**an introduction to the issues concerned in writing for**

# the Panflute

**by:**


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Translated from Dutch by Nadja Spooren

**The panflute**

A wind instrument consisting of a row or bundle of pipes which are closed at the bottom. There is a separate pipe for each tone.

- Range, tuning, chromatics and flattenings
- Jumps, intervals
- Embouchure and articulation
- Dynamics
- Vibrato
- Fluttertongue
- Glissando
- Flageolets
- Whispertones
- Doubletones
- Noisetones
- Singing and playing simultaneously
- Slaptongue
- Pizzicato
- harmonics

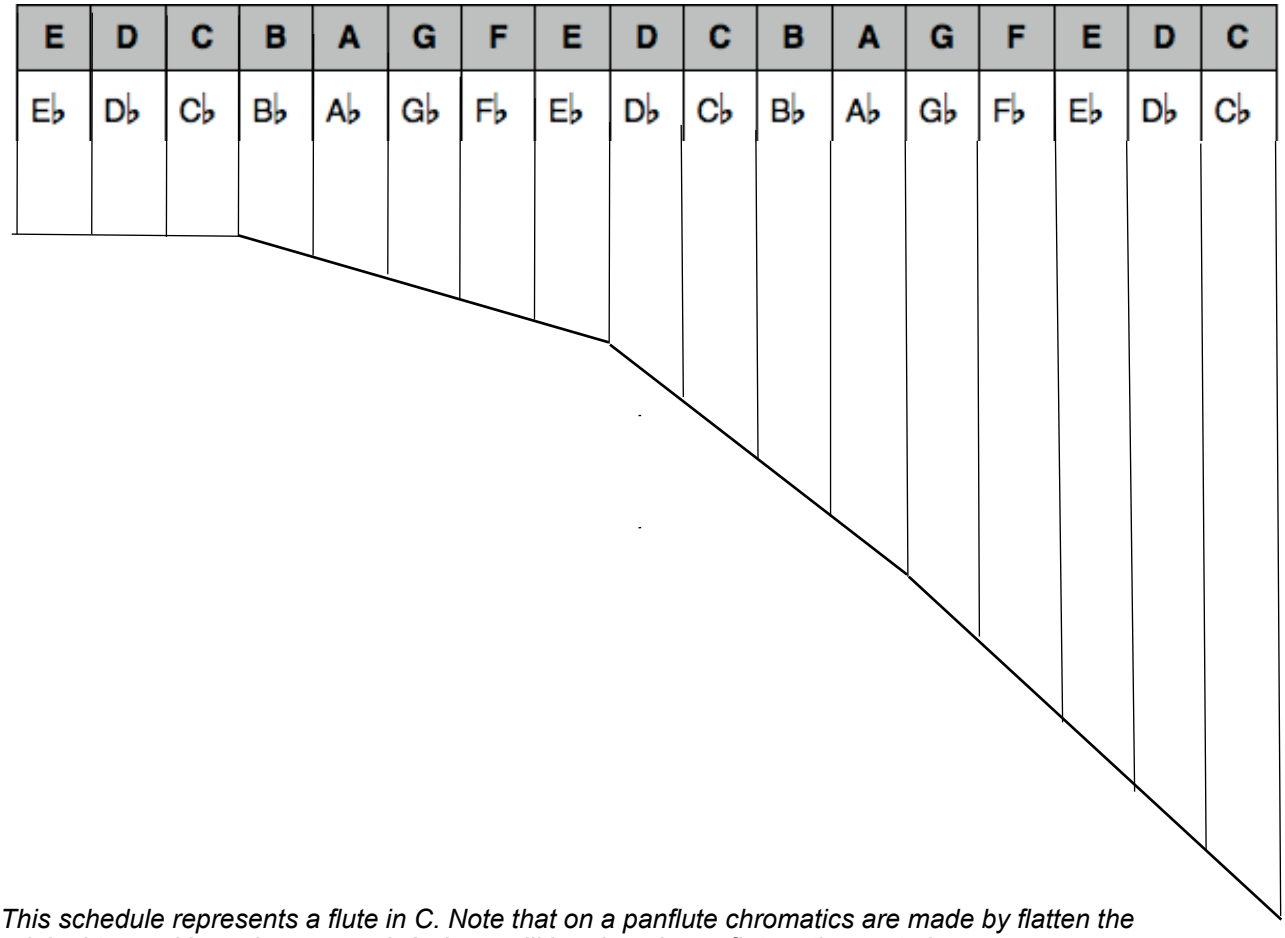
Range, tuning, chromatics and flattenings

There are many different kinds of panflutes, varying in shape, material, range, and tuning. A standard instrument does not exist. In Europe, however, the Eastern-European model - a single concave row of pipes stopped at the bottom - is the most common instrument used. Traditionally, it is tuned in G major. The instrument is prevalent in Romanian folk music. The range of this instrument goes from G1 to G4.

Another tuning which is gaining ground is that of C major. These instruments are used or classical music, to prevent octave transpositions, as it has four extra pipes in the lower register in comparison to panflutes in G major. The range of C panflute is C1 to G4. These are not strict limits, as tones can be lowered (flattened) and the use of flageolets extends the range to five octaves. This will be discussed more elaborately in later chapters.

There also are larger instruments, up to two octaves lower. These will not be discussed in this paper. Should you decide to write for panflute, always consider what the range is of the instrument of the player(s) you will be writing for - a flute in G already has a smaller range than a flute in C, and not everyone has a bass panflute.

The tuning of the panflute also has a significant influence on the sound and chromatics. A scale in C is naturally easier to play on an instrument in C than on an instrument in G.




*This schedule represents a flute in C. Note that on a panflute chromatics are made by flatten the original tone with a minor second. A sharp will be played as a flat on the next pipe.*

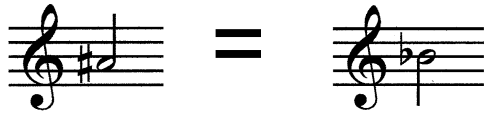
Chromatics

The panflute is a diatonic instrument. Nevertheless, chromatics are possible by making use of flattenings. These flattenings can be done in several ways:

1. changing the angle of blowing into a pipe by tilting the instrument. The bottom of the instrument will be moved away from the player slightly;
2. lessening the tension of the lips;
3. lowering the speed of the air;
4. pressing the instrument more against the lower lip, causing the pipe to be covered more;
5. making a backward movement with the jaw to cause a slight tilt in the flute;
6. partially covering the top of the pipe with a finger.

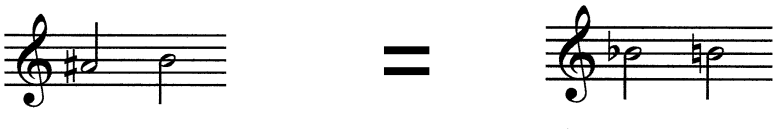
The last method is at times indeed a very handy solution, but normally a combination of the first five methods will be used to realise a flattening. Having said this much, it follows that when the flute is held vertically or is even tilted backwards (with the bottom of the flute moved slightly towards the player), or when the lip tension and the speed of the air are increased, the tone will become higher in pitch. In practise it is hardly possible to raise the pitch by half a tone; this is only possible from the fourth octave, and the most that can be reached before that is a quarter tone from the second octave.

Therefore, chromatics on a panflute can only be done with flats. A sharp will be played as a flat on the next pipe in pitch.

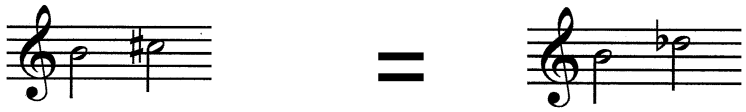


In short, on a panflute only the diatonic intervals from the C or a scales can be played on a flute in C. All other intervals are derived from these, and are realized through intonation.

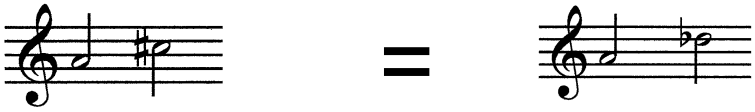
This leads to the remarkable phenomenon that, on panflute, a minor second is actually a prime in distance and movement, a minor third a second, a major third a fourth, or a major second a third.



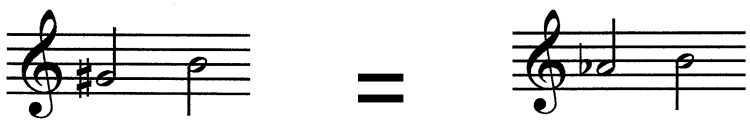
*Minor second is prime*



*Major second is third*



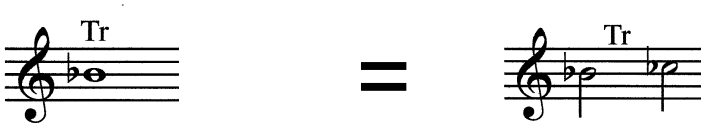
*This example shows that a major second on A is a "diminished" fourth on panflute; this interval is played on the pipes E and A.*



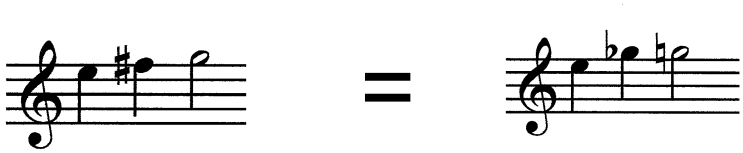
*This example shows how a minor third on G sharp is played: on the pipe A and B.*

A panflute player is used to this phenomenon, and will read as easily in D major as in F major. Enharmonic notation is therefore not necessary.

