding "f" c#2, I use a fingering in the second register (0 1 ¾2 3 4567b) and therefore have to play the slurred d2 and the trill-like figure afterwards in the second register as well. It is then more practical to perform the "f" f2 afterwards with a standard fingering. Dynamics are performed through use of the piano key. In the next bar I can change to the extra f/f# key to perform the trill-like figure on e2. Usually this trill can only be performed in a compromised way because of the fork fingering on f2.



4.4. Collaboration with a composer

(…) changes may well come about through the work of players and makers, and these changes will then be exploited by composers.[280] Frederick Morgan

Performing on an instrument which at first sight found its place mainly in early music, I was privileged to be supported by open-minded teachers who were also interested in contemporary music. This is the music that I always felt most attached to and intrigued by, not only because of the adventurous and experimental sound worlds, but particularly because most of the composers are still alive and I could get in direct contact with them. When I started my musical career, I was fortunate to work with many different composers from all over the world. Through these collaborations I have learned a lot about the performance practice of contemporary music, as well as its interpretation and staging.

When I started this research, I didn't know how much I could gain from the repertoire written specifically for the Helder Tenor. I didn't even know how many of these pieces already existed. In this early stage, I began to freely explore the instrument through my own eyes and made my own discoveries. Later on, I wanted to bring these discoveries to life through new compositions, meaning through collaborations with composers. It was then that I realized that composers are not all composers in the classical sense anymore, and that I could and should make use of that. Therefore, I distinguish between three categories and working strategies:

a) Commissioning a new work by a composer who is a composer: this collaboration is based on what I demonstrate and how much the composer can imagine the sound world of the instrument, in this case the new instrument.
b) Commissioning a new work by a composer who is also a recorder player: this is a work in progress because the composer can experiment with the instrument and we can exchange ideas back and forth to create a new piece together.
c) Commissioning a new work by a composer who is also a performer: this suits any performance-based artist and we meet through improvisation and develop a piece together.

[280] = *(…) Veränderungen können durch die Arbeit von Spielern und Instrumentenmachern entstehen und diese werden dann durch Komponisten genutzt*; in: Gisela Rothe: *Recorders Based on Historical Models* (Mollenhauer, 2007), p. 66

Although I have examples for all three categories, which are also documented in audio and video files in my appendix[281], my case study for this section is based on the third category. During this collaboration I was working with another pioneering instrument which made the working process and musical material quite exceptional.

Gerriet K Sharma & Susanne Fröhlich – *Semaphor* (2018) for Helder-Jahn Tenor and Icosahedral loudspeaker, supported by "Das Amt der Steiermärkischen Landesregierung" (A9) and "Initiative Neue Musik e.V."

"Semaphor" was developed for Helder-Jahn Tenor and Icosahedral loudspeaker (IKO) together with the composer and sound artist Gerriet K Sharma. I have never experienced a collaboration that close and intense before, and it was the first time ever that I was responsible for creating my recorder part. The step-by-step growth of the piece over a two-year time frame as well as the unique setting of two prototypes joining a dialog and exploring the aesthetic possibilities of spatial composition, are strengths of this work and make it special.

During my first year of doctoral studies, Gerriet was finishing his doctorate at the KUG and when I listened to his electronic music for the first time, I was immediately caught by his extraordinary sound world. It felt very comfortable listening to his music, especially because of both its delicacy and intimacy. He treats sounds, silence, rhythm and timing very respectfully and I had a strong feeling that I could add something to his musical universe with my new instrument. While getting more familiar with Gerriet's compositions, I was sure that I could use as much as possible of the Helder Tenor's new potential and that our piece "Semaphor" would turn the usual sound world of the recorder upside down.

This collaboration was characterized by the fact that I was allowed to fail. Therefore, I could introduce all of the ideas I had in mind without worrying about the end product. Because Gerriet works in a similar way, he was very patient with me. He likes to explore extreme border areas, no matter how unrealistic it would be to perform them. To prepare

[281] a) Sebastian Elikowski-Winkler: *termini spezzati II* (APPENDIX: 8.8. *Recital Recorder 2.1* (from approximately minute 58.50) with Ingólfur Vilhálmsson on bass clarinet and Matthias Engler on percussion, and b) Terri Hron: *Beast Calls – Susi Spinus* (APPENDIX: 8.5. Debut CD, 8.8. Recital *Salon de musique*)

for several live sessions with the IKO, we sent musical ideas back and forth through recordings and miniature compositions. From these origins we gradually developed our piece together.

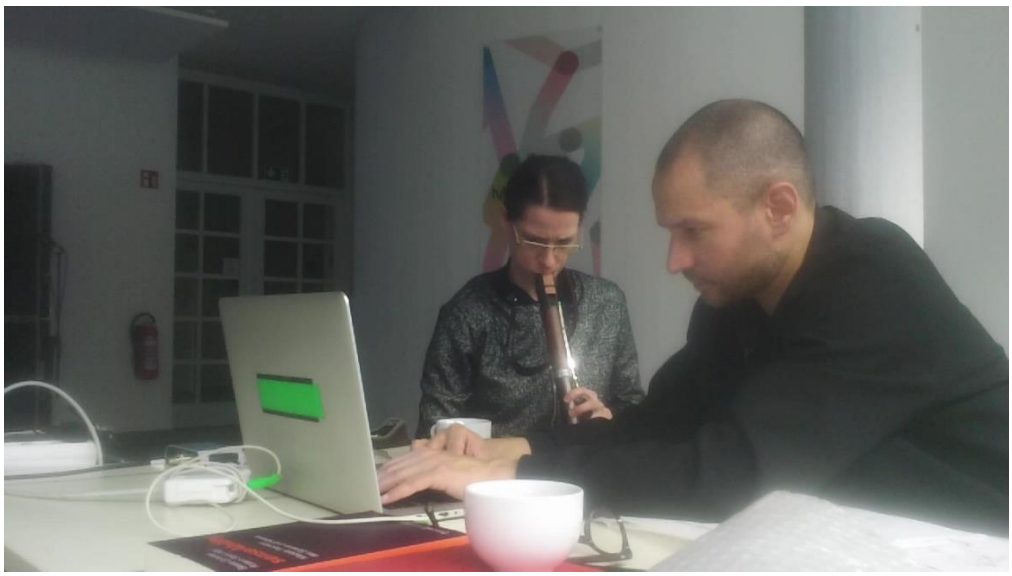


Photo 97: *working session with Gerriet K. Sharma at hybrid-lab, TU Berlin*

When I "met" the IKO for the first time, I felt like I was in an electronic wonderland. Gerriet introduced me to its possibilities, capabilities and even its physicality, and although I had already heard the IKO in action before, I was astonished at how I literally experienced the various soundscapes in a physical way. Gerriet did extensive research on spatial sound composition in computer music and the sculptural nature of sound textures for his doctoral thesis at the KUG.[282] He has become an expert in performing with the IKO like an instrument, and this expertise, pared with his deep comprehension for space, led us to the theatrical staged spatial composition "Semaphor". The title refers to a visual telegraphy system used for transmitting information through, for example, hand-held flags.

[282] Gerriet K Sharma: *Composing with Sculptural Sound Phenomena in Computer Music* (2016; English Version 2018)

© Gerriet K. Sharma

Photo 98: *residency with Gerriet K. Sharma at esc medien kunstlabor, Graz*

We structured "Semaphor" in ten distinctive sections and in each of them I explore special features of the Helder Tenor, respectively the Helder-Jahn Tenor. These sections are based on our first experiments with my instrument in combination with Gerriet's electronic sounds, which also include altered or synthesized samples of me playing on the Helder Tenor. Working through a miniature "wish-list" that each of us had, we were able to create our "Top-Ten-list" which was then put into a time frame and compositional form. The next step was to discuss the various performance modes of the IKO which Gerriet developed during his artistic research project and could be now used in combination with me as a live performer. Each description denotes an action of one performer in relation to another performer's action and is understood as spatiotemporal. These following nine modes were very helpful for my improvisations with the IKO:

- to raise or lower
- to fill
- to masque
- to add
- to imitate
- to play counterpoint
- to have a dialog
- to start/trigger
- to stop

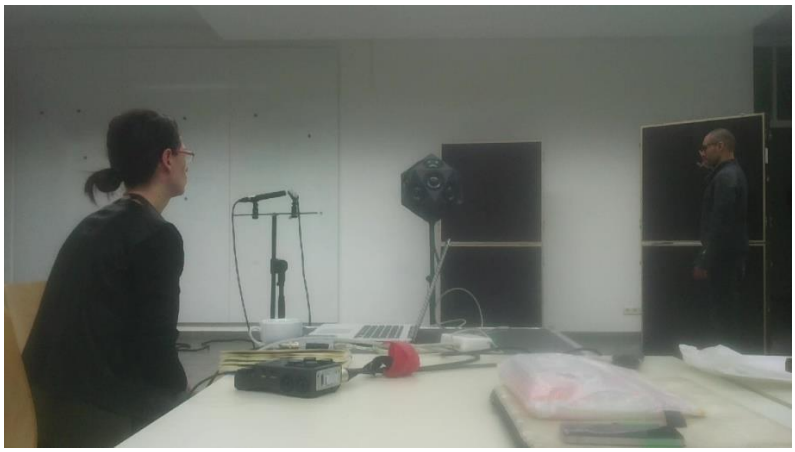


Photo 99: *working session with Gerriet K. Sharma at hybrid lab, TU Berlin*

To get a better understanding of the musical material we used for "Semaphor", I would now like to discuss every section in more detail. The score, which is actually a set of instructions of every section, can be found in the appendix.[283]

Section 1: *Eingangshalle – körperloser Raum*[284]

This section, also called "bodyless space", introduces elusive sounds and plays with awareness and focus, challenging the listener to work out which performer is doing what. The material consists of pre-recorded samples as well as grainy sounds, airy notes and whistle tones, which I can produce on the Helder-Jahn Tenor through *granular tones*, *white noise tones* and the "Pfeifton". It is meant to be a gentle, but very concentrated opening, with both instruments entering the stage sound wise, touching each other's surfaces.

