Arttu Nummela

The contemporary string instruments

How to master extended bowed string instrument performance techniques

Written reflection within degree project
The sounding part consists of the following recording:

Sounding part 1. Knox, Garth, Viola Spaces, No 2: Sul Tasto “Ghosts”
Sounding part 2. Ligeti, György, Viola Sonata, First movement: Hora lungă
Abstract

In this study, the focus is on techniques for playing contemporary music on the viola and other bowed string instruments. These techniques include playing overpressure, some percussion techniques, special pizzicato and left-hand pizzicato techniques, different contact point techniques, various harmonic techniques such as Effleure, multiphones and subharmonics, and trills. In order to effectively execute these techniques, it is important to experiment and practice them in various ways. To properly execute percussion techniques, for instance, it is suggested to seek guidance from percussionists and for pizzicato techniques double bass players or guitarists. For practicing part, this thesis should be a help for players struggling with the extended techniques. The use of these techniques is discussed with the goal of practicing them to achieve the highest level of performance possible. For readers who are already familiar with these techniques, I suggest skipping the introduction and jumping directly to the fifth part of the study.

Key words: contemporary music, contemporary bowed instrument techniques, extended technique practice
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1 Introduction

In this thesis I am studying contemporary styles of playing bowed string instruments – mainly the violin and the viola – from the performer’s point of view. I am going through different extended techniques of playing, but not only how they work and how they sound, but also how to practice and master them. There is only a little literature about the topic, because usually writers tend to prioritise the composing aspect of these techniques. Therefore, I think that there is a need for players, on any level, to have some guidelines on how to practice extended techniques when they appear in the repertoire.

There will be an introduction of each chosen technique with score examples. Some of the techniques have a standard notation system, and some do not. There will also be a description of how these styles are sounding – how is angular bowing differing from normal one? Or is it just a failure of one’s education?

Most of the extended styles of playing are bowing techniques because on string instrument the sound is mostly made with the bow. That is why the bow is the most used element in making different timbres in contemporary music.

The other sound making element is pizzicato – playing with fingers. This is limiting different techniques even more than the bow. String instrument played with fingers still have a huge variety of playing styles from piano-like articulation to similar articulation with percussion instruments.

Percussion techniques are also part of playing string instruments in a new way. In these techniques the whole instrument can be used, also with help with other devices such as guitar picks, triangle stick and glass sticks. Depending on where you hit the instrument – with love and caring, of course – the instrument gives different sounds. For the composers who are reading this study I want to mention that if you are planning to write a piece which has a lot of percussion techniques blending with normal style of playing, players might change their main instruments and bows to secondary instruments when the level of normal playing is lower than with their main instruments.

In practice rooms players are often struggling with contemporary techniques and learning them is incredibly difficult because there are so few guides on how to make them work properly. Also, the level of these techniques can stay low because there is no standard level of playing them, so in the concert situation half well is going to be acceptable. If a player is playing Brahms with terrible intonation and without sense of tasteful phrasing, the audience is not going to like it in most cases. The same kind of standards does not occur
for contemporary string instrument techniques. If it is convincingly played, audience is happy – or in some cases, when the piece is over.

When practicing extended techniques, one should first think about how the composer is wanting it to sound. Sometimes the technique can be Paganini-like tricks just for the show but in most cases the composer wants a special sound. Is this sound supposed to stick out or be part of the piece’s sound world?

The performer should think of their instrument as a playground. One can test new things and play with the instrument as children – searching for new sounds: Finding the ways of doing something the composer asks, performer wants, and audience loves.

For the practicing part, this thesis should be a help for players struggling with the extended techniques. Or players who are curious of how to widen their knowledge of playing the instrument. Why are vibrato exercises part of daily routine but not mastering overpressure? These techniques also need regular practicing to keep the level high. There are no highways to happiness where one learns the playing style and knows it for a life. I myself have struggled with subharmonics; learning them, forgetting them, getting frustrated when trying to play them, learning them again, forgetting them...

I have tried to provide some exercises for techniques and tricks to get to the start with everything. Some things I have found useful while testing and trying to get everything work. But as always in playing the instrument, the individual practice is ninety-five percent of the work. Hopefully this five percent that I can give will encourage many players to try to learn these techniques and enjoy playing contemporary music more!
2 The right-hand techniques

In this chapter, I have organized different techniques into two main categories: right-hand techniques and left-hand techniques. These are divided into several subcategories, such as bowed techniques and pizzicato techniques. There is also a category for harmonics and various techniques, which contains other techniques that don't fit into the other categories mentioned above.

2.1 Bowed techniques

2.1.1 Contact points

Figure 1. Zlata Brouwer’s picture of different “official” contact points.¹ ²

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Sul ponticello

Sul ponticello is a bowing technique that produces a thin, reedy, and highly articulated sound on string instruments. It is achieved by placing the bow closer to (or on) the bridge of the instrument, rather than in the normal contact point on the strings. The first mention of the technique dates back to 1542, when it was described by Sylvestro di Ganssi. In contemporary music, it is used with much more nuance than in older music.

Figure 2. Different contact points marked in different lines in Allen Strange’s Star Salon Strikers and Slider’s Last Orbit. The top line indicates extreme sul tasto, the middle line position normale and the bottom line on the bridge.

3 Auer, Leopold: Violin playing as I teach it, Frederick Stokes Company, 1921, 21–22
5 Allen Strange: Star Salon Strikers and Slider’s Last Orbit, Permanent Press, California, 1973
Sul tasto

In contrast to sul ponticello, sul tasto is a bowing technique in which the bow is placed further away from the bridge of the instrument, and closer to the fingerboard. This results in a softer, more muted sound with fewer overtones. In contemporary music, the technique of sul tasto is often stretched to its limits, with musicians exploring the full range of tonal possibilities available through precise control of bow pressure and placement.

Sounding part 1. Knox, Garth, Viola Spaces, No 2: Sul Tasto “Ghosts”

Sub ponticello

Sub ponticello is a technique in which the bow is placed on the opposite side of the bridge from the usual contact point. This produces a unique sound and allows the player to explore the full range of tonal possibilities available on their instrument. The sub ponticello technique can be marked in different ways, as demonstrated in examples from Alvin Curran’s piece for violin (Figure 3) and a violin solo from George Crumb’s string quartet (Figure 4).

Figure 3. Sub ponticello marking in Alvin Curran’s Thursday Afternoon.

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6 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 1
Circular bowing

Circular bowing is a technique in which the bow is making continuous circular movements, from sul ponticello to sul tasto, as well as from the point to the middle of the bow (Figure 5).\footnote{Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 6}

Recording 5. Example of circular, lateral and angular bowing

Figure 5. Circular and lateral bowing in Garth Knox’s Viola Spaces.\footnote{Knox, Garth, Viola Spaces, Schott, Mainz, 2009}

\footnote{Crumb, George: Black Angels, C. F. Peters, New York, 1971}
Lateral bowing

Lateral bowing, spazzolato (Figure 5), is when the bow is moving only between sul ponticello and sul tasto, which feels like brushing the strings with the bow.11 12

Angular bowing

Angular bowing is when the bow is drawn at an angle rather than parallel to the bridge, in order to create a different timbre from normal bowing with some characteristics of sul ponticello and an "unopen" sound. It can also be marked in many ways, as demonstrated in the following example from von Biel's string quartet (Figure 6).