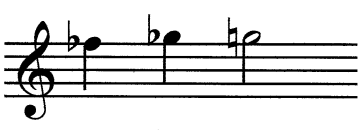
A flattening in itself is not too difficult to do. But, the lower the register, the more effort it takes to reach the right pitch. The movement becomes larger as the pipes do. Still, the context will always determine whether a flattening is possible or not. The change between flattened and normal tones determines the difficulty of the passage.  Sometimes the flattening in itself is not the problem, but the normal tone. This is the case when more tones are flattened than not. Playing a chromatic scale at a high tempo is simply always difficult, although it is not impossible. Of course, the required speed will always be the most important factor. In some instances fingerings can help. A trill, A flat - A, for example, can only be done by moving a finger on the A pipe. For this, the player needs sufficient time to place and remove the finger; while moving the hands the instrument is out of balance. This also goes for a trill such as C - D flat. This technique does require a player with large hand in the lower register. The lower pipes are comparatively long and the (left) hand needs to be able to support the bottom of the flute. This can often be done with the thumb, while the index or middle finger are used for the flattening. As soon as the length of the pipe exceeds the length of the thumb and index finger, this technique is no longer possible.
A trill B flat - B can be done in two ways. With the finger technique, or bij flattening both the B and C pipes and playing those in quick succession. A C flat will sound as a B:




These enharmonic tones, then, influence the movements that need to be made. On a flute in C, one pipe need to be skipped to play a G/e scale:



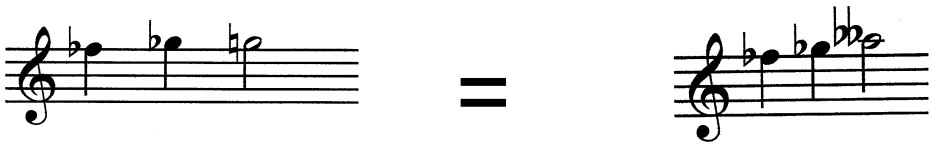

But again enharmonic tones can help to get rid of the 'hole' in between e and g (f sharp), by playing the e on the f pipe by flattening the latter.



Whether this last option is suitable for the player, depends on speed, articulation, dynamics and sound colour. Flattenings have the tendency to be softer and have a different sound colour from unflattened tones. A choice will always have to be made between these parameters; the context determines which is more important. When there is plenty of time, an open sound is required, and a portato is written, the choice will be to play the E on the E pipe. However, when the passage is fast, soft and legato the preferred playing method will be the second option, an E on a flattened F pipe.

Double flats

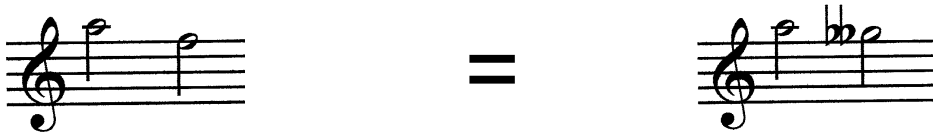
The particular characteristic of flats to be softer than unflattened tones opens up new possibilities. The tones C D E, apart from being played on the corresponding pipes, can also be produced on the pipes D E F with the help of double flats for D and E. The F pipe only requires a half tone flattening. The double flat version will sound much softer, more intimate and more introvert. Here is another example:



In the case where the G is played on the G pipe, it will differ mainly in colour from the previous tones, as these are flattened. Should the G be played on an A pipe, this colour difference will be much smaller. This is the preferred option when the passage has to be played softly. This technique I have named 'couvré', since the essence lies in covering up the pipes with the lips to a great extent.

*Verso* by Ron Ford is a very good example of a piece that makes use of this technique. An immense difference in dynamics is realised by first playing a very strong unflattened tone, to be immediately followed by the neighbouring higher pipe in a double flat, in order to produce the same tone with extremely soft dynamics.

Another example:



On a panflute the tones A and F are situated next to the G. This pipe will have to be skipped to play to play the example above. This is not the case when the F is played on the G pipe, which enables true legato playing. This method can be applied when articulation is the most important factor, the dynamics not stronger than mezzo piano and when the F is that last note in the phrase. It would be a very different thing, were the F to be followed by an unflattened tone, for example a C a quarter down. In that case, the colour of the double flat F would stand out in a negative way and too much energy will be lost by tilting the flute and making the jump between G double flag and C. This will be very audible.

Jumps

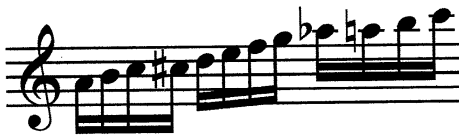
Jumps have already been touched upon in the previous chapter. Still, a lot more remains to be said. Again the context determines to a great extent whether something is difficult to realise or not. It goes without saying that the greater the distance between the pipes to be played, the bigger the risk becomes that it goes wrong. However, when there is plenty of time to make the jump, and the tones are not linked together, then there is no real problem. It all becomes more complex when other things happen around the jump; speed, direction, and articulation.

- speed

Take the A major chord: A C# E A

The three intervals that have to be played are a fourth, second, and fourth. Should the rhythm be regular and all jumps be made in the same time, then the panflutist has to vary the speed at which the instrument is moved horizontally. This because a second is a much smaller interval than the previous fourth; the instrument has to be moved at a slower pace. For the next interval, the player has to up the speed of the movement again. It will be clear from this that not only the width of the jumps determines the difficulty, but especially the different jumps and speeds that follow each other.

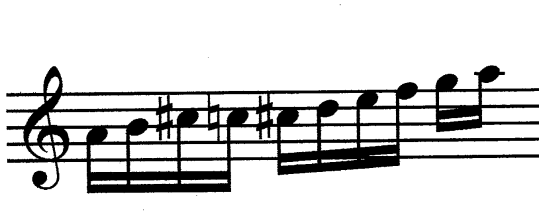
Another example:



To play these notes no jumps need to be made, but there most certainly is a difference in speed. The c sharp and d are played on the same pipe; the same goes for a flat and a. In this case, the difficulty lies in stopping and starting the movement of the flute. The example above is very playable, nonetheless.

o Direction

Taking the risk of sounding repetitive, here, again, the context is the most important factor to determine the complexity. It does not matter much whether a jump is going up or down, as long as there are no prescribed dynamics or articulation, assuming second intervals in a constant rhythm. As always, the length of time available for any movement is also important for complexity.



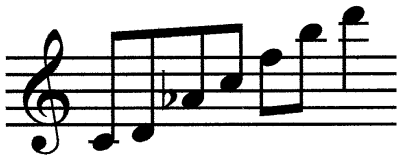
The example above is very doable, but difficulties can arise at the moment after the third, b-c sharp. For this third jump the speed of the horizontal movement is higher than the preceding and following intervals, and on top of this comes a change of direction right after b-c sharp for the second down, c sharp-c natural. This is followed by a second up, which brings with it another change of direction, though the speed stays the same. Finally, there is the prime c sharp-d (both played on a d pipe), which means no horizontal movement of the flute at all. An absence of horizontal movement can at times be an advantage, since it leaves the flutist time to recover the lost balance.

On paper, the most difficult category of jumps is when the direction of the movement changes. Of course, there are series of jumps in the same direction which are even more complex, for example with a lot of variation between intervals and with large intervals, as opposed to a trill. Still, the direction of a jump becomes extremely important when a jump is bigger than a second - the interval increases and pipes in between should not sound. The combination of two (or more) large intervals in opposite directions would of course be the most difficult. This is only true for all intervals on paper though: all panflute players share the experience that an octave jump followed by an octave jump back to the starting point, is easier than two octave jumps in the same direction.

o Articulation

Numerous beginnings of a tone are possible by making use of different positions of the tongue. The more forward the position of the tongue in the mouth, the stronger the articulation will be. The only exception to this is an articulation based on the letter L. An often-used articulation is one where the tongue is placed between the lips. This has a very strong result and is very good for staccato passages. For legato, this articulation is not right. The airstream is stopped much longer than, for example, with an L articulation, which allows the air to keep flowing. When the pipes to be played are positioned next to each other, a placing of the tongue is generally not necessary at all, which enables a true legato.

The articulation, then, is mainly influenced by the size of the intervals, the octave, and the speed. All jumps have a direct effect on the articulation. It is physically impossible to connect two pipes that are not adjoined, so suggestion becomes all-important. When a jump is not directly followed by another interval bigger than a second, it is very well possible to avoid an audible silence between the two tones. Is it again followed by a larger interval instead, the staccato character of the instrument will become more audible, which is a logical consequence of the fact that a panflute is a row of pipes. Naturally, the speed makes all the difference. While the player has enough time to recover the balance, the problems mentioned above will (or should) not occur. The next jump functions simply as a new beginning, and will therefore give no extra difficulties.



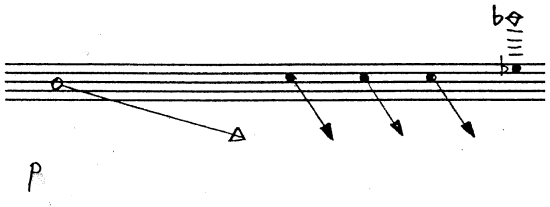
In the example above it will be difficult to play legato, depending on the tempo.
However, in some cases a definite articulation of a second interval is preferred. This is the case, for instance, when this interval is played on one pipe: d - d flat. Should the flutist not articulate, then a glissando would sound. This can be prevented by softly articulating with a *g* (from the French *garçon*) in the back of the mouth. For a split second there is no air, and the flutist can tilt the instrument into the right position for flat. This makes a sounding legato possible, even though it is technically not played as such. It will be obvious that legato playing becomes increasingly more difficult with increasing jumps.