Section 2: *Vorstellungsrunde*[285]

The goal in this scene is to present both instruments in an interview-like situation, demonstrating what is possible in a quite clean and precise way. For us it was important not to create competition between the two instruments, but rather instigate and tease each other up to a short climax. I use techniques which refer to electronic music sounds, for example the *beating multiphonics* and the bisbigliando on a *forte fingering*. The peak is reached by a d4 played on both instruments, freezing the space at that particular moment.

[283] APPENDIX: 8.3. Analysis sheets
[284] = *entrance hall – bodyless space*
[285] = *interview*

Section 3: *Spiegelraum*[286]

Like the aftershocks caused by an earthquake, this section reacts to the drama from the section before with a comforting pulse from the IKO, which spreads throughout the whole room. I float on top of that pulse with soft, pin like pitches created within the *extended third register* in combination with the *lip control*.

Section 4: *James Debussy*

This section starts with a crescendo built over 50 seconds for both instruments. I'm the driving force and we end together in a high, hissing intensification of what happened before. In this moment, I use fast articulation on the *extension note b0*, slowly *overblow* into the highest harmonics possible, and then lead into a harsh breath sound at the window of my instrument. Afterwards the atmosphere calms down through two soft, contrary pitch levels: a circulating high sound from the IKO and the *lowest note* possible on the Helder-Jahn Tenor – d0 performed with a closed bottom hole.

Section 5: *Flur ohne Licht*[287]

In this scene, the first face-to-face confrontation with the IKO takes place. Both instruments are put into a rather uncomfortable situation, which is not meant like a fight against each other, but rather search for an escape together, which also happens at the very end with me leaving the stage behind one of the reflectors. The material of the IKO consists of very fast moving, repetitive sounds and some pre-recorded breathy effects of the Helder Tenor with a *closed windway*. I join this material and enter a dialog with the IKO, also introducing the *lip vibrato* to join the repetitive movement of the IKO.

Section 6: *Einöde*[288]

After this quite emotional ending, time stands still, and we enter a state of suspension through comforting slow waves of the IKO. Being invisible to the audience, I change both *platelet* and *block*, to avoid any unwanted effects through condensed water in the windway. This enables me to freshly re-enter the scene (still behind the reflector) with quite subtle Flageolets, created within the *extended fourth and fifth register* in combination with the *lip control*.

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[286] = *mirrored room*
[287] = *hallway without light*
[288] = *wasteland*

Section 7: *Dröhnung*[289]

This section is a complete solo for the IKO and highlights for a short moment the immense physical impact this speaker can have, and the weapon-like power that drives the IKO's 20 membranes. It gradually expands the space by increasing a full resonating, multi-layered sound that brings everything in the hall into vibration. Just before it becomes too demanding, the almost bursting tension dissolves, leaving the feeling of drinking a healing potion. All spatial constellations that had been laid out before are erased, and the stage and auditorium is cleared for new concentration.

Section 8: *Wiederaufnahmeverfahren*[290]

While the IKO is still fading out, I blend into its chord and take over the solo. I introduce new material which consists of a variation of *trills* and *trill figures* on f1 and g#1, making use of the *extra keys* as well. The IKO begins to accompany me more and more with encouraging rumbles, high buzzes and pre-recorded air sounds. This inspires me to exaggerate my circular breathing, add a *harsh pizzicato* articulation, and overblow into *multiphonic trills* and *harmonics*. After our shared climax, we freeze on a microtonal shifted interval with me using the *lip control* to get as close as possible to the IKO's timbre. This creates a fermata moment, which at this point sounds like a question mark.

Section 9: *Windkanal*[291]

In this scene, the IKO and I both audibly and visually melt together through strong, high and breathy hissing sounds. By moving the *platelet slightly upwards* and putting my right index finger at the windway exit, I create sharp harsh air sounds which get as close to the IKO sound as possible. At a certain point, I lead into the coda by introducing the final note a1, while still staying in the character of the IKO sounds through the *white noise tone* technique.

Section 10: *Indian Door*

Our story has been told, so this section uses as little material and motion as possible to keep the listener's attention and bring the piece to a close. Therefore, I stay a lot on the

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[289] = *drone*
[290] = *retrial*
[291] = *windway*

white noise tones in combination with *quiet multiphonics* and *flageolets* which all are created through the *lip control*.

Now that you have an overview of this 23-minute piece, I would like to point out a few interesting details about "Semaphor". First of all, I could not imagine any other recorder model performing in this setting and speaking the same language as the electronics, except for Paetzold bass recorders which share a similar contemporary sound world to the Helder Tenor. However, considering that the IKO is a spatialising instrument, the static playing position of the lowest Paetzold basses might be a huge restriction. In this piece, we try to discover a shared perceptual spectrum and spatiality of both instruments in dialogue, and thus aim to expand the aesthetic possibilities of spatial composition in the present. Furthermore, I exploit the instrument from its dynamic side, using a wide range going from "niente" and "ppp" up to "fff" within three octaves. At a certain point during our collaboration, we decided that playing acoustically would enable us to get as much spatialization and realistic sound quality as possible. I also discovered through the further developed Sound Unit of the Helder-Jahn Tenor, that I could use different block positions for a distinctive timbre of the instrument[292] and gain optimum sound quality for the playing techniques used in every section. Here is a summary of what works best listed in order of the piece:

- granular tones with wider block position (12h + 9h)
- breathy flutter tongue with wide block position (12h + 12h + 12h)
- white noise tone with wider block position (12h + 3h)
- flexibility in all registers with standard block position (12h)
- lip control tones with wider block position (12h + 6h)
- overblow on extended bottom note with slightly narrowed block position (12h – 9h)
- lowest note with standard block position (12h)
- air sounds through almost closed windway, also including lip vibrato with wide block position (12h + 12h)

[292] The piece "termini spezzati I" written by Sebastian Elikowski-Winkler in 2013 was originally based on four different block positions for four distinctive timbres. Because of the Sound Unit's operational limitations, we had to make the piece work with three block positions.

- air and hiss sounds with slightly shifted platelet and wide block position (12h + 12h)
- quiet multiphonics also in combination with white noise tone with wider block position (12h + 6h and 12h + 12h)

Photo 100: *presentation at OSIL symposium, Probensaal Mumuth in Graz*

During our working process I was confronted with several challenges. The biggest one for me was the reproduction of sounds that I had freshly found. Quite often, a new sound that I came up with could not be reproduced right away or was even lost completely. This sometimes depended on temperature and humidity,[293] but more often was affected by small details such as the size of the windway, a specific shadowed fingering, my thumb nail or a certain throat or tongue position. This is the actual core of my artistic research project, to find out how, when and where I could use these new findings. I was able to explore these details from the inside out through our long working process and several try-outs, and the official premiere was extraordinarily exciting in that sense. Secondly, I worked with my standard Helder Tenor model at the start of the process, and then changed halfway through to the Helder-Jahn Tenor which I received at the end of April 2018. I realized that many sounds with the lip control work differently with the Helder-Jahn Tenor and it was quite challenging to find the same sounds, newly engage with these sounds, and then possibly take them further.

[293] In cold venues I use an electric heating cushion to warm up the instrument. A hairdryer is also possible, especially if there is not much time to warm up the instrument.