![Angular bowing](image)

Figure 6. Angular bowing from Michael von Biel’s String Quartet.13

Other

Filtered bowing is when the bow is placed on a harmonic node. For example, the first natural harmonic, which produces an octave higher note, is located right in the middle of an open string. If the bow is placed very close to that point, it creates a hollow sound combining the open string and the chosen harmonic. Here is an example from Garber's piece "Michi" for solo violin (Figure 7).

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11 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 6
12 Thorvaldsdottir, Anna, Selected performance techniques on strings, Lateral bowing, 2022, accessed 14 December 2022, https://www.youtube.com/watch?v=JcU4mJCosI8&t=110s
Triple stops can be made by bowing the string close to the left-hand fingers, which is one example of extreme sul tasto.

One can also play on the tailpiece of the instrument, but the sound produced varies greatly depending on the instrument and tailpiece. The best sound on the violin and viola is produced with wooden tailpieces that have a sharp angle otherwise it doesn’t make much sound at all. The double bass is the best instrument for this technique. Also, any part of the instrument can be bowed as in Kaija Saariaho’s piece Vent Nocturne (Figure 8).

Figure 8. The lower note of last two bars is indicating of playing the body of an instrument in Kaija Saariaho’s Vent Nocturne.  

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14 Garber, Harley, Michi, La Jolla, Lingua Press, California, 1969  
2.1.2 Overpressure

Overpressure can be produced in two different ways: with or without a specific note. When asked for gradual overpressure with a specific note (Figure 9), it should be stopped with the left hand and allowed to sound as long as possible before the crashing sound of the bow pressure takes over. Angular bowing close to the bridge can help to prolong the sound of a note.

Recording 6. Example of overpressure, ALFs and chop

Overpressure without a specific note is produced in a similar manner, but the left hand only dampens the string. This technique is used, for example, in John Zorn's string quartet "Cat O' Nine Tails" (Figure 10).

Subharmonics and Anomalous Low Frequencies

Subharmonics are pitches that sound lower than a stopped pitch. They are created through overpressure with careful bow placement and bow speed. The pitches in subharmonics follow a mirrored overtone series (Figure 11). The earliest instance of this technique in written music appears in George Crumb’s "Black Angels" (Figure 12).

19 Strange, Patricia; Strange, Allen: The Contemporary Violin: Extended Performance Techniques, Scarecrow Press, 2001, 24
20 Schelleng, John: The Physics of the Bowed String, Scientific American 87, 1974
21 Strange, Patricia; Strange, Allen: The Contemporary Violin: Extended Performance Techniques, Scarecrow Press, 2001, 24-25
Figure 12. Subharmonics marked as squares in George Crumb’s Black Angels.\(^{22}\)

Anomalous Low Frequency (later ALF) is a similar phenomenon to subharmonics, with various pitches ranging from a minor third to a perfect twelfth lower than the main note.\(^{23}\) The master of this technique is Mari Kimura, who has recorded an entire album called “The World Below G and Beyond” featuring pieces containing ALFs (Figure 35).\(^{24}\)\(^{25}\)

“Chop”

"Chop" is a sound that is created by hitting the bow against the strings with great pressure and a slight angle, so that the bow moves a bit when it lands on the strings. Normally, this would just produce an articulated sound, but with overpressure, the bow is stopped immediately. This technique is usually used in folk music as well as in contemporary pieces that require percussive string attacks.

\(^{22}\) Crumb, George: Black Angels, C. F. Peters, New York, 1971


\(^{25}\) Kimura, Mari, The World Below G And Beyond, Mutable Music, New York, 2010
2.1.3 Col legno

In "col legno" (which means "with a wood" in Italian), the player uses the wooden part of the bow rather than the hair to play the instrument. The first mentions of this technique date back to the 17th century\textsuperscript{26}, and it has been used in many early pieces such as Hector Berlioz's Symphony Fantastique (1830) (Figure 13).

![Figure 13. Col legno in Hector Berlioz’s Symphony Fantastique.\textsuperscript{27}](image)

Col Legno Battuto

Col legno battuto is a technique in which the bow is hitting or bouncing on the strings. That is the most common way to play it in earlier music as well (Figure 13). This technique can be done with stopped or dampened strings. When played with stopped strings, there are two sounds produced: the sound of the battuto and the quiet sound of the stopped note. When played with dampened strings, only the clicking sound of the battuto is produced. The clicking sound can also have a pitch, depending on where the player hits the bow on the string. For example, if the player hits the A string at the third harmonic node, which normally produces an A two octaves higher than the open string, the battuto click will also be at that pitch. However, this is extremely difficult to control and is rarely used.

\textsuperscript{26} Walls, Peter: Bow II, The New Grove Dictionary of Music and Musicians: Claudel to Dante, Groove, New York, 2001

\textsuperscript{27} Berlioz, Hector: Symphony Fantastique, Breitkopf & Härtel, Leipzig, 1900
Col Legno Tratto

Col legno tratto is similar to col legno battuto, but instead of hitting the strings, the player is playing them in a normal manner. Usually, the tone produced is barely audible, so often a few hairs of the bow are allowed to touch the string in order to produce more pitch and a slightly clearer tone even though this is cheating.

Other (Bow Glissando, Half Col Legno, Brushing)

There are also other col legno techniques, such as col legno bow glissando, which is usually executed as battuto and involves sliding the bow across the strings (Figure 14). The most commonly used col legno technique is half col legno – which is often just marked col legno tratto – in which the player is bowing the string using both some hair of the bow and some wood at the same time. Brushing techniques can also be used in col legno playing.

Figure 14. Col legno glissando in Daniel Wyman’s piece The Shadow Nos.28

28 Wyman, Daniel, The Shadow Nos, Vista Music, Monte Sereno, 1982
2.1.4 Other techniques

Battuto (Jeté or Ricochet)

Battuto is similar to spiccato, but instead of moving the bow horizontally, the bow is bounced on the string. It is most commonly used as a thrown bow (jeté or ricochet) when the rhythm is not necessary determined.

Tremolo

Tremolo is a technique that can vary greatly in contemporary music. It can involve irregular, fast bow changes that create a blending sound in ensemble playing, or it can be played "as fast as possible" (Figure 15). The articulation of the tremolo can also vary, with the bow hair either grabbing the string on every stroke or "flying" over the string to create a smoother timbre.