Portato is practically always possible, except when there is hardly any time to make the jump to a higher register and back. Not just the jump takes time which causes the note to shorten in length, but a higher air-speed is required to make the higher registers sound properly. In order to make this possible, the articulation has to be to the front of the mouth, so that the tone begins immediately and relatively loudly. The other way round, a large interval to a lower register, has a quite different effect. Not a high air-speed, but a large amount of air is needed to make the pipes sound. The articulation of a low pipe will quickly sound like the Dutch H. It is important to note that the lower pipes take longer to sound than the smaller, higher pipes. Speed, then, is easier to realize in higher registers than the lower. Staccato is always possible on the panflute.

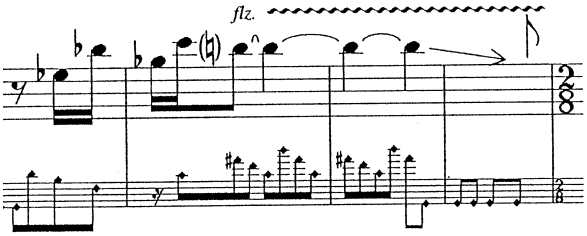
Glissandi

The glissando that I want to discuss first is the glissando on one pipe. As was mentioned before, only flattenings are possible on panflute. For chromatics the player changes the air pressure, embouchure and the position of the flute to such an extent that the original tone becomes half a second lower. It is possible, however, to flatten far more than that; for the smaller and higher pipes even more than a sixth. To play a flat on the lower pipes, a much larger movement needs to be made in comparison to the higher and smaller pipes. The example below shows how much more flexible the higher pipes on panflute actually are. It needs to be noted that the dynamic possibilities become more limited as the flattening becomes bigger, the tone becomes softer and the colour changes: it sounds more and more closed - which is exactly what happens to the pipe.
A melody of which the main tones are connected to each other with glissandi will never have one colour. The same dynamics are theoretically possible, but then the note material has to be chosen very carefully. The glissandi cannot be to big, for example. The player will then look for a solution in double flats, as a normal playing of the pipe will always sound louder and more open than the flat.

The second way of making a glissando on panflute, is to move past several pipes without articulating them. This is very much a stereotypical way of playing. Such a glissando, on principal, will consists of tones from the diatonic scale according to the tuning of the instrument (C major, a minor, C flat major, a flat minor).
When there is time, a finger can be put on the pipe that should sound half a tone lower. The flat will not be clearly audible, as it will be softer in comparison to the other notes. The next pipe will also sound less clearly, because the finger inevitably also covers part of that pipe.



*In Memoriam Toru Takemitsu (1997), for 5 panfllutes By André Douw. Black arrow heads indicate a glissando over more pipes , the open arrow head a glissando on 1 pipe.*




*Bird (1999) by Gerard Beljon. A combination of flatterzunge and a glissando. The glissando is indicated with a flash.*

Dynamics

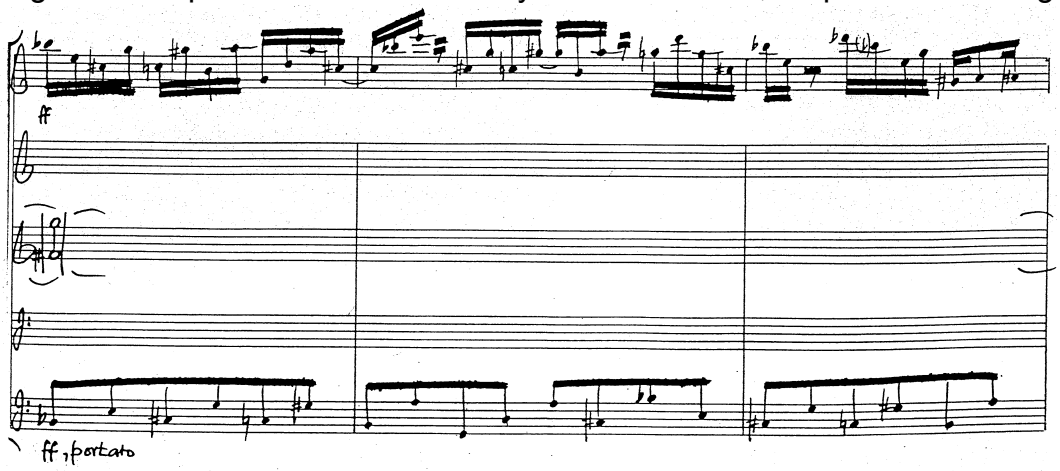
This subject has already been mentioned in the previous sections. These are the dynamic properties of the instrument:

- an average of mf - mp;
- the lower register sounds softer than the higher register;
- flattened pipes as a rule sound softer than unflattened pipes;
- a high tempo combined with jumps diminishes the dynamic range; piano in the higher register will become more difficult, forte in the lower registers.

Dynamic differences can be made extreme on panflute, especially when good use is being made of the natural dynamics of the instrument. Double flats are the solution for playing very softly. A good example for this is *Verso* by Ron Ford. In this work a sforzato is repeatedly followed by a pianissimo, at the same pitch. This can be done by playing the sforzato on the pipe matching the pitch, and the pianissimo on the pipe one pitch higher in double flat. Harmonics can at times also be used, when the score asks for high and soft pitches. Harmonics will be discussed in a later section. Of course, the sound colour will change when using these techniques.

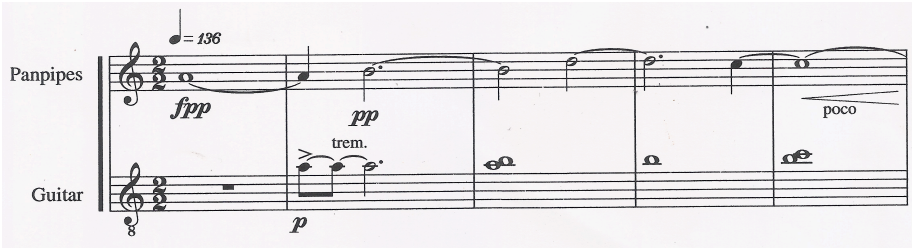
As ever, context determines what the dynamic range is. The available time also makes a big difference. The longer a tone can sound, the softer of louder it can be played. The bigger the distance between pipes, the shorter the time they can sound as the movement from one pipe to the next takes time. This is also true for soft passages: even though the pipe sounds for a shorter period of time, the pipe still needs time to produce the initial sound. When there is little time to produce sound, more force will be needed to make it happen, making it impossible to play the pipe at its softest. These are general rules,that are good to keep in mind when exploring the extremes of the instrument. There are many examples of pieces with fast passages and plenty of jumps that still sound forte.

A good example of this is *PERFLA* by Daan Manneke, for panflute and organ.




*The panflute is very loud in this part, however, if the tones had had more time to sound. with smaller gaps between the notes, dynamics could have been even stronger.*

Passages could also be extremely soft when played entirely as double flats, but then it should be written in double flats in the first place. The danger of out of tune playing increases considerably, though.




*The Beginning of Verso (2000) by Ron Ford. The first tone should sound first very loud and immediately after very soft. Since flattened tones are softer then natural tones, the first note is played on the normal A pipe and for the pp played on a B pipe, double flattened. Although played on two pipes, it zounds as if it was played on only one.*

Vibrato

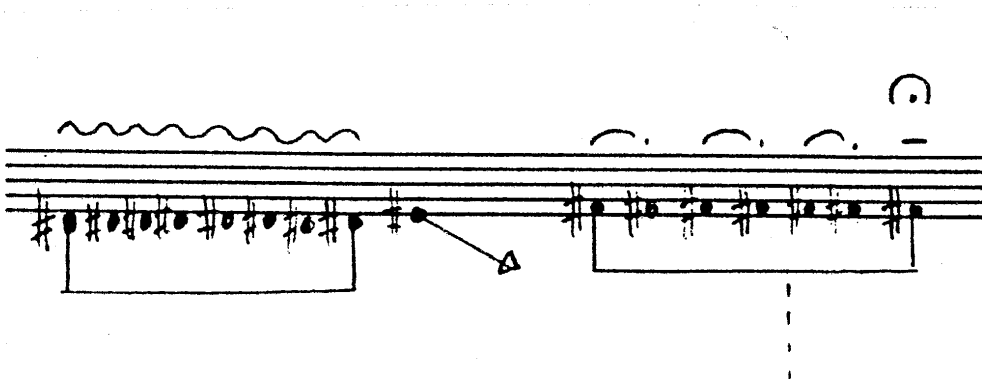
There are several ways of producing a vibrato on panflute.

o The traditional vibrato on panflute is made by alternately moving the instrument back and forth. The airstream stays constant, only the position of the instrument changes. This causes the pitch to fluctuate. This technique can best be compared to a string vibrato. The movement can be fast or slow. The fun element of this vibrato is the possibility to write down the number of fluctuations there should be played; the movement of the hand and the lower arm can very well be coordinated.

o The diaphragm vibrato is the standard vibrato for wind instruments, and can easily be used on panflute. Here, as well, the speed of the vibrato can be adjusted, only not to such an extent as with the hands. In this vibrato, as well, the pitch fluctuates, although less then with the hand vibrato. Vibrato with the diaphragm mostly causes the dynamics of the pitch to change. Since this vibrato is less connected to and associated with the folklore traditions of panflute playing, it is more suitable for classical music.

o A finger vibrato is also possible on panflute. A finger is moved above the pipe, which will give the effect of a Baroque flattement. This technique, unfortunately, is not very practical, as the left hand needs to be moved to a less comfortable position. This takes time and disturbs the balance of the instrument.

o A last method is varying the embouchure. The air speed and thus the dynamics will fluctuate. In colour, this vibrato can be placed in between the first two vibratos described above.