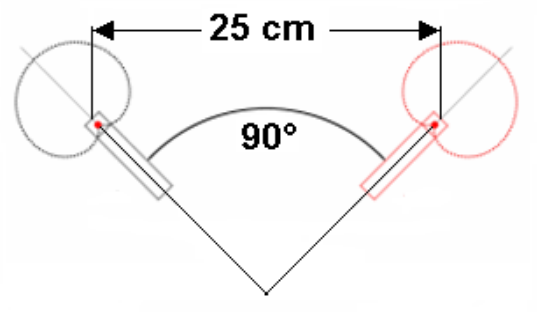
The biggest challenge for both of us was to develop a piece with an electronic device as the second performer on stage. Gerriet, who has written several papers with his colleagues Frank Schultz and Franz Zotter, examining the instrumentality of loudspeaker arrays and the IKO's way of orchestrating spaces, was now confronted with a task that could possibly destroy everything he had discovered within one performance. What would happen to the filigree sculptural formations once a human being entered the spatiotemporal scene? However, the contrary happened, and in our first session I already got the feeling of playing chamber music and perceive the IKO not as a loudspeaker, but rather as a colleague and partner on stage. This was only possible due to Gerriet's expertise on how to perform with and compose for the IKO, as well as his ideas and openness to bring the IKO into context with another live performer, understanding both instruments as sound projectors that make sound spatially tangible. During our working process we became more and more aware of the different ways I could interact with the IKO. What felt at first like a complete reduction of my physical presence, shifted to both performers achieving the maximum concentration and optimum balance in presence and sound quality of both performers, depending of course on what was required for the scene and dramaturgy. For example, we realized that as soon as the IKO starts performing multi-layered movements, spreading over the whole range of the stage, I can allow myself to use body movements as well, but always in relation to the IKO. This also has a big impact on my positions on stage. We experimented a lot with transitions from one section to the other, thus from position to position, and finally choreographed the whole piece by following the dramaturgy of the music, creating an overall sensual experience. The next challenge for me was to then dare to be free and take risks and to make every performance unique.

The final step of our collaboration was to find a way to document our piece in a way that would meet the requirements of a spatial composition and present its depth and dimension. Although we recorded and videoed our work sessions and performances,[294] my biggest goal was to include 'Semaphor' on my debut album.[295] When I first came up with this idea, Gerriet and I knew that we could not just go into a standard recording studio, but that we would need both special equipment and a mastermind to make this recording happen. Gerriet's colleague Frank Schultz, who is an audio researcher and

[294] Video recording of the premiere can be found in the APPENDIX: 8.3. Analysis sheets
[295] APPENDIX: 8.5. Debut CD

responsible for the IKO's algorithms and technical support, came up with two ideas that we could use in the CUBE studio at the IEM in Graz: a stereo version in equivalence stereophony, and a headphone stereo version using a dummy head.

For the stereo version in equivalence stereophony, we used the Eberhard Sengpiel (EBS) recording system with two condenser microphones at 90-degree angle, at a distance of 25cm.

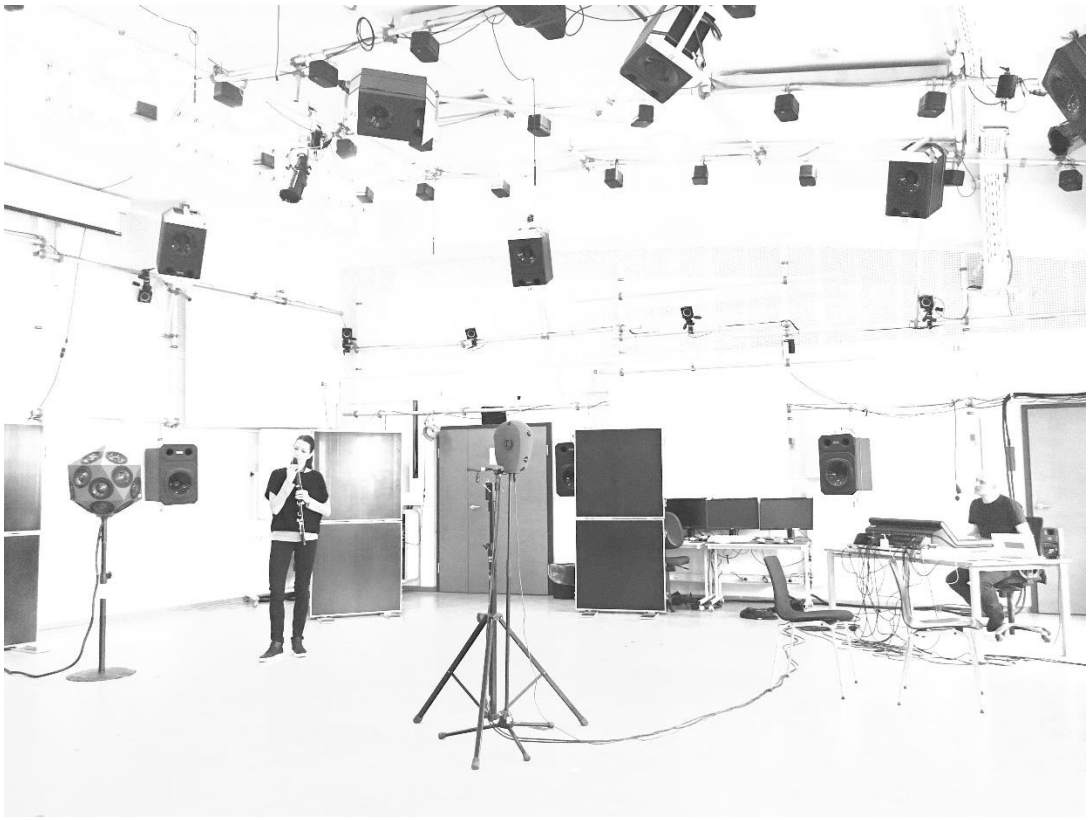


© sengpielaudio

Photo 101: *Eberhard Sengpiel recording system*

After experimenting with several positions of the microphones, Frank chose a distance of 4.80 metres perpendicular to the IKO's axis. Aesthetically, this solution was the most sensible, because the diffusion and direct proportion were exactly the same and fit perfectly with the acoustics of the CUBE. The 90-degree angle and short distance of the microphones to the IKO made us rethink my live performance spatial positions, and most positions were adjusted for each section to get the most out of the audio recording. In order to meet the requirements for living room listening conditions, we slightly adjusted dynamics to a range of 50 decibels for the album.

We also recorded "Semaphor" in headphone stereophony with a dummy head which had been tested several times in live performances. For this recording, we chose the same position as the microphones in the equivalence stereophony recording. To fully perceive this composition as if "live in concert", we kept the original and intended dynamics of approximately 72 decibels. Although binaural recordings have been made in the past of electronic spatial music, the combination with a live performer is quite unique and therefore its documentation is an important testimony of our time.



© Gerriet K. Sharma

Photo 102: *recording session with Gerriet K. Sharma and Frank Schultz at CUBE, TU Graz*

4.5. Findings in comparison

To clearly present the new potential of the Helder Tenor, it was important to find out, which and how many extended playing techniques have been developed so far, when these techniques appeared for the first time, and when they were established in methods and other pieces. This allowed me to make immediate comparisons and get an overview of actual numbers.[296]

Through this research, I've come to realize that our extended playing techniques and contemporary performance practice hasn't changed much in the past 50 years. Pieces from the 1960s[297] and 1970s[298] are still some of the leading compositions when it comes

[296] A detailed chart can be found in the APPENDIX: 8.1. Charts Playing techniques
[297] For example, Rob Du Bois "Muziek" (1961), Jürg Baur "Mutazioni" (1962), Louis Andriessen "Sweet" (1964), Luciano Berio "Gesti", and Makoto Shinohara "Fragmente" (1968)
[298] For example, Maki Ishii "Black Intention" (1975), Kazimierz Serocki "Arrangements" (1975/76), Konrad Lechner "Varianti" (1976), and Ryohei Hirose "Meditation" (1976)

to avant-garde playing techniques and sound possibilities. In 1978 Gerhard Braun already mentioned this phenomenon in the chapter, *Ausblick* (outlook), which concluded his book *Neue Klangwelt auf der Blockflöte* (The recorder's new sound world).[299] Since then a few more exciting explorations have been made, especially through new instruments which have been developed such as the modern Ganassi recorder[300] and the renowned Paetzold bass recorders.[301] Forward-looking performers and their inspiring initiatives,[302] as well as composers and their visionary ideas for the recorder,[303] have also resulted in exciting new discoveries.