Figure 15. Irregular tremolo (sub ponticello) in first violin and viola in Krzysztof Penderecki’s String Quartet No. 1.29

29 Penderecki, Krzysztof, String Quartet No. 1, Przedstawicielstwo Wydawnictw Polskich, Poland, 1963
Arpeggio and Chords

In contemporary music, arpeggios can be played in a non-determinant manner, which is useful when the composer wants some starting notes to be heard but the harmony to be blurry. Arpeggio chords can also be played from top to bottom rather than in their normal order, or vice versa. It is also possible to play chords with four notes at the same time by removing the frog from the bow and playing with the loose hair. However, this technique is more of a party trick and doesn't offer much musical value.

Bariolage

Bariolage refers to the technique of playing two – same or different – notes repeatedly on two different strings. This technique is often used in Bach's music – as well as in any string instrument repertoire throughout the history. In contemporary music, bariolage can be used to create special sound and rhythmic effects by changing the string without changing the note. It is also a very practical technique for working with microtonality (Figure 26).

Air (Luft) bowing

Luft bowing is a technique in which the bow is played without the violin or viola by whipping it through the air. In Anna Thorvaldsdottir's "AIŌN", this technique is used without pitch damping the string with all fingers while "bowing" it (Figure 16).

Figure 16. Airy bowing in Anna Thorvaldsdottir’s AIŌN.\(^{30}\)

\(^{30}\) Thorvaldsdottir, Anna, AIŌN, Chester Music Limited, World, 2019
2.2 Pizzicato

Palm pizzicato

Players may not realize that pizzicato can be produced in many different ways. The most common method is to pluck the string sideways with the index finger. Orchestra players may be familiar with touch pizzicato, which is played upwards with a slightly sweaty or sticky finger and produces a quiet sound. Pizzicato can also be played downwards, resulting in a more nasal sound than normal pizzicato. Using the thumb to play pizzicato produces a warmer sound because the area of the finger touching and releasing the string is much larger than with the index finger due to the size and angle of the finger. Composers may also ask for pizzicato to be played on the fingerboard (sul tasto) or close to the bridge (sul ponticello) to achieve smooth or sharp articulation.

Nail pizzicato

Nail pizzicato is a technique in which the string is plucked using the nails of the right-hand fingers, rather than the fingertips. This technique produces an additional "click" sound at the beginning of the note.\(^{31}\)

Bartók pizzicato and slap pizzicato

Bartók pizzicato or snap pizzicato is played upwards, similar to touch pizzicato, but by stretching the string so that it hits the fingerboard. Despite its name, this technique was actually used as early as 1673 in Heinrich Biber's Battalia where it imitates cannon shots (Figure 17).\(^{32}\) Bartók pizzicato produces a sound similar to a whip and can be played with stopped or dampened strings. Slap pizzicato is similar to Bartók pizzicato, but it is executed by hitting the string towards the fingerboard without stretching it (Figure 18).

\(^{31}\) Thorvaldsdottir, Anna, Selected performance techniques on strings, Muted pizzicato with fingernail, 2022, accessed 14 December 2022, https://www.youtube.com/watch?v=xjh2ouD6VBY


Figure 17. Bartók pizzicato is marked “NB” in Biber’s Battalia.\(^{33}\)

**Tremolo pizzicato**

\[\text{two-handed tremolo} \quad \text{damp-slap!}\]

Figure 18. Tremolo pizzicato and dampened slap pizzicato in Garth Knox’s “Nine fingers” from Viola Spaces.\(^{34}\)

A skilled player can create a pizzicato tremolo using all, or at least two of their fingers (Figure 18).\(^{35}\) However, composers should not expect the same even result from string instrumentalists as they would from a guitarist.

\(^{33}\) Biber, Heinrich, Battalia, Doblinger, Vienna, 1971

\(^{34}\) Knox, Garth, Viola Spaces, Schott, Mainz, 2009

\(^{35}\) Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 3
Chords

Pizzicato chords can be played as arpeggios or all the notes at the same time. Pizzicato also allows for the playing of high-range double-stops simultaneously, such as a melody on the A string accompanied by a C string on the viola.

Other pizzicato techniques

Pizzicato also offers the opportunity for a "natural" diminuendo glissando, in which the player plucks the string and makes a glissando, and the tone fades away on its own. As seen in George Crumb’s piece Four Nocturnes – this glissando is produced with four-note chords, which cannot be sustained using the bow (Figure 19).

![Figure 19. Pizzicato glissando in George Crumb’s Four Nocturnes.](image)

Other pizzicato techniques include strike tones, in which the player flicks the string with the nail, and strumming the strings like a guitar, which creates a similar effect to tremolo but works well with chords.

In sul ponticello pizzicato, the player plays the pizzicato tone close to the bridge, resulting in a sound that lacks the core of its fundamental tone.

In Effleuré pizzicato, the player stops the string halfway down – or in practice about two-thirds of the way down, resulting in a sound with no resonance.

36 Crumb, George, Four Nocturnes, C. F. Peters, New York, 1971
Harmonic pizzicato is produced like normal harmonics, but the player must lift their stopping finger away immediately after plucking the string.

### 2.3 Percussion techniques

Percussion techniques involve knocking or striking the instrument. The player can do this with their hand or a soft mallet and at different places on the instrument to produce different sounds (Figure 20). For example, knocking the back of the instrument produces an open sound, the tailpiece can make the strings vibrate, and the ribs do not produce much sound in low frequencies.

![Figure 20. Note example from Stanley Lunetta’s Wringer.](image)

One special technique is the thumb roll, which is made by sliding the thumb on the back of the instrument. The friction between the thumb and the instrument will make a rolling sound. However, since this technique is rarely successful in performances even by professional percussion players, I would not recommend anyone practicing it more than for fun in the practice room.

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38 Lunetta, Stanley, Wringer, Unpublished manuscript, 1967
3. The left-hand techniques

Most left-hand techniques do not produce sound on their own, but they are combined with bow strokes or pizzicato played with the right hand. However, these techniques are essential for producing unique sounds and expressions in contemporary music. They require precise control and can be challenging to master. Despite this, left-hand pizzicato is an exception, as it does produce sound on its own.

3.1 Left-hand Pizzicato

Ordinary left-hand pizzicato

Left-hand pizzicato is played with the left hand and is very useful when combined with normal bowed notes or battuto. It is indicated in scores with a + on the note that should be played this way.39

Slurred pizzicato (Hammer, Pull-off)

These techniques are familiar to all electric guitarists. Essentially, if the next pizzicato note is higher than the previous one, the player performs a hammer pizzicato, in other words hits the string so hard that it starts to ring. A pull-off is similar, but in the opposite direction: the player performs a somewhat normal left-hand pizzicato from a ringing tone to a lower tone.40

Bitones

Bitones are produced as a hammer pizzicato, but without dampening the lower part of the string (Figure 21). Therefore, both the "normal" (between the bridge and the finger) side of the string and the other side (between the finger and the nut) will make a sound. The sound on the pegbox side will be much quieter than the normal part due to the lack of the resonating body of the instrument.