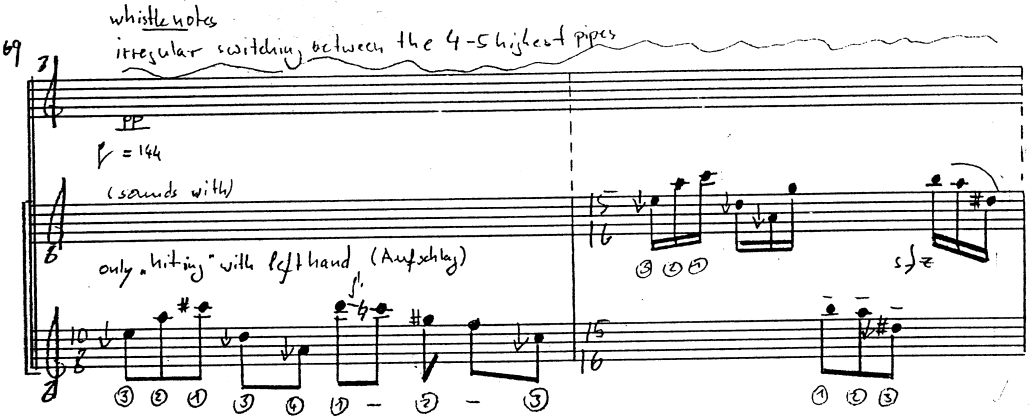
*In Memoriam Toru Takemitsu (1997), for 5 panflutes by André Douw. The waves above the d # indicate the frequency of the vibrato. The work is proportionally notated: 1 cm is 1 sec.*

Fluttertongue

This technique is known on most wind instruments and works very well on panflute. By moving the tongue inside the mouth, the air stream is continually disturbed; compare pronouncing a sharp R for a while in one airstream. Since an R needs a more or less constant airstream, it is rather difficult to play this softly. A legato where one or more pipes are skipped is not difficult, because the pipes react a tiny bit slower when playing Fluttertongue, the skipped pipes are blown but not audible.

Whispertones

As the name implies, these tones are extremely soft. Aside from this, they are also very unstable when it comes to pitch and they sound rather hoarse. The sound is more or less comparable to that of an old-fashioned boiling water kettle, only then much softer. Fast playing of these tones is not possible, especially because the intonation takes time. Whispertones are more easily produced as the pipes become higher. Do not write whispertones below E3; the risk that they will not sound on lower pipes is very great.




*Drei Steine hoch (1999) by David Helbich. A graphical notation of whispertones. Heldich makes use of the instable character of the whispertones, and doesn't indicate a fixed pitch.*

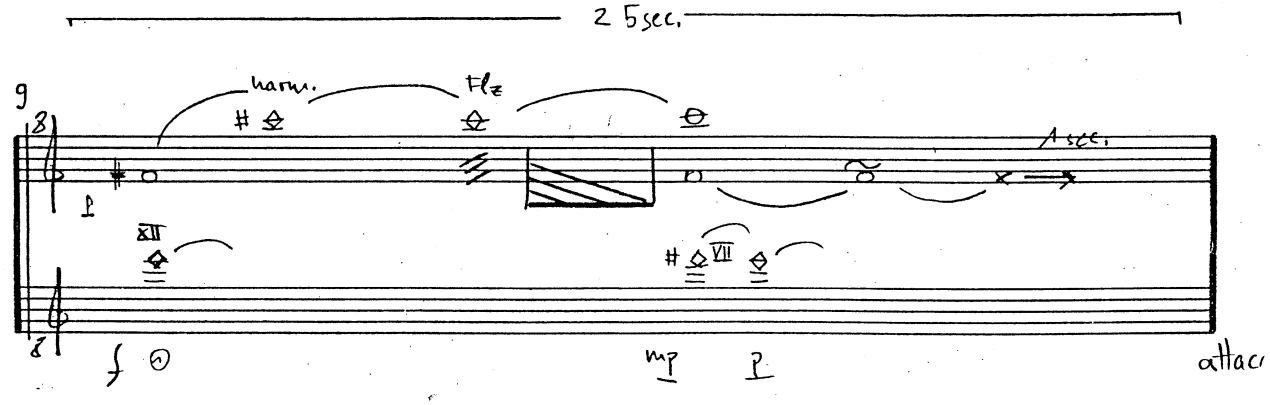
Double tones

On panflute, the following intervals can sound simultaneously:

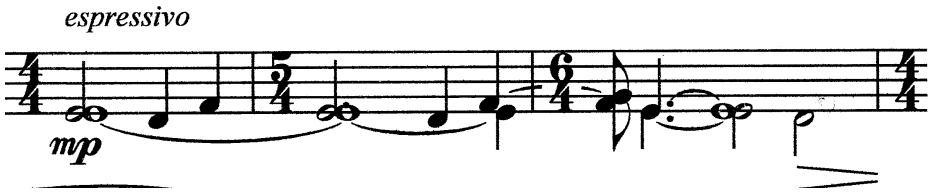
- Minor and major second
- small third
- octave and fifth (the latter will be out of tune)

The second and third are produced by blowing on two adjacent pipes at the same time. Since the panflute is a diatonic instrument in C, only the minor second e-f (or e flat - f flat) and b - c (or b flat and c flat) are possible. All other double tones are major seconds. There is a trick to increase possibilities, however. By lowering the shortest pipe (highest in pitch) by half covering it with a finger, you can create a minor second on all pipe combinations. By covering the longer pipe (lowest in pitch), you can create a minor third. Because two pipes are blown at the same time, this technique requires a lot of air, especially in the lowest register. Furthermore, the dynamic range is limited as the air pressure needs to be relatively strong, making piano double tones almost impossible. Flattened double tones break rather easily when played strong. Good examples of second double tones can be heard in *Lifebirds* by Timuçin Sahin. A misunderstanding with the composer forced me to look for this technique, for which I now am very grateful.

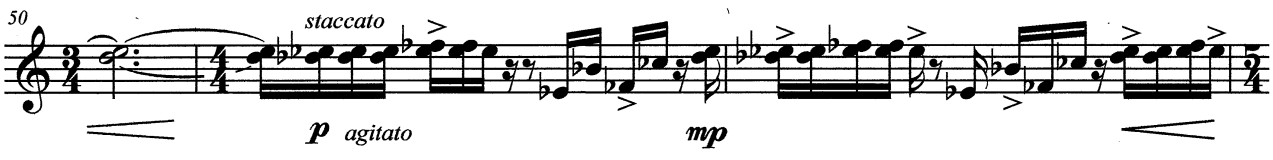
The interval octave and fifth can be realized by overblowing and thus playing the first harmonic of the pipe. The trick then is to play right at the breaking point of the pipe, so that the ground and the harmonic sound simultaneously. This works best when the ground is a flat. The effect works really well, and can be heard in the piece *Drei Steine Hoch* (1999) by David Helbich.



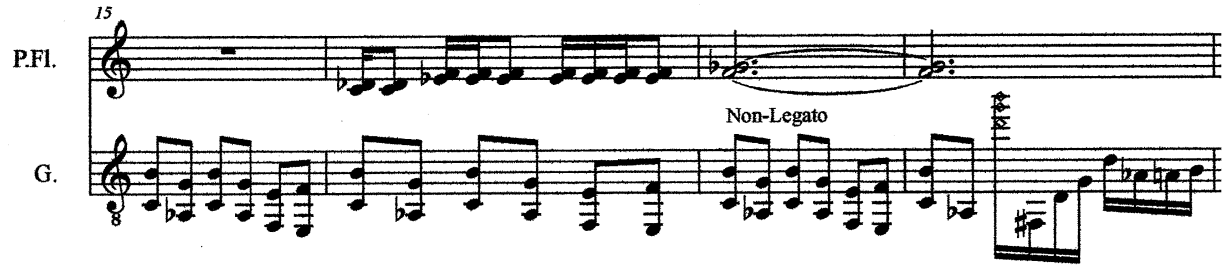

*Drei Steine Hoch (1999), by David Helbich. A double tone realized by overblowing sounds after the 10th second.*




*Some bars of the third etude for panflute (2009) by Kjell Hählen. The composer respects the diatonic nature of the instrument, no finger technique is required.*



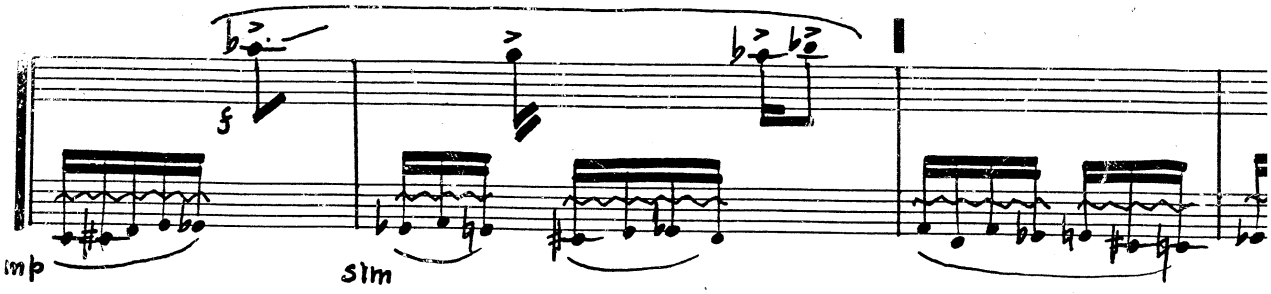

*Some more bars of the third etude for panflute (2009) by Kjell Hählen.*




*Lifebirds (2003) by Timuçin Sahin. Here you see a combination of flattened and non flattened (natural) tones. For those who are flattened, the flautists will have to use its fingers to cover the pipe which has to sound a semi tone lower.*