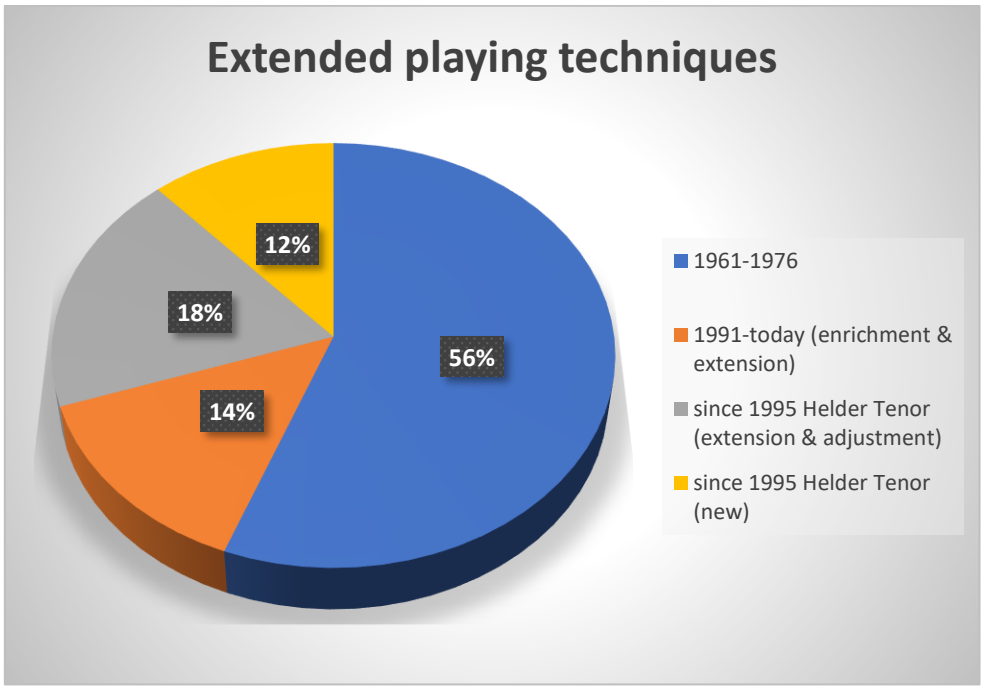


Figure 14: *diagram of extended playing techniques*

[299] Wilhelmshaven, 1978, p. 93
[300] "Rotations" by Jan Rokus van Roosendael was the first piece written for the Ganassi g-alto in 1988.
[301] "Seascape" by Fausto Romitelli was written 1994 and is the first solo piece featuring the new potential of the Paetzold Contrabass.
[302] For example, the first International Week for Twentieth-Century Recorder Music in Amsterdam 1988, Recorder Competitions in Rome (1991) and Calw (1992, 1995) including new commissions (Maki Ishii "East green spring", Calliope Tsoupaki "Charavgi"), and the "Internationale Tage für Neue Blockflötenmusik Basel" (1993)
[303] For example, "Austro" (1991) by Giorgio Tedde, using circular breathing, "Weeds in Ophelia's Hair" by Rolf Riehm, using an extreme range of dynamics, or "nah, getrennt" (1992) by Matthias Spahlinger using an immense variety of microtones.

As one can clearly see in the diagram above, The Helder Tenor recorder is an instrument that brings a new dimension into our performance practice and takes our playing technique to another performance level. In total I have found 106 playing techniques, out of which only one[304] has not yet been used in compositions and is therefore not included in my calculations. From 1961 to 1976, 72 playing techniques were developed and used in various contemporary music scores that were mainly written for copies of baroque instruments. During this time, but especially afterwards, these techniques were deepened and *used more sparingly and effectively*,[305] appearing in numerous scores and becoming established in various methods. From 1991 onwards, these techniques have been enriched by five new air sounds and three new variations of articulations and extended by five new pitch effects and five new ways of preparation. Since 1995 there have been 15 additional new playing techniques developed on the Helder Tenor plus 24 improvements, including 16 extensions and eight adjustments.

The following chapters provide a detailed summary and description of each of the extended playing techniques that can be played on a recorder, with a focus on the new potential of a contemporary recorder model such as the Helder Tenor.

4.5.1. Contemporary techniques of recorder playing

This section gives an overview of the contemporary techniques of recorder playing including the special Helder Tenor techniques which are underlined. My main focus is extended techniques, but I have also included some general playing techniques that are important for contemporary music. The same list appears in the appendix[306], with additional information on repertoire and methods in which these techniques were used and discussed for the first time. Besides that, I have included recordings of every technique to show their actual sound and to demonstrate that these techniques also work on the Helder Tenor.

I have divided these playing techniques into four different categories so that each individual technique and the ways it can be manipulated is made clear. Most of these playing techniques can be performed on all recorder models, but they will sound and work

[304] Playing technique number 1.02.d) *whistle tones at the finger hole*
[305] Eve O'Kelly: *The recorder today* (Cambridge, 1990), p. 63
[306] APPENDIX: 8.4. Playing Techniques_Repertoire&Methods

differently depending on the size, bore, voicing and keywork of each instrument. The four categories are discussed in the following order (chosen by their order of appearance when playing): air sound, articulation, pitch and possibilities of preparation. I have aimed to make this list as comprehensive as possible to give a full overview of the recorder's extraordinary potential. As Michael Vetter already wrote in his treatise in April 1964:

When these technical possibilities are fully exploited, the recorder is a new instrument which combines and mixes the characteristics of the flauto dolce with that of a "flauto acerbo" in a natural way; on the other hand, it can clearly contrast them and produce musical tensions as scarcely any other instrument can.[307] Michael Vetter

1. AIR SOUND

1.01. breath noise

a) breathing in through the mouthpiece (with and without articulation)
b) breathing out through the mouthpiece (white noise; window[308] closed with one finger of the right hand; only left-hand fingerings possible)
c) breathing in and out at the window (completely closed or at different angles; different consonants possible, e.g. "s", "sch", "f")
d) breathing in and out through finger holes (different consonants possible, e.g. "s", "sch", "f")
e) breathing out through closed teeth and/or whispering a consonant like e.g. "s", "sch" or "f" (this only works in the first two registers)
f) breathing out opening the upper lip (transverse flute embouchure) and/or whispering a consonant like e.g. "s", "sch" or "f"
g) breathing out with distance to the mouthpiece (variations through different consonants e.g. "s", "sch", "f")
h) whistle (into the window or body[309])
i) <u>breathing out through the mouthpiece with a closed windway (starting from e2; sounds best with a wide windway)</u>

---

[307] = *In allen diesen technischen Möglichkeiten voll ausgenutzt, ist die Blockflöte ein neues Instrument, dessen Eigenschaften als Flauto dolce sich mit denen eines „Flauto acerbo" auf natürliche Weise miteinander verbinden und vermischen, um an anderer Stelle wieder deutlich gegen sie in Kontrast zu treten und klangliche Spannungen entstehen zu lassen, wie sie kaum ein anderes Instrument in seine natürlichen Grenzen einschließt*; in: Michael Vetter: *Il flauto dolce ed acerbo* (Celle, 1969), p. 8
[308] Very often falsely referred to as the labium.
[309] Recorder without head joint.

j) breathing out through the mouthpiece with a slightly opened windway and tongue on top of the windway entrance ("white noise tone", or "Rauschton"; especially in the first two octaves)

k) "granular tone" (distortion on certain pitches, especially in the highest registers and rather open fingerings; works best with a wide block position)

1.02. whistle tones

a) at the mouthpiece (with all holes closed; wide windway works best)

b) across the window (with all holes closed, or with closed head joint only)

c) at the window (with one finger splitting air at the windway's exit while blowing through the windway; works best on low instruments, especially Paetzold basses)

d) across the finger hole (works best on the third finger hole of the upper hand)

e) "jet-whistle" (works best on the first finger hole of the upper hand with all other holes closed)

1.03. vibrato

a) diaphragm

b) larynx

c) mouth (like chewing: a-f-a)

d) tongue (e.g. "j", "l", across the windway entrance)

e) shake (works over the range of approximately one octave and a fifth, but works best on low notes)

f) labium (Theremin sound; with right hand, only left-hand fingerings possible; adjust pitch with the piano key)

g) air flutter (e.g. with right index finger at the top of the window, depending on the size of the windway exit; adjust pitch with the piano key; works better with the piano key)

h) finger

i) knee (especially on forte fingerings in the first octave)

j) lip (throughout the range)

1.04. **circular breathing**

a) regular

b) including lip control effects

2. ARTICULATION

2.01. **legato** (expanded through extended 2nd, 3rd and 4th register)

2.02. **different consonants:** b, d, f, g, h, k, l, p, r, s, t, z (also in combination; inside or outside the mouthpiece; or in combination with vowels)

2.03. **pizzicato** (closed lips) or "slap tongue" (no overblow on Helder Tenor; variations through different block positions especially in higher registers)

2.04. **sputato** (open lips; including overtones)

a) lots of air sound (th)

b) dry air sound (t)

2.05. **tongue ram** (pronounce "hot" or "ht" with or without breath noise)

a) into the mouthpiece

b) into the window

2.06. **whispering/speaking words** (also in combination with finger movements)

a) into the window

b) into the body

2.07. **tongue click**

a) into the mouthpiece

b) into the window or body

2.08. **"kiss" articulation**

a) into the mouthpiece

b) into the window or body

c) works also "stretched"

2.09. **finger or key click** (also bottom hole)

2.10. **flutter tongue** (variations through different block positions)

a) tongue (in front)

b) guttural (in the back, high)

c) guttural (in the back, low)

2.11. **trumpet embouchure** (through middle joint)

2.12. **“fade in fade out” articulation** (<>)

2.13. **“hiss” articulation** (on harmonics)

2.14. **block click** (through lower lip or right index finger)

3. PITCH

3.01. **range** (lowest note (extension), highest note (extension), chromatic)

3.02. **different block positions:**

a) standard
b) narrow (affects all registers, especially the attack)
c) wide (affects all registers)

3.03. **alternative fingerings/colour fingerings** (more variations through extended key system)

3.04. **overblow**

a) enharmonic (with and without articulation)
b) harmonic (with and without articulation)
c) multiphonic
d) microtonal
e) white noise (with covered bottom hole; works better with a wide windway)