39 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 3
40 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 3
Figure 21. Bitones in viola part in Gordon Fitzell’s Double Quartet for Plucked Strings.  

**Other**

Scooping is when the player scoops their finger under the string and releases it by letting the string rotate away from the finger, creating a gentle attack and a quiet sound.

Buzzing pizzicato (or bowed) is made by playing in a normal manner but blocking the string with a left-hand fingernail, resulting in a buzzing sound.

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41 Fitzell, Gordon, Double Quartet for Plucked Strings, Unpublished manuscript, 1995
3.2 Glissando

Figure 22. Graphically defined glissando in Earle Brown’s String Quartet.\(^{42}\)

Glissando

Normal glissando is a technique that is often used in contemporary music due to its adaptability (Figure 22). It can be combined with almost any other extended technique, and its general idea is to glide between different notes (Figure 23).

Figure 23. Double stopped glissando with vibrato in György Kurtág’s In Nomine – all’ongherese, Signs, Games and Messages.\(^{43}\)


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\(^{42}\) Brown, Earle, String Quartet, Universal Editions, London, 1970

\(^{43}\) Kurtág, György, Signs, Games and Messages, Editio Musica Budapest, Budapest, 2005
Portamento

Portamento is a glissando between two different notes. It has a starting and an ending point and is often referred to as a glissando in the everyday language of musicians.\textsuperscript{44}

Harmonic Glissando

There are three kinds of harmonic glissandos which will be discussed in next chapter.

Bend

Bend technique is borrowed from electric guitarists. It can be done in two different ways: either pulling the string sideways on the fingerboard while bowing the note or pulling the string with a lower finger (between the stopped note and the nut) causing the string “tune” up.

Effleuré Glissando

Effleuré glissando works the same way as other Effleuré techniques by pressing the string halfway down. It produces a hollow sound during the glissando. This technique is extremely difficult if the composer also wants harmonics to be heard.

\textsuperscript{44} Auer, Leopold: Violin playing as I teach it, Frederick Strokes Company, 1921, 24–25
3.3 Other

Vibrato

In contemporary music, vibrato is sometimes a controlled element of the piece. It can vary from senza vibrato, which means without vibrato, to very wide vibrato. It can also vary in speed, from slow to fast (Figure 25). Vibrato is usually marked with a curly line on the stave or indicated in the written text (Figure 24).

![Figure 24. Defined vibrato in Krzysztof Penderecki’s String Quartet No. 1.](image)

![Figure 25. Slow and wide vibrato in György Kurtág’s Virág – Zsigmondy Dénesnek, Signs, Games and Messages.](image)


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45 Penderecki, Krzysztof, String Quartet No. 1, Przedstawicielstwo Wydawnictw Polskich, Poland, 1963

46 Kurtág, György, Signs, Games and Messages, Editio Musica Budapest, Budapest, 2005
Effleuré

Effleuré means half-stopping the left hand. This produces either a half-harmonic, half-stopped sound or just a hollow normal sound.

Damped string

The string can be damped by the left hand while playing with the bow. This produces a kind of bi-sound from the string brushed with bow hair. The sound is like brushed and lateral bowing and can be combined with them. This technique is used in Anna Thorvaldsdottir's piece AIÓN (Figure 16).

Microtones

Microtones are any tones between normal semitones. Usually, they are fourth-steps instead of normal half-steps, but they can be really anything between the normal western 12-tone scale system.47

Here's an example from Garth Knox's Viola Spaces "In Between" with normal quarter tones (Figure 26) and advanced microtonality in the first movement "Hora Lungă" of György Ligeti's Viola Sonata with explanation (Figures 27a and 27b).

![Figure 26. Barriolage with quarter tones. Knox, Garth: “In Between”, Viola Spaces.48](image)

47 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 5-6
48 Knox, Garth, Viola Spaces, Schott, Mainz, 2009
Figures 27a and 27b. Advanced overtone microtonality and explanation in György Ligeti’s Viola Sonata.\textsuperscript{49}

Sounding part 2. Ligeti, György, Viola Sonata, First movement: Hora lungă

\textsuperscript{49} Ligeti, György, Viola Sonata, Schott, Mainz, 1994
4 Harmonics

Harmonics are an old style of playing, but in contemporary music they are interesting because they are the soul of string instruments. Without a fingerboard, string instruments would be all about harmonics, but for every string musician's discomfort, someone invented putting a fingerboard on the instrument.

Natural (open) harmonics

Natural harmonics are the foundation of everything in this chapter. They are produced by lightly touching the string at different points while bowing an open string. Different pitches are made by changing the left-hand finger position: If the player plays the open C string and lightly touches the first harmonic node, which is exactly in the middle of the string, the pitch will be an octave higher. The open C is called the fundamental and the octave higher C is the first overtone. The next node is in the 1/3 (and 2/3) of the string, making the second overtone an octave and a fifth higher G than the open C, and so on (Figure 28).

![Figure 28. Three octaves of the harmonic series starting from C.](image)

Artificial (stopped) harmonics

Artificial harmonics are made by stopping the string and placing an additional finger on one of the harmonic nodes, usually the third overtone so the pitch

will be two octaves higher than the fundamental note. It is also possible to produce any other reachable harmonic.

**Bowed harmonics, Fawcetts**

Bowed harmonics, also called Fawcetts after the inventor\(^\text{51}\), are a difficult, almost uncontrollable way to play harmonics. They require careful placement of the bow's contact point and exact bow speed. The harmonic nodes should not be touched with fingers, but rather just carefully bowed so that the fundamental does not sound anymore.\(^\text{52}\) The sound is very close to multiphones. Because the contact with the string must be weaker than in ordinary playing, this style sounds like an error in the player's technique.

**Effleuré, multiphonics**

Effleuré harmonics, also called multiphonics, are a combination of bowed harmonics and Effleu\text{r}é stopped notes. Usually, the term multiphonic is used to describe clusters in wind instruments or singers.\(^\text{53}\) To play this technique, the player should place their finger slightly on the string and press halfway down. When played well, this technique will produce two different notes: the natural harmonic and the stopped note.

**Pizzicato harmonics**

Pizzicato harmonics are produced in the same way as normal harmonics, but the player must lift their stopping finger immediately after plucking the string.

**Pulled harmonics (Italian harmonics)**

This technique works best with larger string instruments like the cello and the double bass. The player places their finger on one natural harmonic node and pulls it sideways to create a glissando effect.


\(^{52}\) Thorvaldsdottir, Anna, Selected performance techniques on strings, Light bow pressure, 2022, accessed 14 December 2022, https://www.youtube.com/watch?v=mp7CW9nZgnk

\(^{53}\) Strange, Patricia; Strange, Allen: The Contemporary Violin: Extended Performance Techniques, Scarecrow Press, 2001, 132
Trills

There are two different types of harmonic trills: a full and a half harmonic trill (Figure 29). A full harmonic trill is made by trilling between two different natural (or artificial) harmonics. In this trill, the player must lift their finger, like how pianists do in a trill. In a half harmonic trill, the player trills between one of the harmonic nodes and an open or stopped string. Bow placement, pressure, and speed are crucial in this technique!