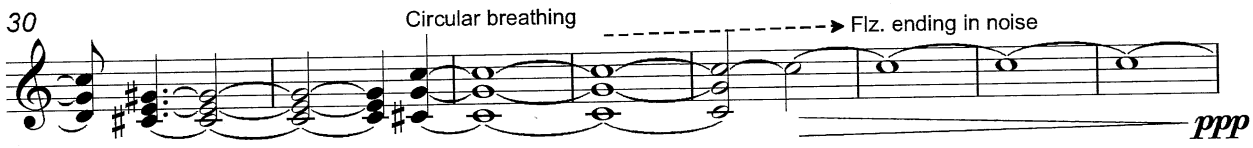
Noise tones

The most neutral sound on a panflute can be played by having the largest possible embouchure for each pipe. When the embouchure is made bigger or smaller, this is reflected in the colour of the sound. When this is done in an exaggerated way together with a faster airstream, the noise becomes more audible than the actual pitch. So, noise tones are really made by taking the wrong embouchure for a certain pipe.
A second method is by blowing really softly, which works very well below E3. The combination of the more gradual airstream and the lower pipes makes the noise very soft.
A third way is by hissing with the tongue behind the teeth in such a way that the pipe sounds. This requires a lot of force, and therefore sounds rather aggressive, but it can be very effective and expressive as well. This version of noise tones can be heard in *Faux-Bourdon* (1995) by Daan Manneke.

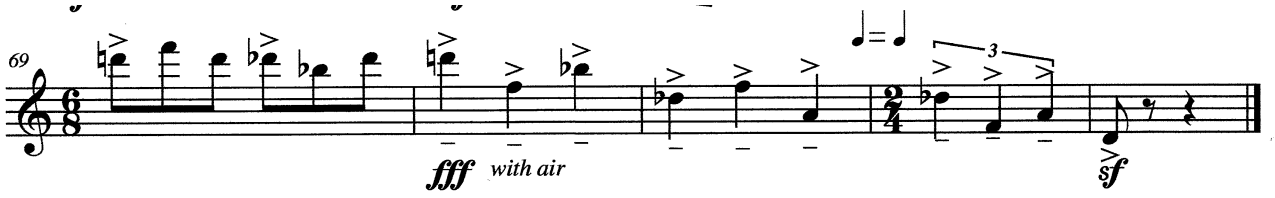



*Faux Bourdon (1995) by Daan Manneke. The noise tones are written on the lower staff.*

In all cases, flats can be played.
Playing noise tones with the embouchure means that gradual colour differences can be made. When the embouchure goes from normal to tight, more and more overtones will become audible, resulting in more noise at the edges of the tone. This process can of course also be reversed, from a tight embouchure to a normal one.



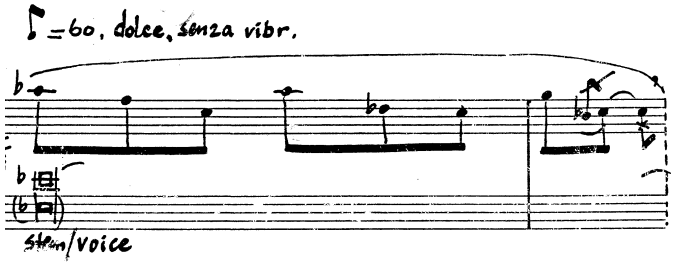

*Imaginary Friend (2004) for panflute and electronics by Danny de Graan. An example of multiple effects at a time: Flatterzunge, gradually added noise and a diminuendo.*




*Etude 1 for panflute (2009) by Kjell Hählen. He describes noise tones as a tone with a lot of air.*

Singing and playing

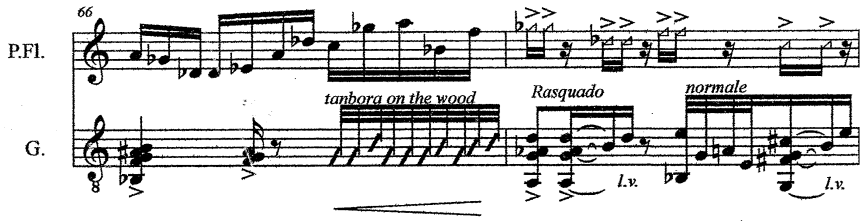
This is another technique also known from other wind instruments. Voice and instrumental sound blend into a curious sound cocktail. The voice can vary in pitch or can, of course, stay fixed as a bourdon. In that case the articulation with the tongue cannot be made properly any more, as the sound of the voice will also be interrupted. With a bourdon tone it is hard to make jumps; the player will naturally want to avoid the skipped pipes from sounding, despite the continuous airflow from the voice. The player then needs to find an articulation that makes the voice stronger than the noise from the intervening pipes. Also this effect can be heard in *Faux Bourdon* (1995) by Daan Manneke. What always works as a surprising and almost magical effect is sounding the voice while breathing in. Of course the colour of the voice changes, and there is a break between breathing in and out, but this does not stand out when the end and beginning of a tone on the flute coincides with the intake of breath.




*Faux Bourdon (1995) By Daan Manneke. The voice, used as a bourdon, is notated on the lower staff. The airstream needs to be stopped after the playing each single note on the upper staff, otherwise the pipes in between the notes will sound to. As a result of that, the voice will have the same rhythm.*

Slaptongue

For this technique, the tongue is put against the soft palate of the mouth, sealing off the mouth cavity, and air pressure is built up behind it. When this pressure is released above a pipe a kind of explosion sounds. This sounds really well on the lower pipes, but is also possible in the higher registers. A good example, again, is *Lifebirds* (2003) by Timuçin Sahin. This technique cannot be done at fast tempos. Practice makes art, but I would recommend 70 slaptongues per minute. When the slaptongue is played together with a tap of the finger on the flute, the result sound like the keyclick of the flute.



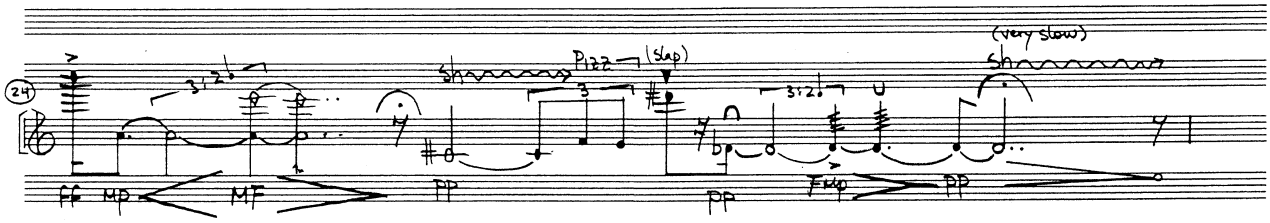

*Lifebirds (2003) by Timuçin Sahin. In bar 67 slaptones are indicated with a triangle like note head.*

Pizzicato

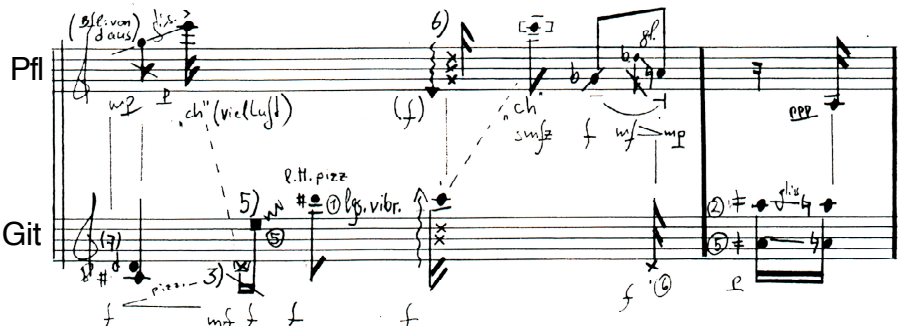
This is a typical panflute technique. A finger is squeezed into a pipe and pulled out again. A vacuum is created in the pipe, which is filled up again after the finger is removed. This causes a popping sound. Practice shows it is very difficult to produce a proper rhythmical succession of pizzicati, but a pizzicato at an exactly indicated moment is possible. Even though it is possible to put two fingers in two different pipes, it is still very difficult to make them follow each other in an exact rhythm. These two fingers can of course also be removed at the same time. When the player can sit down, the panflute can be put in his lap and two hand can be used, making larger intervals also possible.

The pitch of a pizzicato is more or less a quarter tone higher than the actual pitch of the pipe used. This can be corrected by covering part of the pipe with the other hand.

There is one other obstacle for this technique: the size of the hands of the player determines how many pipes can actually be used. With small hands and/or slight fingers, a pizzicato on the larger pipes is very difficult, if not impossible. And, the other way round, when the player can't even fit the little finger into a pipe, a pizzicato is not possible on the smaller pipes. This should therefore always be discussed with the player.