3.05. **underblow** (“flageolet tone”)

a) “underblow”
b) technique with slightly opened thumb hole (works better with the piano key)
c) more possibilities including upper octaves through the principle of pure harmonics and lip control

3.06. **transverse flute tone**

a) on certain finger holes
b) at upper part of middle joint (Shakuhachi technique)

3.07. **covered sound**

a) with one finger of the right hand at the window, depending on the size of the window (only left-hand fingerings possible; adjust pitch with the piano key)

b) with right hand at the window (only left-hand fingerings possible; adjust pitch with the piano key)

3.08. "Pfeifton"

a) noisy (flat palm; only left-hand fingerings possible)

b) pitched (round palm; only left-hand fingerings possible)

3.09. fast improvisation with random fingerings (with or without articulation; variations through different air pressure)

3.10. trill

a) trill (more options through extended registers)

b) double trill (trill with two notes alternating)

c) trill figures (including microtones)

d) timbric trill/bisbigliando (more options through extra keys)

e) multiphonic trill (more options through extra keys)

f) "Pfeifton" trill (with right-hand flutter at labium)

g) glissando trill (with trill mainly on right hand)

3.11. tremolo (more options through the extended registers)

3.12. glissando

a) small interval (more options with the piano key up to a2), either with finger or breath

b) large interval (more options through extended registers)

c) labium (with right hand; only left-hand fingerings in the first register are possible; adjust pitch with the piano key)

3.13. short pitch fluctuation (on long notes)

3.14. multiphonic (different sound qualities through different block positions)

a) harmonic (three playing techniques : normal sound into overblow, overblow into normal sound, direct)

b) disharmonic ("beat"; more options through extra keys)

c) "insecure"[310] (unstable,[311] unlike stable harmonic and disharmonic multiphonics)

[310] Named by Donald Bousted in his piece "In Preparation" (2003).
[311] Named by Martine Kientzy in his treatise "Les sonds multiples aux flutes a bec" (1982), p. 8

d) "delicate"[312] (soft)

e) "quiet" (only two pitches; works better including white noise tone effect)

3.15. microtone

Mainly used:

1/4 tone (+/- 50 cents)

1/6 tone (+/- 33 cents)

1/8 tone (+/- 25 cents)

1/12 tone (+/- 16 cents)

Other intervals are possible as well. Through the piano key one can easily produce microtones in the first two octaves.[313]

3.16. two recorders at the same time (only one-hand fingerings possible, including the left and right pinkie finger for smaller models; different tunings possible; finger holes can be taped)

3.17. playing and singing at the same time (or whistling into the recorder)

a) drone (one pitch only)

b) counterpoint

c) dissonance

d) "Summton" (any pitch)

e) singing into the window or body

4. POSSIBILITIES OF PREPARATION

4.01. outside the instrument, e.g. with aluminium foil, plastic wrap, paper bags, clay or plasticine, etc. at the labium or any (exit) opening; e.g. closed register[314]

a) head joint closed with aluminium foil

b) head joint closed with paper bag

c) recorder with closed bottom hole (with a key or plug) or covered bottom hole (with the knee)

d) recorder with closed bottom hole and closed window/labium

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[312] Named by Martine Kientzy in his treatise "Les sonds multiples aux flutes a bec" (1982), p. 8

[313] Listed in chapter 3.1.2.

[314] Named by Michael Vetter in his treatise "Il flauto dolce ed acerbo" (1969), p. 10

4.02. **inside the instrument,** e.g. putting something into the windway, or the head or middle joint

a) aluminium foil between the head and middle joint (or closing the bottom hole
b) paper inside the windway
c) chop stick in the bottom hole

4.03. **playing on certain parts of the instrument,** e.g. head joint, mouthpiece, head and middle joint, middle and foot joint, middle joint, foot joint, bocal, cap, etc.

a) head joint alone
b) foot joint alone
c) without foot joint
d) chop stick tapping or scratching the head joint's exterior

4.04. **different shapes and materials for the block**

4.05. **different shapes and materials for platelets (windway roof)**

4.5.2. Improved contemporary playing techniques (after 1995)

The following playing techniques are more effectively executed on the Helder Tenor and therefore enrich the standard playing techniques and performance practice of a regular recorder model, either through an extension or an adjustment.

Extensions are described in the same order as the list of playing techniques:

- *knee vibrato*: is produced by moving the bottom hole forth and back on the thigh. This effect works very well on strong notes, especially on Helder forte fingerings.[315]
- *expanded legato*: sometimes legato musical phrases are written over several register changes and it can be quite difficult to make this phrase sound as balanced as possible. Through the extended registers one certainly gains more options to choose from.[316]
- *pizzicato*: using a harsh articulation like the pizzicato on early music recorders, especially copies of baroque recorders, causes an overblow and therefore the

[315] A list of Helder forte fingerings can be found in chapter 3.1.2.
[316] A list of the extended registers can be found in chapter 3.1.1.

actual notated pitch is hardly audible. Because there is no overblow on the Helder Tenor, the notated pitch sounds strong. Variations can be created through different block positions.

- *flutter tongue*: this effect is very common and can be varied through three different positions: tongue in the front, the upper throat, or the lower throat. One can create even more variations through different block positions.
- *extension of lowest note*: through the extension key for b0 plus a closed bottom hole to d0.
- *extension of highest note*: through the principle of pure harmonics up to e4.
- *extension of alternative fingerings*: these colour fingerings are one of the strongest features of the recorder and therefore it is an absolute enrichment to have even more possibilities. In this case, one gains more options and stronger variations due to the bore in combination with the extended key system.
- *trill*: this ornament is sometimes placed over register changes. Through the extended registers one can avoid unnecessary register jumps and gain more options for trill combinations.
- *timbric trill/bisbigliando*: these fast changes in sound colour work best with a strong and audible change in sound colour, depending on the register of the particular note. One gains more options to choose from through the extra keys and the extended registers.
- *tremolo*: idem trill.
- *multiphonic trill:* one can create more options and variations through the extra keys.
- *glissando with small interval*: on a regular recorder model this effect can be produced by slightly sliding the fingertips up or down an open finger hole or by raising or dropping the air pressure. The piano key adds another option one can choose from.
- *glissando with large interval*: sometimes a glissando is written over a register change and this can cause some difficulty. Extended registers might help and offer more options to choose from.
- *multiphonic in general*: these specific sounds work very well on the recorder and are therefore used quite often in pieces. One can create more variations through different block positions. A wide windway helps to produce a multiphonic but

makes it less strong in quality. The narrower the windway, the harder it becomes to produce a multiphonic, but the more colourful it can sound.

- *disharmonic multiphonic*: these "beating multiphonics" work very well on the Helder Tenor, especially through its new bore and the extra keys. In contrast to the harmonic multiphonics, two dissonant pitches will mainly sound and create vibrations of different strengths depending on the pitches created.
- *microtone*: it is quite easy to produce microtones on a regular recorder model through its open finger holes and by changing air pressure, although this depends a lot on the register. The piano key provides an additional option to raise pitches microtonally because you can open this key without the need to change air pressure.

Adjustments are described in the same order as the list of playing techniques:

- *whistle tones at the mouthpiece*: these harmonics are produced by closing all holes, including the bottom hole, while breathing in through the mouthpiece. Shaping the airstream through different vowels and varying the air pressure, creates different *whistle tones*. This effect works best with a wide windway.
- *labium vibrato*: this effect imitates the sound of a theremin quite effectively. By moving the slightly curved fingers of the right hand[317] up and down (not completely closing the window) and therefore moving or massaging the air stream at the labium, one can create a contrasting vibrato and even add variations through different speeds. This impacts the tuning, which can be adjusted through the piano key.
- *air flutter*: this very soft vibrato is produced by putting the right index finger close to the windway exit to split the air. Variations in air pressure will create variations in the speed and amplitude of the vibrations. This also impacts the tuning and the pitch can be adjusted with the piano key.
- *white noise overblow*: this harsh air sound is created by closing all finger holes, including the bottom hole, and using a lot of air pressure to overblow into a white noise effect. It works best with a wide windway.

[317] Best position is to focus the instrument between right thumb and the right index finger above the windway exit and moving middle, ring and pinkie finger.

- *underblow with slightly opened thumb hole*: these flageolet effects are produced within the first register by slightly opening the thumb hole and fingering a half tone lower. Although this works quite well on any recorder, it works even better on the Helder Tenor with notated fingerings, a slightly opened thumb hole and through using the piano key.
- *covered sound with one finger*: this is related to *air flutter*, but in this case the finger only covers the sound and doesn't split the air. The pitch can also be adjusted with the piano key.
- *covered sound with right hand*: this is related to *labium vibrato*, but in this case the right hand covers the sound without moving. The pitch can also be adjusted with the piano key.
- *labium glissando*: this is related to *labium vibrato*, but the fingers only move in one direction, either up or down. The pitch can also be adjusted with the piano key.