Figure 29. Half (bar 39 lower voice) and full harmonic trills (bar 38 middle voice) in Kaija Saariaho’s Vent Nocturne.54

Glissando (artificial and natural)

Harmonic glissando can be made in natural harmonics by sliding the finger over the string, producing a change in different natural harmonics (Figure 30). Note that the player cannot play lower harmonics than the first overtone; one cannot smoothly slide to the fundamental.

Figure 30. Harmonic glissando in Garth Knox’s Harmonic horizon from Viola Spaces.55

55 Knox, Garth, Viola Spaces, Schott, Mainz, 2009
The other type of harmonic glissando is artificial glissando, where the string is stopped and moved as a package up or down. This creates a normal glissando effect with a harmonic sound.

**Seagull glissando, Helsinki’s metro glissando**

There are two ways to play seagull glissandos, also called Helsinki’s metro glissando or false harmonics, and both of them end in the same result. In the first one the player stops the string as an artificial harmonic and slides up or down without changing the gap between stopping finger and “harmonic” finger. In the other way of doing this the player plays only harmonic notes with both of the fingers sliding up and down in the same manner. Both of these techniques work best with the cello.

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56 Thorvaldsdottir, Anna, Selected performance techniques on strings, False harmonics, 2022, accessed 14 December 2022, https://www.youtube.com/watch?v=ZVIkEKmsTXA&t=57s

57 Thorvaldsdottir, Anna, Selected performance techniques on strings, False harmonics, 2022, accessed 14 December 2022, https://www.youtube.com/watch?v=ZVIkEKmsTXA&t=57s
5 Learning the techniques

This chapter is divided into two parts: well-known techniques and not so well-known techniques. In the well-known techniques section, I will explain how they work and what kind of different sounds can be produced when playing these techniques. In the not so well-known techniques section, I will provide insight on how they should be produced and how to achieve the desired sound for a particular case.

Learning contemporary techniques on the violin or viola is like learning any other technique. It is important to isolate the problem and learn it in the simplest way possible. If you have never played or tried a particular technique, it may take time to get a sense of how it works. Patience is key in this process.

5.1 Well-known techniques

Sul ponticello and Sul tasto

For learning to play different sul ponticellos, one needs to know a few things about how the timbre is affected, which are basically the same as in all sound production on string instruments: bow pressure, bow speed, and contact point.

How do these factors affect sul ponticello? Firstly, the main thing is to play close to the bridge, which is the meaning of the term in Italian (on the bridge). The contact point can vary a bit depending on how the other elements are being used and how high on the fingerboard the player is stopping the string, but I would not recommend playing further than contact point 3 (Figure 1) if you are not looking for a special effect. It is possible to get a sul ponticello sound while playing in a normal contact point as well, but the core of this playing style is playing close to the bridge. Moving the bow a bit closer to the normal contact point but not entirely, will produce a poco sul ponticello sound. This will make a cold sound with still a lot of the fundamental note.

The fun part is varying the bow speed and pressure. The easiest way to find different sounds is to play tremolo on the tip of the bow with light bow pressure. By increasing the pressure, and going closer to the bridge, you should get more overtones and less of the fundamental note in the sound; in other words, more sul ponticello. Then, by slowing down the tremolo with the same pressure, the sound will have more of the fundamental note but still keep the rich overtone series in the sound. This requires some practice since the bow must maintain the same unfamiliar contact point and pressure.
throughout the bow stroke. Releasing the pressure in longer and slower bow strokes will lose the fundamental and the dynamic. You should get a really squeaky and cold sound. This is a good exercise for not only learning how to play different timbres in sul ponticello, but also for searching for new possibilities. Then, you can play different etudes such as Kreutzer's numbers one and two in sul ponticello, and in advanced cases, Garth Knox's Viola Spaces number one "Beside the Bridge". Unlike sul ponticello, sul tasto technique does not require as much extra practice as an extended technique. The physical laws are the same as in normal sound production. The point to consider is which sound you want to produce, and therefore search for the different opportunities sul tasto offers. The mindset behind practicing should be like sul ponticello, and different sounds are easiest to find while playing the piece you are going to perform, to get the most suitable result. The annoying part for the performer is the rosin, which is going to get stuck on the part of the strings over the fingerboard, and therefore on the left-hand fingers. If needed, you can clean it up with a cloth between movements or during a long rest.

“Chop”

This folk music technique is played by hitting the strings with the frog of the bow. There should be no normal up or down movement while placing the bow, but rather lateral movement for more sound. Finnish folk music violin pedagogue Mauno Järvelä describes the technique as imagining that the bow has glue on it. The bow should be allowed to drop towards the strings with the whole weight of the arm. To soften the sound or achieve a longer attack, one can tilt the bow and experiment with lateral motion.

Recording 6. Example of overpressure, ALFs and chop
Col legno

Col legno is a technique that may require professional players to switch to their secondary bow, as the desired volume in contemporary music is often much higher than in older music and may damage the wood of the bow. Col legno battuto does not differ in any way between early music and contemporary music. It is usually marked as either having a sounding pitch or no pitch at all. There are a couple of ways to get more sound out of col legno battuto: one is to hit the string harder with the bow, using the point of the bow for faster movement even though it is thinner and more fragile there. The other way is to hit the string as close to the middle as possible, but without hitting the fingerboard. Maintaining a balance between these two aspects can be difficult, as it becomes harder to hit the right string the further one gets from the bridge, and on some instruments, it is not even possible to go too far from the bridge on the highest and lowest strings because the body of the instrument gets in the way.

In col legno tratto, precision with the right-hand fingers is needed to guide the bow straight and maintain contact with the desired point on the string. The bow will already be tilted by the fingers, so it can be demanding. In this technique, the player can search for the desired sound by placing the bow in different contact points. Because this technique is very quiet, it can help to give a little lateral movement to the bow so that the wood interacts with the wound of the string.

By tilting the bow back from full col legno, the player can achieve half col legno. Here, the player can choose how much actual pitch and how much col legno sound they want by pressing the bow harder against the string, rather than tilting it in different ways, as tilting the wood away from the string can easily lose the col legno timbre.

Col legno glissando is made by hitting the string in a jeté or ricochet style, releasing control of the bow so it can bounce freely on the string. The bow strike will produce the same note as normal playing would if stopped in the same spot as the bow hit. This can be challenging as players are not trained to strike the right pitches with good intonation using the bow. It can be learned by playing scales and arpeggios on one string and finding harmonic nodes for reference points. To perform a glissando, the bow is simply moved laterally from the first note downward or upward, depending on how the glissando is marked. Keep in mind that the movement upward is much smaller than downward due to the gap between notes in the high position, and the string should be damped to eliminate bitones from the open string.