*IBEYI (2006) by Louis Aguirre. Pizzicati are followed by a slaptongue.*

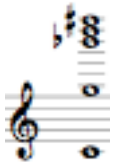



*In Stein by David Helbich. A pizzicato on three neighbour pipes as an answer to the rasgueado of the guitar.*

Harmonics and overblowing

The panflute is made out of a row of closed pipes; closed at the bottom. This is important to know, as a closed pipe only has the odd harmonics. This gives a characteristic sound, and touches upon the hart of the instrument. If you want to make music with a closed pipe, there are only two options: a panflute or an organ. For, when you were to make holes in the pipe and thereby shortening or lengthening it with the fingers, the pipe will not sound because it leaks. It is possible to make it sound nonetheless, by changing the blowing angle, but then the instrument will sound like the flute. The handicap of the panflute, the jumps between pipes, in short is also its strength. Because you are forced to take a new pipe for almost every pitch, it is also possible to create the ideal circumstances for each pipe, for example in diameter. This is why the color of the instrument is so even across all the registers of the instrument, why it is possible to play very softly in the highest register (given there is enough time), and why the sound color is so pure.

As I said, the panflute only has the odd harmonics, which is made visual in the example below. In this example only the harmonics that can be played by overblowing have been written down.



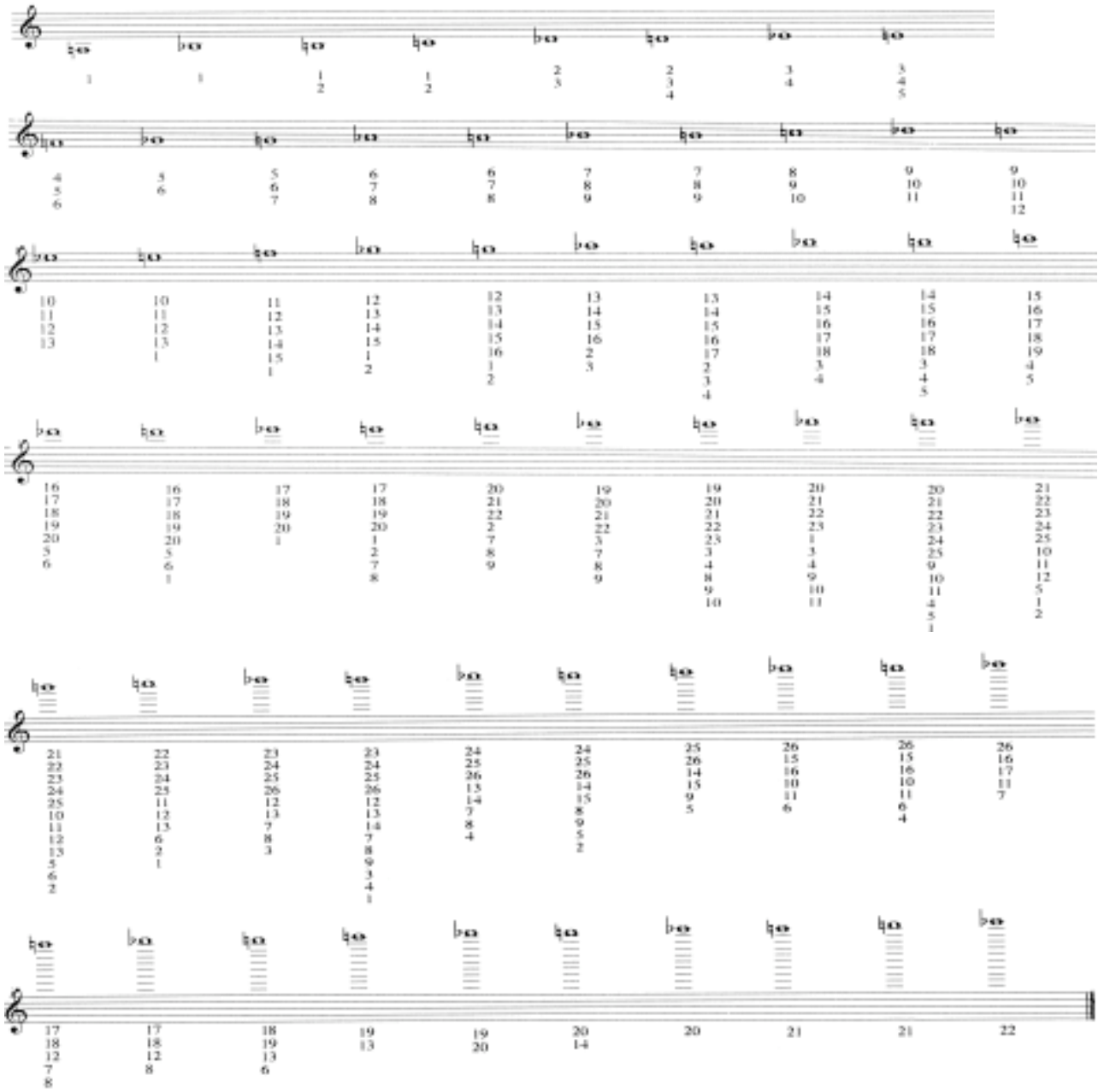
There are several ways to play harmonics. The first method is rather crude: by blowing with a lot of force.
The second method is to make a very small but relaxed embouchure, which enables an easy change between harmonics. This method is much more delicate and precise than the first, and can very well be used in music.
Describing the character and behavior of the harmonics is complex, because there are a lot of parameters. This is true in any case:

- harmonics and overtones in general have a color that I prefer to call 'lontano'.
- The bigger the pipe, the more overtones can be made audible. On the smallest pipes hardly even the first overtone can be produced.
- The bigger the distance between the ground tone and the overtone, the more difficult it is to produce.
- The bigger the distance between the ground tone and the overtone, the stronger (louder) that overtone will sound.
- Flats are easiest to produce the first two overtones. After that it becomes more difficult again, since more force is needed to produce the overtones and more air goes in and out of the pipe. This is more difficult on a partially covered pipe because of a flat than on an open pipe.

The flats really make the use of harmonics very interesting, as not only the ground becomes a flat; the harmonic changes along with the ground. On panflute, the second harmonic on C is an E. This E is out of tune (too low), and rather strong because a lot of air is needed to produce the tone and correct the pitch (by blowing more air, the pitch rises). It becomes easier when an E flat can be played. The dynamic range increases and the sound becomes more pure. Of course this also depends on intonation, but that can be achieved by changing the position of the flute among other things, not by increasing the air pressure. For the smallest pipes, the first overtone can only be gotten by flattening the pipe. D4, for example, should have A5 as the first overtone, but this will not sound as an harmonic. The first possibility is A flat 5.

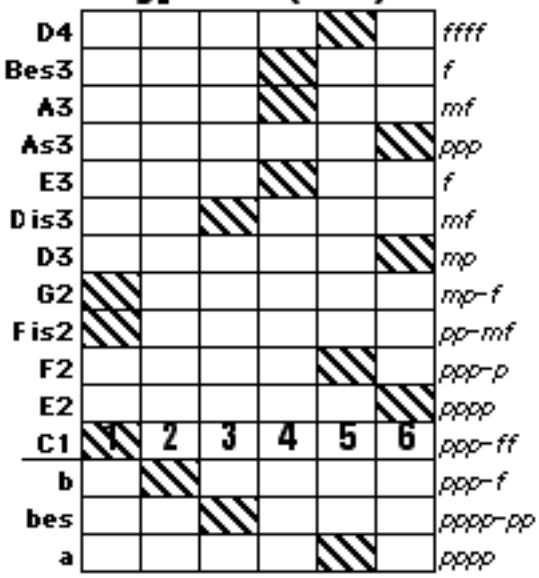
By combining overblowing with flats an endless amount of possibilities is created. Some pitches can be played on up to thirteen different pipes. All these have their own color, of course, which in their turn can be manipulated by adding vibrato or fluttertongue.
The (im)possibilities differ greatly per player, as well as per instrument. It actually varies from day to day, and sometimes from hour to hour. When a lot of extremely high harmonics need to be played in a row, the embouchure of the player will become strained. It will then be impossible to play any more harmonics for a while.

What follows next is an overview of the complete range of the panflute. Harmonics and flats have been put into this as well. Below each note are numbers, which indicate the pipes on which the pitch can be played.

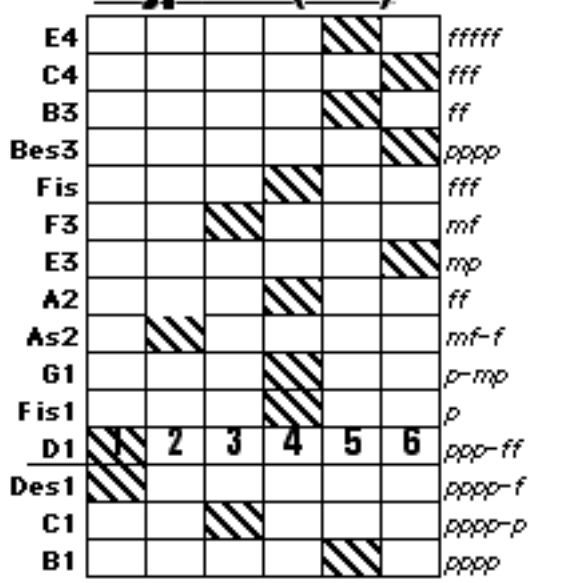


Next is an overview of all the possibilities per pipe in a matrix. Every matrix represents one pipe with all the possible pitches on that pipe. Those will be the ground pitch (underscored), the flat of the ground, the harmonics, and the flats of the harmonics. The left Y-axis indicates the pitch, the right Y-axis the dynamic range or that pitch.
The X-axis indicates the level of difficulty. The entire column above and below the numbers written in the X-axis indicates one of the following levels:
1: easy
2: not so easy
3: difficult
4: very difficult
5: problematic
6: nigh impossible
The coloured squares behind the notes give the level of complexity for each note.