4.5.3. New contemporary playing techniques (since 1995)

In this section the new playing techniques of the Helder Tenor are explained in more detail. They are listed once again in order of appearance:

- *pure harmonics*: the Helder Tenor is based on the principle of pure harmonics, which means that when the four lowest notes are overblown, pure overtones will be reached (more or less). These harmonics, as well as the third octave, do not require force and a lot of air pressure compared with, for example, baroque recorders. The embouchure is comparable to singing in head voice with a high palate and is used in combination with shadowing certain finger holes, depending on the pitch and therefore its nodes and antinodes.[318]
- *use of lip control*: by pressing the lips together, the tone gets a smooth and clean beginning and ending. Depending on the register, one must adjust the air pressure in relation to the support of the diaphragm while at the same time relaxing the fingers, especially the ones which should be shadowed. This mechanism also

[318] More information in chapter 3.1.1.

enables one to create additional flageolets and to play softly within the third octave.[319]

- *circular breathing with lip control*: this allows one to use circular breathing in soft dynamics over two and a half octaves. It requires a slightly different technique because of the pressed lips, and one must be careful to keep a steady lip pressure.
- *wide windway*: by using the screw at the back of the mouthpiece (clockwise) one can easily move the block up and therefore change from the standard sized windway to a wide windway. As mentioned in chapter 3.1.3. a wide windway needs less pressure, but more air speed, volume and attack, and the pitch will slightly increase.
- *Rauschton* or *white noise tone*: air sound is usually added to the pitch externally by opening the lips. By pressing the lip control while putting the tip of the tongue on the windway entrance, the air sound blends together with the pitch and becomes audible through the windway.
- *lip vibrato*: shaking the recorder while pressing the lip control. This effect works within the whole range.
- *quiet multiphonic*: using the lip control while playing a certain multiphonic (g#1, a1 and b^b1 work best). Here it is important to know that only two notes will sound at the same time and that it takes quite a while to create a stable interval. This effect works more easily and sounds more quickly in combination with the *white noise tone*.
- *fade in fade out-articulation* = <>: using the lips instead of the tongue for an articulation. This effect needs more time than a normal tongue articulation.
- *block clicks*: striking the block with the right index finger. This effect works well with other clicking sounds such as key or mouth clicks.
- *narrow windway*: by using the screw at the back of the mouthpiece (counter clockwise) one can easily move the block down and therefore change from the standard sized windway to a narrow windway. As mentioned in chapter 3.1.3.a narrow windway requires more air pressure, but less air speed, volume and attack, the pitch will slightly decrease, and the total range gets smaller.
- *granular tones*: work on special fingerings in the third octave (especially around e3) while pressing the lips using a high palate and quite strong air pressure.

[319] More information in chapter 3.1.3.

- *hiss articulation*: works on certain harmonic fingerings, using a “ht”-articulation while pressings the lips. This effect works only in staccato.
- *different shapes and materials of the block*: one can use for example a block made from modelling resin for a rather rough sound quality.
- *different shapes and materials of the platelet*: one can use for example a platelet made from African blackwood for dark, piercing and noisy sounds, in contrast to Synpor for rather fine, pure and melodic sounds.
- *breathing out through the mouthpiece with a closed windway*: almost completely closing the windway by pressing the lips and using a lot of air pressure. This effect sounds sharper than the *white noise tone.*

5. Conclusion

During the 1960s until the mid-1970s, a few keen recorder players together with composers revolutionized the recorder performance practice and playing techniques and *put the instrument in a completely new context: the musical avant-garde*[320]. In practice, this means that recorder players defied their instrument's supposed limits and met the same technical demands that were already considered normal for "modern" instruments such as an extended range, complex rhythmic patterns, experimental alterations in timbre and a wide spectrum of dynamics. After this revolution settled down and extended playing techniques became established, the search for new recorder repertoire began and contemporary recorder models suited to contemporary music were developed more frequently. Reflecting on four years of intense research and an adventurous journey of exploring an incredibly versatile contemporary recorder model, I am very happy to present the Helder Tenor's new potential through this thesis and its supporting material.

The Helder Tenor has had a big impact on my playing technique and performance practice. What follows is a summary of the main physical and psychological experiences that I have gained through rehearsals, recordings, performances and conferences:

- **Physical experience**

After a few years of intense Helder Tenor playing, I noticed certain changes within my body, for example, the horny skin on my left thumb because I play a lot with a leaking thumb hole, and the horny skin on my right thumb because of the instrument's weight and different holding position. This makes me feel more connected to my instrument, like a visible bond between me and my instrument. Through the extensive use of the lip control, I finally feel my lips when playing, which I enjoy very much because this also helps me to feel more attached to my instrument. In the past I could play for many hours a day seven days a week without any physical side effects, and I could also rest for one week and return to playing without any problems. I now have to train my lips and exercise every day to stay in shape like other wind players. Furthermore, I am training to feel the air column underneath my fingertips because the fingerings for the third octave and lip control require this sense more than for standard recorders (although this is proving

[320] = *(…) das Instrument* (recorder) *auch in einen völlig neuen Zusammenhang stellten: den der musikalischen Avantgarde*; in: Gerd Lünenbürger: *Zur Rolle der Blockflöte in der zeitgenössischen Musik* (Tibia 3/1996), p. 183

beneficial for other recorder models as well). In addition, I am training to play without force and less air pressure in the third octave, which is very different to regular models and brings more flexibility into my playing. Last but not least, I am rethinking and training my finger movements on keys to make it feel more natural. The resonance pads are quite helpful here.

- **Psychological experience while rehearsing and performing**

Performing on the Helder Tenor has become more and more satisfying with my growing expertise. My expanded performance practice and playing technique enables me to play many more timbres than usual, and to implement the actual dynamics written in the score. I can't imagine a concert without this instrument anymore and I use the Helder Tenor for most contemporary solo and chamber music repertoire written for a tenor or alto recorder.

Playing a well-balanced third octave is still quite miraculous to me and I sometimes even get confused which octaves I am playing. On regular recorder models the octaves are quite distinct because the air pressure rises when going up the scale. The Helder Tenor is based on the principle of pure harmonics, so the third octave works completely differently and has to be rehearsed again and again, especially when you've mainly grown up with baroque-type recorders. As mentioned in my introduction, I am trained to get the most out of my instruments, no matter what. The Helder Tenor offers so many more possibilities, which can be overwhelming. Once in a while I have to force myself to stick with the instrument and its many options: to find the best solution for a certain passage and not choose the easier way. It is hard work but is always worth the effort in the end. Over the past year, I have realized that I'm starting to take a few special features such as balance and dynamics for granted. I was feeling unsatisfied and wanted to go a step further, and only by comparing the Helder Tenor with regular recorder models it's become clear what I have achieved. This experience has taught me that instrument making is a process and I hope it will always develop further.

- **Psychological experience while recording**

Recordings were a very important tool during my research and I recommend them for any musician. Very often I was positively surprised that the sounds and dynamics I was making are now possible on a recorder and I could finally add new sounds and techniques that I was looking for. This motivated me a lot and pushed me further. Besides that, I got immediate feedback and could analyse what and how to improve, for example, fingerings

for better balance, or my technique for the lip control and piano key. Analysis of the recordings were quite revealing especially regarding dynamics. I realized for the first time that some of my piano fingerings were even louder than the standard fingerings, because their change in timbre had tricked me. Next to that, I discovered that playing a dynamic phrase, meaning working with piano key and dynamic finger movements, has more effect than just the dynamic fingering itself. This kind of knowledge brought my playing technique to another level of performance.

- **Feedback from outside**

Recorder players and colleagues react with both scepticism and admiration and I guess it is now a question of whether one is willing to walk new paths with the recorder or not. While for some players it is probably a matter of taste, for me as a teacher it is a matter of responsibility. If we don't explore current and future possibilities, we can't make a real choice and hand it over to the next generations. When I perform on the Helder Tenor with other musicians, there is a lot of interaction and expressive chamber music making: much more than I am accustomed to with my regular instruments. I am able to blend in, play on top, play along, support from underneath, add special timbres, and be part of the whole ensemble rather than the exotic exception. When composers and other musicians hear me play, they are positively surprised by the new potential of the Helder Tenor. Very often they have never heard a recorder like this and wonder what kind of instrument it is. This is also the case with the Paetzold basses. The audience always comments on the sonorous sound of the Helder Tenor but also takes it for granted that an instrument of today can create all of those sounds and dynamics. For them it is hard to imagine that a classical contemporary music instrument still has to fight for an extended range, balanced volume of tone, rich palate of timbres and wide spectrum of dynamics.

With contemporary recorder models such as the Helder Tenor and the Paetzold basses, I finally have the feeling that I have arrived in contemporary music. In the past, there were often moments, especially in mixed chamber music ensembles, when the limitations of regular recorder models hit me hard and I realized that I couldn't compete. Even a big collection of regular recorder models couldn't help me out. However, with an exquisite selection of recorder models such as the Helder Tenor and the Paetzold basses, I now have a rich palate of timbres, and can work in a more specialized manner with each

instrument, exploit its full potential more purposefully, and convey the characteristics of each instrument much more clearly to composers, who are very often overwhelmed by the many choices of recorders.