Pizzicato

In older music, pizzicato is rarely practiced or taught in lessons. However, it can make a big difference in the sound depending on how it is done. One can
practice it by searching for different sounds with varying contact points, the
direction of the movement, fingers, and how much flesh is put on the string
before releasing it. The pressure of the left hand also affects the sound, and in
pizzicato glissando, it must be greater than in single note pizzicato.

Bartók pizzicato can be produced by scooping the string with the index finger
or thumb for a normal or soft sound in lesser nuances. Using the thumb is
likely to produce more of the actual pitch because the movement of the string
will be more vertical than with the index finger. For loud Bartók pizzicato,
the string can be pinched and lifted straight upwards, resulting in a lot of
slapping sound towards the fingerboard and less of the actual pitch.

Another contemporary pizzicato technique to learn is pizzicato tremolo, in
which all fingers play one after the other. This can be started with only two
fingers, practicing it as fast and even as possible, then adding another finger
and repeating. This is also helpful for fast pizzicato passages, so the musician
has the option of "two-fingered pizzicato" in their arsenal.

Harmonic pizzicatos should always be played by lifting the finger on the
harmonic node immediately after releasing the pizzicato, allowing the note to
sound freely. The contact point should be as far away from the bridge as
possible without disturbing the string slipping under the finger that is holding
the harmonic node. This can be made easier by placing the harmonic node
finger half on the side of the string and half on the top, so the movement of
the string after releasing it does not miss the harmonic node stop.

**Microtones**

Microtones are one of the most difficult techniques for educated musicians of
Western classical music. Our ears are used to dividing an octave into twelve
steps, and it is not easy to remember the exact intonation of the steps between
these. Luckily, we now have tuning devices or applications to help us find the
perfect intonation.

Quarter tones are the most basic microtones used in contemporary music, and
it is important for musicians who play a lot of contemporary music to have
them in their toolkit. An easy way to practice this intonation is to play scales.
Start with a chromatic scale with quarter tones, finding different positions like
a quarter tone up or down from the third position. You can also play normal
scales starting from a quarter tone off from a normal tone. Because not all
microtones in music are chromatic, it is also useful to practice different
intervals like a second plus a quarter tone or a fourth minus a quarter tone.
This can be done with different arpeggios and double stops.

Here are some examples of scale exercises. A player can find their own
microtonal changes as desired (Figures 31, 32 and 33).
5.2 Special techniques

Other contact point techniques

Some of the contact point techniques are easier to learn properly than others. For example, in sub ponticello, there aren't too many things to think about. The only thing to make it easier is to tilt the viola or violin slightly downward so the bow doesn't slip over the tailpiece - although this problem does not often occur for viola players.

Lateral and circular bowing are somewhat similar techniques. They each have their own motor difficulties with the bow arm. While lateral bowing involves only a swiping motion, circular bowing combines this motion with the normal bow stroke movement.

Recording 5. Example of circular, lateral and angular bowing

In fast lateral bowing, the motion should come from the wrist with the guiding help of the fingers. As in string crossings, the bow arm should be placed between the string levels or on the lower string - depending on the school the player has learned - in fast lateral bowing, the arm should be in the "sul tastò position," a bit further away to help the wrist motion be both out and inwards. In slower lateral bowing, the arm could be used to help achieve a continuous movement without unnecessary bouncing. Both fast and slow lateral bowing can be practiced on open strings, but keep in mind that in slower bowing, the
length of the string affects the technique, so one-string scales can be beneficial to practice in slow lateral bowing.

Circular bowing is always a fast movement. It could be a small movement in quiet nuances or almost the whole bow - though not necessarily all the way to the frog - if the nuance is forte. The wrist movement should be the same as in lateral bowing, and the normal arm movement should be applied to it. In the smaller movement, it may not be necessary to use the whole arm - the movement can come from the wrist alone if the player has enough strength to move the bow laterally while moving it up and down. The most effect is achieved in the upper half of the bow in any case.

Angular bowing is every teacher's nightmare. It is quite difficult to produce continuously with similar quality throughout a passage because the bow will naturally travel to the fingerboard on the down-bow and towards the bridge on the up-bow. This requires that the arm position is "lazy," with the elbow staying close to the side. With some left-hand finger work, this traveling can be corrected. The technique should be practiced first in piano nuance for easier contact point control, then increasing the nuance as playing on one contact point becomes easier.

Playing triple stops with one finger on the high position and playing the open strings next to that string at the same time is not hard but needs to be practiced, depending on the notes being played. This technique is used in earlier music as well, but it is played as a fortissimo chord. As an extended technique, it can be played in piano, but the bow placement has to be very precise. There isn't too much to do with different sounds because the bow is stuck in this particular position for the contact of all three strings.

**Overpressure**

Overpressure is without a doubt one of the most interesting contemporary string instrument techniques. Playing it can vary from easy and careless distortion of the sound to very difficult and precise ALFs and subharmonics. Nowadays, composers often ask for specific distorted sounds, such as "only a little," "white noise," or a lot with sharp pops, as in Robert Ashley's String Quartet (Figure 34).\(^{58}\) \(^{59}\) \(^{60}\) However, the amount of overpressure can also be left up to the performer's discretion.

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\(^{58}\) Thorvaldsdottir, Anna: AIÔN, Chester Music Limited, World, 2019

\(^{59}\) Thorvaldsdottir, Anna, Selected performance techniques on strings, Much bow pressure, 2022, accessed 14 December 2022, https://www.youtube.com/watch?v=Z34TcjpYwJ

\(^{60}\) Ashley, Robert: String Quartet Describing the Motions of Large Real Bodies, Unpublished manuscript, 1972
The basis of overpressure is applying too much pressure towards the string on a normal contact point. The sound should be evenly distorted and continuous unless otherwise specified. Only the basic overpressure varies a lot on different strings. On the C string of the viola, the problem is producing a continuous sound without stops because the string is much looser than the higher strings. However, on the A string, the problem is the amount of distortion because the string is much thinner than the other strings. This can be evened out with the right set of strings.

To practice the ground tone of overpressure, start with damped strings so you can focus fully on the sound of the distortion and not have to worry about pitch. The bow should be placed close to the frog for comfortable playing. Changing the angle of the bow stroke towards the side rather than parallel to the bridge can help with a more fluid execution. If the bow is closer to the bridge, the string will release the pressure more frequently, making it easier to control the distortion, but also lighter compared to when the string is placed closer to the fingerboard. Close to the fingerboard, there is a risk of getting ALFs in the sound if you are playing a fingered note or open string.

Once you have mastered this on every damped string, you can apply pitches, but not open strings this time, because with shorter strings, overpressure is easier to control. Play scales or some easy etudes in this manner, then try it with open strings. It is good to know the difference between how overpressure works in the frog and in the point, even though this technique is not meant to be played in the point unless specifically asked, to save energy. In the point, overpressure is also harder to control because the hair of the bow is tighter.

compared to the tightness of the wood, so the string will not be as easy to catch as it is in the frog.