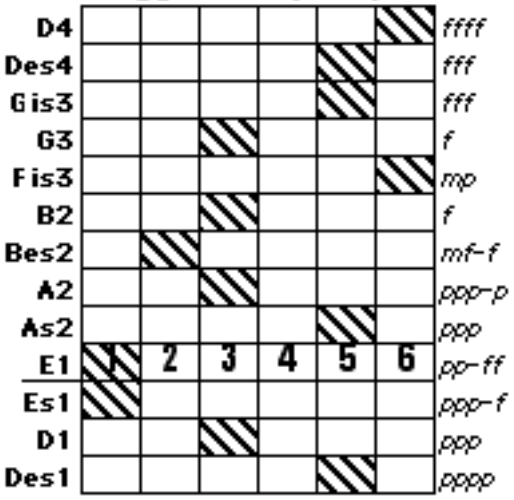
## Pijp 1 (C1)



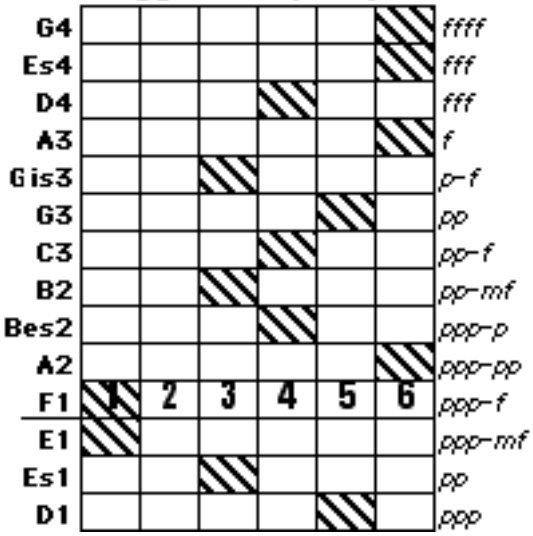

## Pijp 2 (D1)



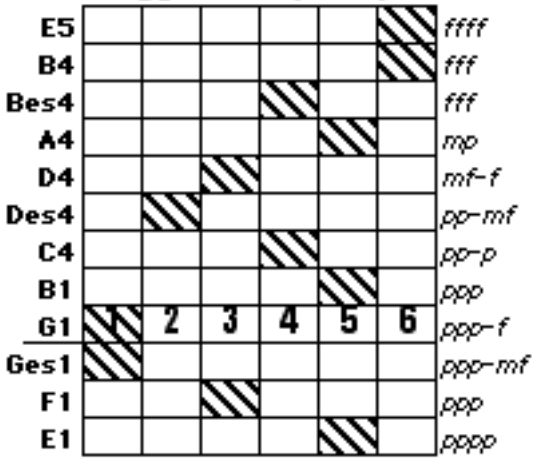

## Pijp 3 (E1)



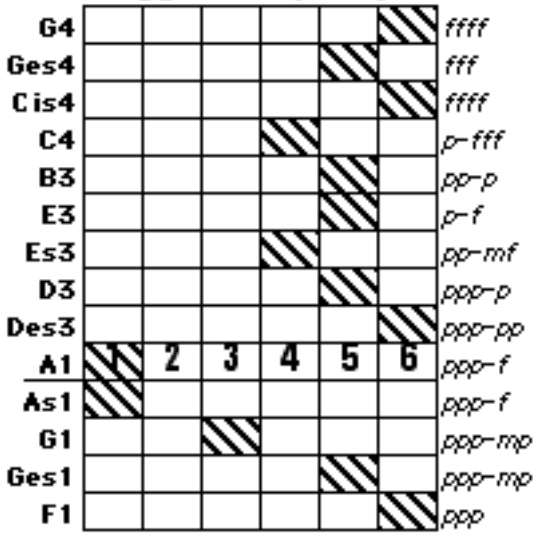

## Pijp 4 (F1)



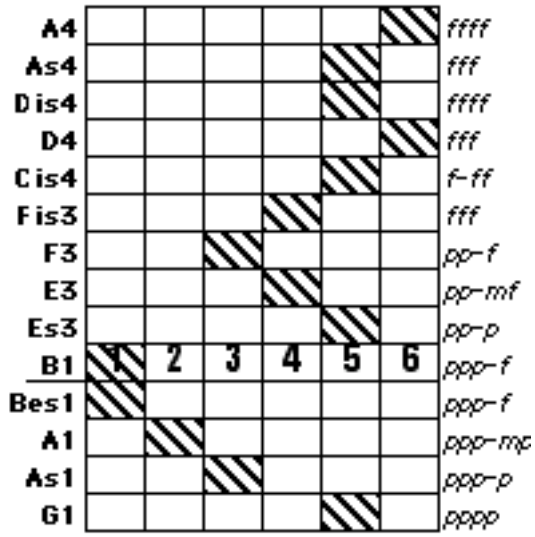

## Pijp 5 (G1)



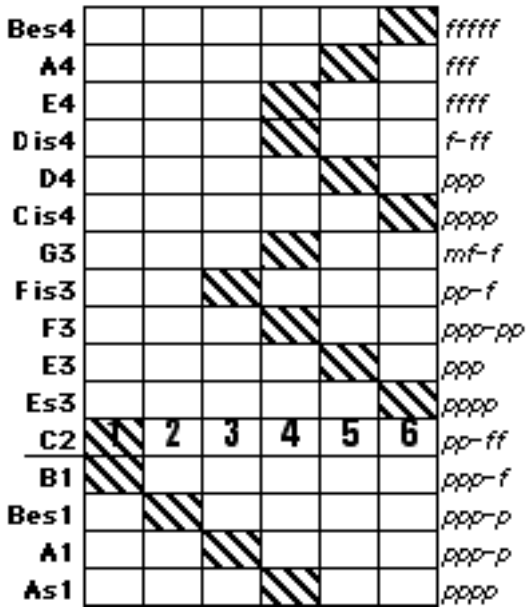

## Pijp 6 (A1)



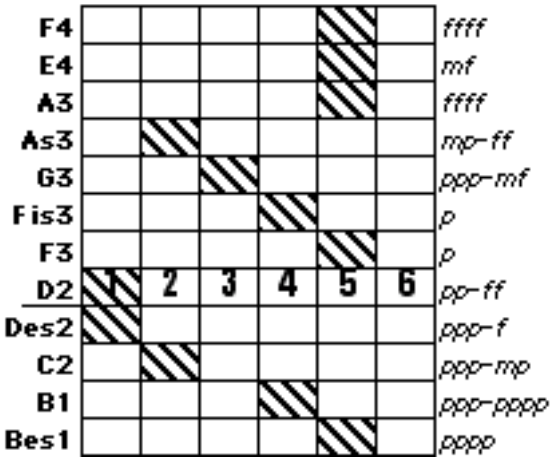
## Pijp 7 (B1)



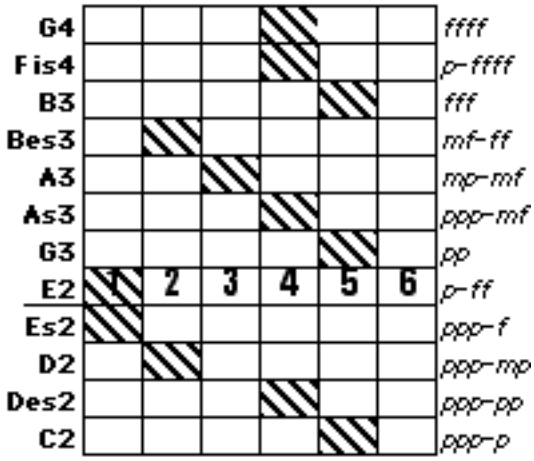

## Pijp 8 (C2)




## Pijp 9 (D2)




## Pijp 10 E2

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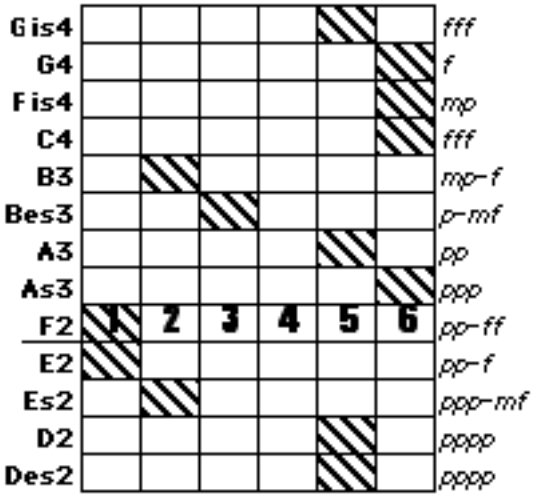


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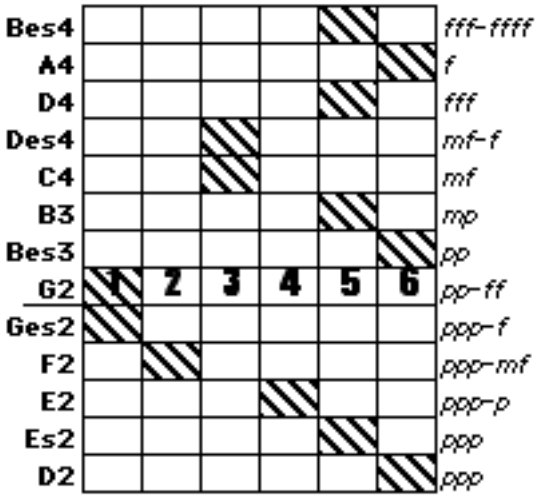