The new potential of contemporary recorder models has been achieved through visionary and future-oriented instrument making, new inventions such as interchangeable blocks and platelets, the addition of keys, and the development of long-lasting instruments with a wide and flexible spectrum of timbre and dynamics. During this research I asked myself if there should be just one universal recorder for the 21st century and concluded that it would be a shame because we would lose the diversity of playing a wide range of repertoire from different epochs. This diversity is very important and makes the recorder quite unique. No other instrument exists in so many variations, sizes and tunings, so we must learn how to use the potential of these various models, meaning we need to study and understand each recorder model to make use of its full potential. This will not only influence the way of playing, but also the choice of repertoire, making it clear that we need contemporary recorder models for contemporary music.

Each era has the instruments most suited to its music.[321]

Nikolaus Harnoncourt

Because of its design and way of playing, a regular recorder is still celebrated as a natural instrument. Therefore, many recorder players don't want to try contemporary recorder models because of their fear of losing authenticity. Through my research I experienced the contrary: the Helder Tenor enables me to adjust and choose my sound through various interchangeable blocks and platelets and different block positions, feel the air column through resonance pads on my keys, play a full and resonant low register, and a well-balanced range of three octaves. So, with its many more expressive possibilities, I feel that I can perform contemporary music more naturally, intuitively, expressively and authentically than on regular recorder models. The Helder Tenor goes far beyond what one is able to play on a regular recorder, therefore, it is absolutely justified to question whether this instrument is still a recorder or a completely new instrument. Because all

[321] = *Jede Zeit hat genau das Instrumentarium, das ihrer Musik am meisten gerecht wird*; in: Nikolaus Harnoncourt: *Musik als Klangrede* (1982), p. 18

principles have remained the same (7 + 1 tone holes, a beak, labium and bell) and the possibilities of manipulating the sound have simply expanded, I believe it should be called a recorder. This allows the Helder Tenor to be compared with other recorder models, be appropriately classified for its playing techniques and performance practice, and to ultimately be viewed as an enriched member of the recorder family.

Despite its positive qualities, very few recorder players are aware of the Helder Tenor's many possibilities, and the following discussion reflects on the four main reasons why. First of all, an instrument's establishment takes a lot of time because performers need to get to know the new instrument, repertoire needs to be created and found, technical issues need to be improved, and most important of all, performers have to be willing to get to know the new instrument. One often doesn't want to change because this means more work and effort, one's comfort zone is challenged, and it might even be risky. However, in my opinion, this openness and willingness is very important for all subsequent generations. Since its development in the early 1990s, the Helder Tenor has already made quite a step forward over the last quarter of a century, including having 67 pieces specifically written for it, and several players trying to push it to its very limits. Secondly, the recorder will always be an instrument for both professionals and amateurs. Although the Helder Tenor has so much to offer, it requires an advanced playing technique and the openness to learn new techniques. This can be overwhelming for amateurs and even for some professional recorder players. To develop an instrument like the Helder Tenor was a big risk but also an exciting challenge for players who want to explore beyond. Thirdly, the environment plays quite an important role and affects the timing of an instrument's first release. If the momentum isn't there and if there is no demand from performers, composers and audiences, the instrument will perish, even if it's the best invention in years. Although the Helder Tenor was developed at a time when the recorder was flourishing in contemporary music repertoire, Maarten Helder was aware that it would take much more time, money and effort to establish his harmonic recorder. His concept was not conceived well enough to convince a broader audience and the economic crisis wasn't helpful either. This leads me to the fourth and last reason: the price of an instrument is always an issue, especially with an instrument like the recorder which can be purchased for very little money. In my experience, it is always worth choosing the best quality and paying more for a better instrument, but reality is different. We live in a throw-away culture with products of low quality frequently purchased and discarded. People are

just not used to spending a lot of money for one good item anymore. So, what do I, and my future colleagues, expect from this instrument in the future?

The recorder is no longer just the early music instrument it used to be, and many diverse inventions are now available on the market. In the professional music scene, it appears in contemporary music operas,[322] music theatre productions,[323] installations,[324] shows,[325] (classical) contemporary music ensembles,[326] classical contemporary solo concertos,[327] improvised music,[328] experimental music,[329] jazz music,[330] and bands.[331] Indeed, in all its variety, the recorder has a lot to offer and suits the music mentioned above. Contemporary recorder models have finally begun to gain ground, but we need more players to explore and know how to play them. Only then can a contemporary performance practice be established, methods be developed, and new repertoire be created. An idea could be to introduce children to contemporary recorder student-models in music schools, so that they get the opportunity to work with keys and perhaps even a Sound Unit from an early age. If we keep playing copies of traditional recorder models most of the time, we will not break new ground, free the recorder from its previous sound aesthetics and present it in new light. This will leave composers, contemporary music ensembles, presenters and audiences still confused and unaware of the recorder's real contemporary potential. Afterall, it is no longer a question of volume because this is easily solved through amplification today. Through my research I have proven that the recorder has become an instrument with its own contemporary voice, rich in many different timbres, and full of expression and flexibility. It is now the responsibility of us recorder players to let this new potential grow and to make people aware of that.

[322] Oscar Bianchi, Wojtek Blecharz, Samir Odeh-Tamimi
[323] Constanza Macras, Amélie Niermeyer, andcompany&Co
[324] Ari Benjamin Meyers
[325] Gabor Vosteen
[326] Curious Chamber Players, Ensemble Ictus, Ensemble Black Pencil, Trickster Orchestra
[327] Dan Laurin, Jeremias Schwarzer, Michala Petri
[328] Josephine Bode, Erik Bosgraaf
[329] Angelica Castello, Pia Palme
[330] Tali Rubinstein, Tobias Reisige
[331] Spark, Jerboah, Hanke Brothers

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6.2. Patent specifications

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- D.P.A. No. DE 3337 704 A1 from 17.10.1983 and E.P.A No. EP 0 138 231 A2 from 17.10.1984 for Arnfred Rudolf Strathmann, Melsdorf: *Flöte mit dem Mundstück einer Blockflöte, welche mit einer Klappenmechanik ähnlich eines Saxophons versehen ist, wobei jedoch die Tasten, Klappen und Tonlöcher den Besonderheiten bei der Tonerzeugung einer Blockflöte angepasst sind.*
- D.P.A. No. DE 3937 500 A1 from 10.11.1989 for Arnfred Rudolf Strathmann, Melsdorf: *Flötenmundstück mit verstellbaren Kernspalt.*
- D.P.M.A. utility model No. 20 2019 001 197 from 11.04.2019 for Susanna Herwig (Geri Bollinger), Tübingen: *Dynamischer Kurzschnabel für Blockflöten*.

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7. Lists

7.1. Illustrations

7.1.1. Photographs

7.1.2. Figures

7.1.3. Musical Examples

7.2. Audio recordings

Bartók, Béla: Aus Gyergyó – Drei ungarische Volkslieder aus dem Komitat Csík
written for soprano recorder and piano, performed on Eagle alto with Jan Gerdes
(Appendix: 8.6. Audio recordings)

Bogason, Tróndur: *Zombie apocalypse*
written for soprano, tenor recorder, clarinet, violin, double bass, percussion and electronics; performed on Helder Tenor with *Figura Ensemble*
(Appendix: 8.6. Audio recordings)

Bornefeld, Helmut: Suite IV, first movement
written for tenor recorder, performed by Peter Thalheimer on a Gofferje Merzdorf tenor in d (Appendix: 8.6. Audio recordings)

Braun, Gerhard: *Grenzgänge*
written for Helder Tenor, performed by Johannes Fischer
(Dissertation: Chapter 4.1.2., Appendix: 8.3. Analysis sheets)

Bruun, Peter: *Seagull Dreams*
written for Helder Tenor, clarinets and percussion, performed on Helder-Jahn Tenor and *Figura Ensemble*
(Appendix: 8.3. Analysis sheets)

Denner, Kathrin A.: *engrave V*
written for Helder Tenor, performed on Helder-Jahn Tenor
(Appendix: 8.3. Analysis sheets, 8.5. Debut CD, 8.8. Recital *Salon de musique*)

Elikowski-Winkler, Sebastian: *termini spezzati I*
written for Helder Tenor (Appendix: 8.3. Analysis sheets)

Elikowski-Winkler, Sebastian: *termini spezzati I* (excerpts)
performed on Helder Tenor with different windways in comparison
(Appendix: 8.3. Analysis sheets)

Fröhlich, Susanne and Sharma, Gerriet K.: *Semaphor*
written for Helder-Jahn Tenor and Icosahedral loudspeaker
(Dissertation: Chapter 4.4., Appendix: 8.3. Analysis sheets, 8.5. Debut CD)

Geng, Shiqi: *Yuki-Onna*
written for baroque oboe, clarinet, violin, accordion, harpsichord, piano and Helder Tenor; performed with students of the KUG
(Appendix: 8.3. Analysis sheets)

Glandien, Lutz: *Vor der Stille*
written for Helder Tenor and electronic tape (Appendix: 8.3. Analysis sheets)

Grossmann, Lukas: *Short cuts*
written for Helder Tenor, soprano, piccolo flute, modern flute, oboe, alto saxophone, violin, viola, cello, guitar and piano; performed with students of the Akademie für Tonkunst Darmstadt (Appendix: 8.3. Analysis sheets)