Playing ALFs and subharmonics is the next step in playing overpressure. Subharmonics follow the overtone series but downward from the fundamental tone. With careful bow speed, pressure, and placement, a player can produce the string, instead of the harmonic's multiplication of the fundamental note, divide the frequency and get octave, fifth, two octaves, and so on lower pitches. Although in theory this is possible, it is not very likely that these tones will come out of the instrument at the right moment. In addition, if there are a lot of subharmonics, it is useful to twist the string when it is changed to make playing subharmonics easier.62

ALFs (Anomalous Low Frequencies) are somewhat similar to subharmonics, but they are a bit more mysterious for researchers.63 There is no clear system for how these tones are produced, so they appear randomly between the third and twelfth down from the fundamental note. However, it is also possible to learn how to produce these notes at the right time, which unfortunately depends a lot on the instrument and string set the player is using. The string set and its age also affect the intonation in this technique.

The technique for both of these techniques is similar. Firstly, the player needs more pressure on the string than normal, but instead of playing close to the bridge or in the normal contact point, the bow should be placed further away from the bridge. Often, for subharmonics, the suggested contact point is the harmonic node - where the player would place their finger when playing different natural harmonics.65 In theory, this is a possible way of doing it, but a problem occurs because, often, for the first octave down, the string is so loose that it is not possible to control the friction between the bow and the

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63 Strange, Patricia; Strange, Allen: The Contemporary Violin: Extended Performance Techniques, Scarecrow Press, 2001, 25

64 Kimura, Mari, "Gemini", Unpublished manuscript, 1993

65 Strange, Patricia; Strange, Allen: The Contemporary Violin: Extended Performance Techniques, Scarecrow Press, 2001, 24
string. When moving closer to the bridge - around the fourth harmonic node, two octaves and a third up from the fundamental note - the string does not behave as it should anymore. The subharmonics become randomized, so one does not get the super low frequencies that are wanted, but around an octave or two higher pitches - ALFs.

To start searching for these notes, the player must place the bow around where the fingerboard ends, add a bit too much pressure, and move the bow at a constant slow speed. It takes time to find the right combination at first. My suggestion is to think about playing in mezzopiano nuance for bow speed, pianissimo for the contact point, and forte for bow pressure. After finding the note an octave below the fundamental, one can start searching for the same subharmonic for different fundamentals - in other words, on stopped strings. One will quickly realize the intonation difference in subharmonics compared to normal playing, with subharmonics being a bit lower than the fundamental, but that differs from instrument to instrument. To find other subharmonics or ALFs, the bow should be placed in a new contact point and then the pressure and bow speed must be adjusted to that new contact point. Once the player can play the desired notes, they can start practicing playing subharmonics between normal notes. Playing a scale down and continuing below the C-string, or every other note subharmonic and every other normally. The final exercise is to slur normal notes and subharmonics, first on the same string and then with string crossings (Figure 35).

Recording 6. Example of overpressure, ALFs and chop

**Percussion techniques**

This technique involves performers switching to their secondary instrument, which can cause the overall level of the performance to decrease. Hitting the instrument is not natural for string players and they often struggle to produce enough sound. To learn these effects, it is always helpful to ask a percussion player for help. They can show you how, where on the instrument, and with which body part you should strike.

There are some general rules to follow if there is not a specific place marked on the instrument body to play: striking closer to the middle of the body produces a bigger and more open sound. If you have time to choose which side of the top to hit, you should choose the bass bar side of the upper bout so that the treble travels further on the body of the instrument, producing a more efficient sound. Striking closer to the ribs produces a more precise but thinner sound.

As with many other techniques, experimentation is key to achieving the right sounds in percussion techniques.
Special pizzicato and left-hand pizzicato techniques

Some pizzicato techniques in contemporary music are weirder than others. Often, playing these pizzicatos is not difficult, but it requires some thought and testing.

Strike tone pizzicato is produced by flicking the string with the nail. The player must decide which way to rotate the right arm around the instrument. It may help if the instrument is dropped from the chin and played in a more folkish manner.

In Effleuré pizzicato, the main concern is the pressure of the left hand. Essentially, the left hand is not stopped all the way, but enough so that the pitch is audible. The pressure should be changed in relation to the volume at which the tone is played: in quiet dynamics, more pressure is needed, and in loud dynamics, less pressure is needed. This way, the pizzicato attack sound stays in the right relation to the sound of the pitch. It is the performer's responsibility to decide the relation between these two aspects.

Normal left-hand pizzicato is not a new invention, but it is highly varied in contemporary music. Slurred pizzicato is played downwards like normal left-hand pizzicato, by pulling and releasing the string with the finger playing the previous note. Upwards is trickier because you must hit the string towards the fingerboard hard enough to produce enough resonance. The movement must be quick so that the string is still resonating, and the new finger does not block the string before striking the fingerboard. This can be practiced in the first exercise (I A.) of Carl Flesch's Urstudien. (Figure 36)

Figure 36. Exercise I A. from Carl Flesch’s Urstudien.⁶⁶

The technique behind bitones is similar to slurred pizzicato upwards. The finger must strike the string and the fingerboard hard enough to make the string ring. The difference is that in bitones, the player must also let the lower half of the string sound. This technique is most effective in higher positions, so the normal-sounding part of the string is shorter and does not dominate too much.

⁶⁶ Flesch, Carl, Urstudien for violin, Ries & Erler, Berlin, 1911
Scooping pizzicato is often used like normal pizzicato, but without much attention. When an orchestra is playing extremely soft pizzicatos together, they usually just push the string down and release it by lifting the finger. In scooping pizzicato, the execution is similar: the player must scoop the string and roll it free to produce as little attack as possible. This requires some care in releasing the string and can be described as the opposite of percussion techniques due to its softness.

**Effléuré and Multiphones**

Bowed Effléuré is extremely difficult to produce well. It requires a well-placed bow, constant speed and pressure, and precise left-hand finger pressure. There are two types of Effléuré to use: natural harmonics, where the half-stopped note produces a harmonic note towards the open string and the fingers below the stopped note cannot be placed on the string; and a style where the fingers below the stopped note damp the overtone, producing a hollow and slightly disturbed sound.

The second style does not present any problems. You just need to decide how much left-hand pressure to use and keep that consistent throughout the passage. An easy way to find the desired timbre for this is to play scales. Once you have found the sound, you can add the technique to easy etudes to vary fingerings. The next step is playing double stops, especially fourths and fifths, as the biggest problems arise when playing on two strings with the same finger. This can be practiced in Otakar Ševčík's exercise "Preparatory Exercises in Double-Stopping," Op. 9, where double stops are started from one note on one string and carried over a string crossing (Figure 37).

![Figure 37. Double-stop exercise from Otakar Ševčík’s Preparatory Exercises in Double-Stopping, Op. 9.](image)

In Effléuré with harmonics, also called multiphones, you can start from the third harmonic node and find the harmonic by adding pressure on the left hand.