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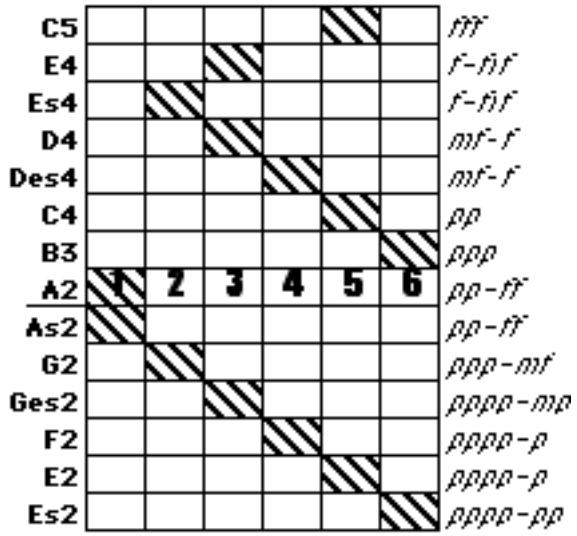


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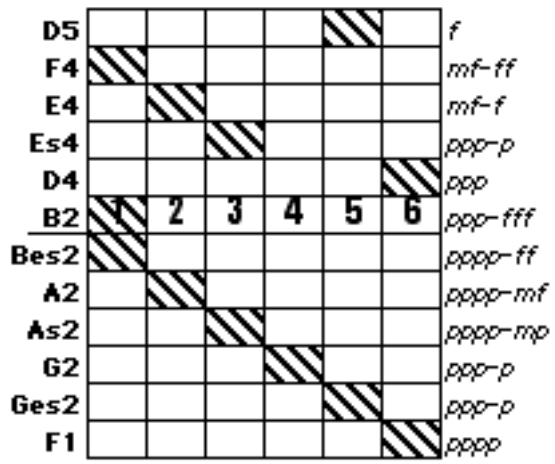


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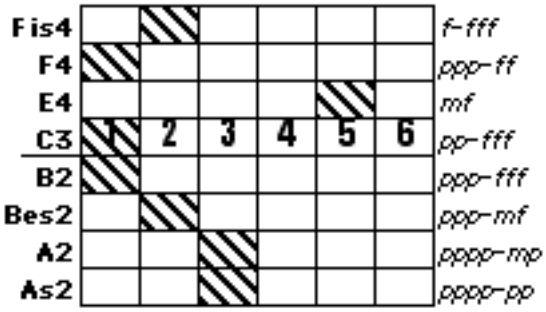


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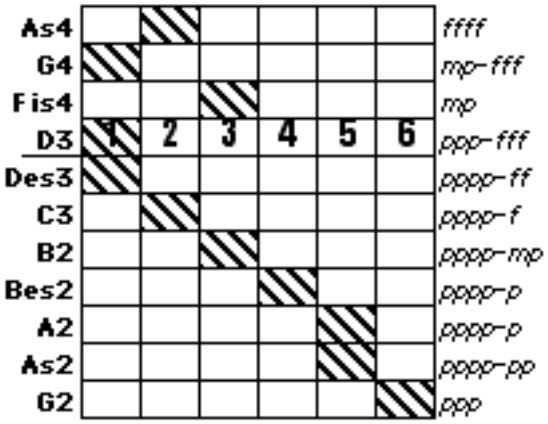
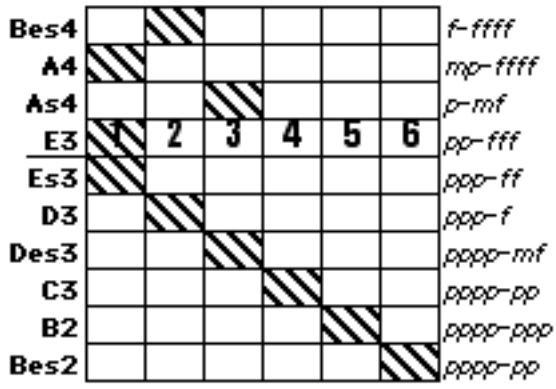



## Pijp 17 (E3)

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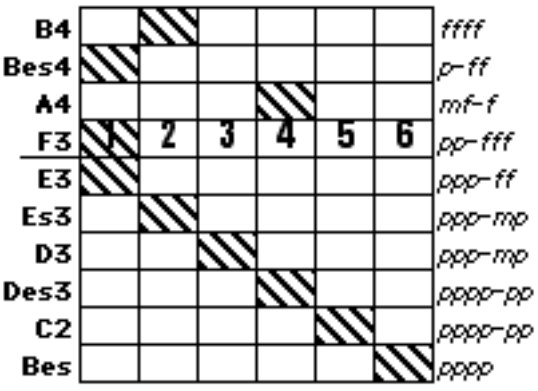

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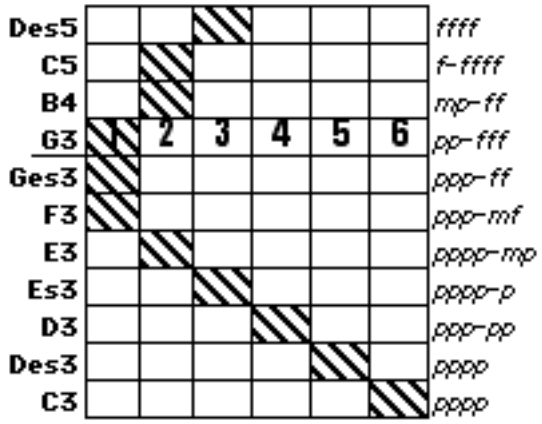


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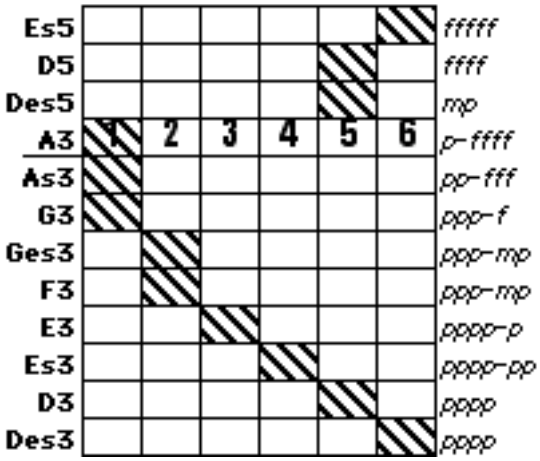


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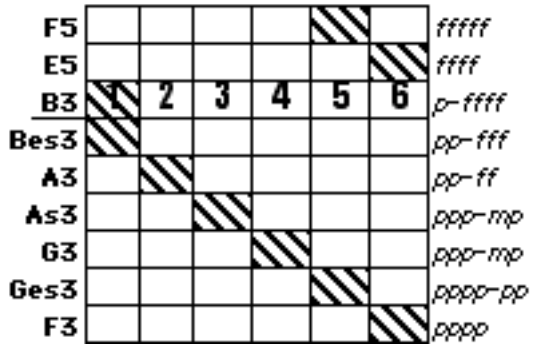


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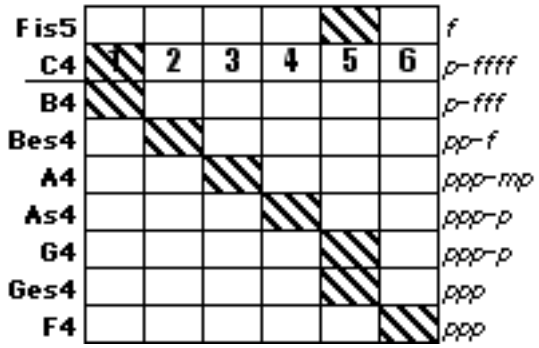


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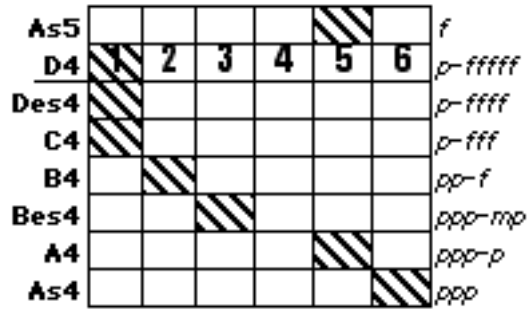


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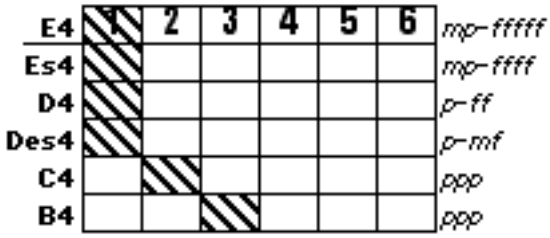


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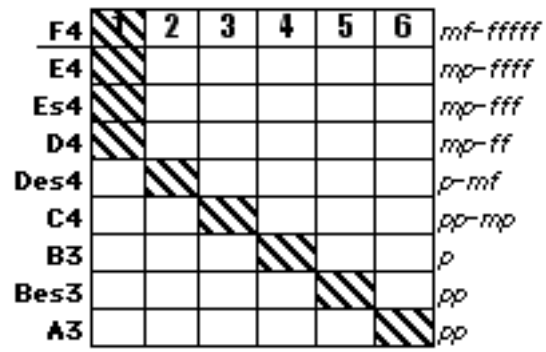


## Pijp 26 (As4)