Hannan, Peter: *RSRCH 12/84 – Dream*
written for tenor recorder, performed on Helder Tenor with a new block made from modelling resin (Appendix: 8.5. Debut CD)

Hron, Terri: *Beast Calls – Susi Spinus*
written for Helder-Jahn Tenor and electronics
(Appendix: 8.5. Debut CD)

Ibishov, Tahir: *Ambivalenz*
written for Helder Tenor and clarinet, performed with Teresa Doblinger
(Appendix: 8.3. Analysis sheets)

Kim, Yei Rang: *Il da (verloren)*
written for soprano, Helder Tenor, bass flute, viola, cello, vibraphone and percussion; performed with students of the Akademie für Tonkunst Darmstadt
(Appendix: 8.3. Analysis sheets)

Lim, Liza: *The long forgetting*
written for Ganassi tenor recorder, performed on Helder Tenor
(Appendix: 8.6. Audio recordings)

Mainwood, Valerie: *Owl Woman*
written for voice and Helder Tenor; performed with Claudia van Hasselt
(Appendix: 8.3. Analysis sheets)

Playing Techniques
performed on Helder Tenor and a baroque tenor recorder after J. Denner by Mollenhauer
(Dissertation: Chapter 4.5.1., Appendix: 8.4. Playing Techniques)

Samawatie, Cymin and Bhatti, Ketan: *Kords*
written for open setting, performed on Helder Tenor and Yamaha basset with the *Trickster Orchestra*
(Appendix: 8.6. Audio recordings)

Samawatie, Cymin and Bhatti, Ketan: *Shir hamaalot*
written for open setting, performed on Helder Tenor with the *Trickster Orchestra*
(Appendix: 8.6. Audio recordings)

Schlünz, Annette: *La faulx de l'été*
written for recorder (soprano, alto, tenor, basset) and percussion, performed on Helder-Jahn Tenor, Mollenhauer modern alto, Moeck Rottenburgh soprano, Yamaha basset; performed with Manuel Alcaraz
(Appendix: 8.6. Audio recordings)

Sciarrino, Salvatore: *Immagine fenicia*
written for modern flute, performed on Helder Tenor
(Dissertation: Chapter 4.3.1., Appendix: 8.6. Audio recordings)

Sharp, Elliot: *Hudson River pieces*
written for open setting, performed on Helder Tenor and Ayumi Paul on violin
(Appendix: 8.6. Audio recordings)

Straesser, Joep: *Points of contact I* (excerpts)
written for tenor recorder and percussion, performed on Helder-Jahn Tenor
(Dissertation: Chapter 4.2.3., Appendix: 8.6. Audio recordings)

Yun, Isang: *The visitor of the Idyll*
written for recorder, performed on Helder-Jahn Tenor
(Dissertation: Chapter 4.2.2., Appendix: 8.5. Debut CD)

Yun, Isang: *The visitor of the Idyll* (excerpt)
performed on Helder Tenor in comparison with Yamaha tenor recorder
(Appendix: 8.6. Audio recordings)

Yun, Isang: *The visitor of the Idyll* (excerpt)
performed on Helder Tenor with prototype foot joint for Felix Breisach video shoot
(Appendix: 8.6. Audio recordings)

7.3. Video recordings

Azzan, Maurizio: *Concetto di aura*
written for Paetzold Contrabass
(Appendix: 8.7. Video recordings, 8.8. Recital *recorder evolution I*)

Bianchi, Oscar: *Crepusculo*
written for Paetzold Contrabass
(Appendix: 8.8. Recital *recorder evolution*)

Elikowski-Winkler, Sebastian: *termini spezzati I*
written for Helder Tenor
(Dissertation: Chapter 3.3.2.3., Appendix: 8.3. Analysis sheets)

Elikowski-Winkler, Sebastian: *termini spezzati I*
performed on prototype Helder-Jahn Tenor
(Appendix: 8.8. Recital *recorder evolution I*)

Elikowski-Winkler, Sebastian: *termini spezzati II*
written for Helder-Jahn Tenor, bass clarinet and percussion, performed with Ingólfur Vilhjálmsson and Matthias Engler from *Ensemble adapter*
(Appendix: 8.3. Analysis sheets, 8.8. Recital *Recorder 2.1*)

Fröhlich, Susanne and Sharma, Gerriet K.: *Semaphor*
written for Helder-Jahn Tenor and Icosahedral loudspeaker
(Appendix: 8.3. Analysis sheets, 8.8. Recital *recorder evolution II*)

Geng, Shiqi: *Yuki-Onna*
written for baroque oboe, clarinet, violin, accordion, harpsichord, piano and Helder Tenor; performed with students of the KUG (Appendix: 8.3. Analysis sheets)

Glandien, Lutz: *Apokryph*
written for recorder, dance, live electronics and video projection, performed on various recorder models such as Helder Tenor and Paetzold Subgreatbass with Iris Sputh and Robert van den Dolder (Appendix: 8.3. Analysis sheets)

Halffter, Cristóbal: *Improvisación sobre el "Lamento di tristano"*
written for tenor recorder, performed on Helder Tenor
(Appendix: 8.7. Video recordings)

Hannan, Peter: *RSRCH 12/84 – Dream*
written for tenor recorder, performed on Helder Tenor
(Appendix: 8.8. Recital *Recorder 2.1*)

Ibishov, Tahir: *Die ungreifbare Silhouette des tanzenden Derwisches*
written for Helder Tenor, clarinet, violin, piano, dancer; performed with students of the KUG (Appendix: 8.3. Analysis sheets)

Kreuser, Timo: *Eine Artikulation*
written for open setting, performed on Helder Tenor and Paetzold Subgreatbass with Ensemble *S.A.F.T.* (Appendix: 8.3. Analysis sheets)

Mainwood, Valerie: *Owl Woman*
written for voice and Helder Tenor, performed with Claudia van Hasselt
(Appendix: 8.8. Recital *recorder evolution I*)

Odeh-Tamimi, Samir: Li-Sabbrá
written for Ganassi tenor recorder and percussion, performed on Helder Tenor with Manuel Alcaraz (Appendix: 8.7. Video recordings)

Ovsepyan, Petros: *Precipitate/Reciperated*
written for modern flute, performed on Helder Tenor (Appendix: 8.3. Analysis sheets)

Scelsi, Giacinto: *Tre pezzi, 3rd movement*
written for soprano saxophone, performed on Helder Tenor
(Appendix: 8.8. Recital *recorder evolution*)

Scelsi, Giacinto: *Ko Lho*
written for modern flute and clarinet, performed on Helder-Jahn Tenor with Ingólfur Vilhjálmsson (Dissertation: Chapter 4.3.2., Appendix: 8.8. Recital *Recorder 2.1*)

Sciarrino, Salvatore: *Imagine fenicia*
written for modern flute, performed on Helder Tenor
(Dissertation: Chapter 4.3.1., Appendix: 8.8. Recital *recorder evolution I*)

Sinan, Marc: *Affectuum machina I*
written for *Neue Vokalsolisten* and *Marc Sinan company*, performed on Helder-Jahn Tenor (Appendix: 8.7. Video recordings)

Straesser, Joep: *Points of contact I*
written for tenor recorder and percussion, performed on Helder Tenor with Matthias Engler (Dissertation: Chapter 4.2.3., Appendix: 8.8. Recital *recorder evolution*)

Straesser, Joep: *Points of contact I*
performed on Helder-Jahn Tenor with Matthias Engler on percussion
(Appendix: 8.8. Recital *Recorder 2.1*)

Tedde, Giorgio: *Austro*
written for alto recorder, performed on Coolsma alto recorder
(Appendix: 8.8. Recital *recorder evolution*)

Tuhkanen, Timo: *Heel*
written for Paetzold Contrabass
(Appendix: 8.8. Recital *recorder evolution I*)

Yun, Isang: *The visitor of the Idyll*
written for recorder, performed on Helder-Jahn Tenor
(Appendix: 8.8. Recital *recorder evolution II*)

Yun, Isang: *The visitor of the Idyll* (excerpt) filmed by Felix Breisach
performed on Helder Tenor with prototype foot joint
(Appendix: 8.7. Video recordings)

Zdralek, Marko: *Strandgut*
written for baritone, Helder Tenor, violin and piano, performed on Plexiglass Helder Tenor by Johannes Fischer and his family
(Dissertation: Chapter 4.1.3., Appendix: 8.3. Analysis sheets)

7.4. Recitals

- *recorder evolution* at the contemporary music festival “Zeitströme” in Darmstadt on 25th of February 2016
- *recorder evolution I* at Acker Stadt Palast Berlin on 12th of September 2017
- *recorder evolution II* at Acker Stadt Palast Berlin on 25th and 26th of October 2018
- *Recorder 2.1* at the contemporary music festival “Klangwerkstatt” in Berlin on 18th of November 2018
- *Salon de Musique* at the contemporary music festival “Archipel” in Geneva on 31st of March 2019

Dedicated to Gerd Lünenbürger.