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so that the stopped note starts to sound as well. This interval is a twelfth. You can also do this the other way around by stopping the harmonic node and releasing the tension until the harmonic is heard. In this case, you need to release bow pressure or add some speed to make the harmonic audible. For example, in the first case, you should decrease the bow speed.

After finding the multiphone at the third harmonic node, you can move to the second node, fourth node, and so on. At the second harmonic node, the interval will be an octave, which can be harder to hear, as well as at the fourth harmonic node. If you go to high positions to find the harmonics, the Effleure is always a prime. If the Effleure is played in first position and continues downwards on the fingerboard and upwards on the overtone scale, the intervals will be out of tune because of the just tuning of an overtone scale.

Effleure glissando is made in the same style as multiphones. No other fingers can be on the fingerboard at the same time, and the finger should have the same half-pressure for the entire glissando. The bow should be moving towards the bridge while going upwards on the overtone scale, even though the left hand is moving downwards on the fingerboard. If this is not done, you will lose the harmonics as you get closer to the scroll. The sound is not as pleasant as in an upwards-going glissando from the second harmonic node, but the effect is cool when the stopped glissando is going down while the harmonic glissando is going up.

Harmonics

In this thesis, it is unnecessary to write how to play natural and artificial harmonics because the style of playing does not differ between earlier music and contemporary music.

In bowed harmonics, the bow should be placed around the same place, close to the bridge, as in normal harmonics, even though there is no finger placed on the harmonic node. The note cannot be bowed with a full sound but rather in a sul ponticello way. When the harmonic is found, the bow speed and pressure need to be constant. When going to high positions, the bow should also be moved closer to the bridge to keep the same overtone audible. If you want to change the overtone, you should move the bow closer to or further away from the bridge and search for the right bow speed and pressure again. This playing style is easy to learn when playing scales consistently, but it becomes trickier when jumping between positions and crossing strings.

Harmonic trills require more careful left-hand technique than other harmonics. When playing half harmonic trills, where one note is the fundamental and the other is the harmonic, the bow should be placed as close

as possible to the normal playing contact point. This makes it easiest to break
the division of the string, but the harmonic should still be able to sound, so
the bow cannot be too far away from the bridge.  

It is easiest to start from the first harmonic node, in the middle of the string.
The highest string is easiest for its tightness. The bow can be placed almost
anywhere here because the first harmonic is easy to catch. When trilling, the
finger on the harmonic node should make a small pizzicato-like movement.
It can be a small movement upwards as well, so that the pizzicato is not
audible to the audience. Once you have mastered the first harmonic node trill,
you can move on to the next node and practice artificial harmonic trills. It is
fine not to get a full sound on harmonic trills because they are an effect that
should not be played with full contact and an intense, deep sound.

Full harmonic trills are played like normal trills, but the lower finger cannot
be stopped while playing the upper note. If the trill is wide, the higher
harmonic finger can be used as in half harmonic trills, plucking the string to
make it ring easier in the lower harmonic. This movement must be very subtle
because there is not a lot of time and harmonics do not need much help from
the fingers to start ringing. It might also help to press the fingers down a bit
more than usual in harmonics, so the division of the string can be disturbed
easier.

Harmonic glissando is simply gliding the harmonic across the string. Unlike
in a normal glissando, the string is divided differently in a harmonic
glissando. In a normal glissando, the movement should be decreased as you
go upwards and increased as you go downwards because the space between
notes becomes smaller in high positions compared to low positions. However,
in a harmonic glissando, the same applies, but slightly differently: the biggest
space between notes is in the middle of the string, and the smallest is at both
ends of the string, so the movement of the hand should be fastest in the
middle. That's why it is more natural for string players to do the harmonic
glissando upwards from the first harmonic node, so the movement speed can
be copied from the normal glissando.

Seagull glissando is like an artificial harmonic glissando, but the distance
between fingers stays the same length regardless of the interval. Then the
harmonic is changed from a low node harmonic to a high node harmonic as
you go downwards, so the produced pitches stay in the same area. This can
also be produced by two harmonic-placed fingers in a high position instead
of an artificial harmonic, but it is easier to control the starting note with an
artificial harmonic. The glissando works similarly upwards as it does
downwards. In this case, the artificial harmonic should start from a small
space between the fingers for the player's comfort. This way, the seagull
glissando sounds like a departing metro in Helsinki.

69 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 4
6 Conclusion

In conclusion, it is clear that learning new techniques takes a lot of time and patience. It is also important to consider the desired outcome and the composer's intentions in different situations.

There are many techniques that can be learned by bowed string instrument players. Some of these techniques, like pizzicato and sul ponticello, are like traditional techniques and often do not require much special attention from players. On the other hand, some techniques are very extended and experimental, such as subharmonics and harmonic trills. A significant aspect of learning these techniques is careful planning how to do them and efficient practice. It is not productive to rush into something without a clear idea of what the final result will sound like.

The best approach is to consider the "problem" from two points of view: what is the desired sound, and what body movement is needed to achieve it. Some techniques require significant deviation from traditional playing styles and may require building new movements in a similar way to how traditional playing style was developed - through practice, practice and practice.

Familiarity with many techniques makes it easier to recognize potential difficulties or errors in a new technique being learned. Therefore, the more a player is exposed to new music, the clearer their understanding of how to execute the new playing style will be. This familiarity also helps when experimenting with new things with a composer or trying to find the desired timbre for a specific piece. Being a tabula rasa is often not a helpful approach when searching for the best result in contemporary music. However, it can be liberating after playing earlier music with strict rules for using vibrato and bow and how phrases should be made, as everybody has followed these rules because they are considered correct.

Knowing the technique before it appears in new repertoire is an advance for a performer. Then the learning process of the piece will be seeking the sounds and timbers and “normal” learning of the piece rather than struggle with the new technique. The main balance point will then be the music and it can be richly performed in subjective way.

For instance, when I was learning György Kurtág's Signs, Games, and Messages during my early years of studying, I was primarily focused on struggling with new technical difficulties rather than exploring the music behind them. Now, when I play them again, I mainly think about the music and use the abilities I have learned. Similarly, with Garth Knox's Viola Species etudes, it has been a pleasure to improve my techniques within the music rather than just learning them and moving on to new pieces. Knox has said that almost every violist's first encounter with microtonality is the first
movement of Ligeti's Viola Sonata, and that was true for me as well. First, it was not easy for me as a young musician to play microtonality in Ligeti's Viola Sonata. Now, playing anything else with microtones is much easier and almost feels natural to me.

The more and more players play contemporary pieces with extended techniques, the more the level of playing these techniques will rise. Also, the more it rises, the more boundaries will be pushed in string instrument playing, and therefore more new techniques will be invented by collaborations of skilled players and composers. And that is what will keep classical music evolving.

70 Knox, Garth: Viola Spaces, Schott, Mainz, 2009, 5
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Recording 5. Example of circular, lateral and angular bowing
Recording 6. Example of overpressure, ALFs and chop