Flute Options

I must state at the outset that my experience, understanding and the sheer number of flutes which have passed through my hands, have led me to believe that simplicity and a lack of gadgetry, above all things, make a good flute.

Firstly, the instruments where large sums of money have been invested in additional keywork always need more maintenance and consequently perform below optimum for much of the time. The addition of physical mass to a flute seems to detract from its flexibility and response. I have also always been struck by the fact that the best flutes seem to be uncluttered by additional mechanism - and consequently weight.

Table of Contents

1. Open Holes and Closed Holes

A highly subjective and extremely interesting subject.

1. From a theoretical perspective very little doubt exists that a closed-hole flute is superior, and the reasons are as follows:

    1.1 Air flow is more regular due to the consistently similar internal surfaces of the pad-cups. This leads to more finely regulated hole placements and slightly more precise intonation.
    1.2 It is on occasion claimed that due to the lack of irregular venting the closed-hole flute has a quicker response. I would disagree with this; I do, however, believe that the closed-hole flute has a more even and consistent tone quality throughout its compass.

2. From a practical point of view there is very little doubt in my mind that an open-hole flute is superior. The reasons are as follows:

    2.1 The additional venting gives the flute greater tonal flexibility.
    2.2 Those who have worked through the Alteś tutor will know that the open-hole flute has greater technical potential - this is to a large extent untapped by players of the open-hole flute.
    2.3 The open-hole flute has an unrivalled feel of life and resonance to it. I believe this to be the major reason for its being favoured by many players. It is a far more intimate instrument than a closed-hole flute.

Open-hole flutes often have G keys in-line while closed-hole flutes have G keys off-set. However, I must point out that there is no additional cost involved in having an open-hole flute with off-set keys, or a closed-hole flute with in-line keys. The style should be dictated by the size of the individual's hand. I believe the best option to be a half off-set G and G-sharp, which has the feel and elegance of an in-line flute with the mechanical reliability of an off-set G and G-sharp.

Beautiful Straubinger flute - Half offset keys

Half offset keys built on one axle. The half offset is more usually built on a separate axle

In summary, I believe that the open-hole flute has more to offer than the closed-hole flute.

In concluding this article I must stress that while not doubting the practical value of additions, simplicity is vital in an excellent flute. The question to ask is simple: How many virtuosi play extra thick-walled silver flutes with B foot-joints with detachable E mechanisms, and integrated B to C-sharp and G to A trill? I believe that you do not find them in the possession of a virtuoso because he/she would have sold the "moment of excess" to someone still in the impressionable stage.

2. Flute Scales

This article looks at another-perennial favourite of flautists: Scales. Many words are bandied around in this regard; modern and traditional, Bennett, Cooper, etc. These words inevitably confuse the situation, as very few flautists actually understand their meaning. This article will look at the situation from a number of points of view and will attempt to clarify firstly, in which way these scales are different, and secondly, the reason for these differences.

The Traditional/Modern Dichotomy
Using the words traditional/modern does not really tell us much about the difference between scales. However, when the descriptive words long/short are paired to traditional/modern, we are well on the way to understanding the difference between the two scales.

The Traditional or Long Scale
The basis for the traditional or long scales are the original scale Louis Lot Flute and, to a certain extent, a number of original Boehm or Boehm & Mendler Flutes. The key to understanding the long scale is that these flutes were built to be played at a pitch of A=435 Hz. At this pitch they were fairly in tune throughout the three registers. Problems with intonation, however, start occurring when attempts are made to play them at sharper pitches, specifically from A=438 Hz upwards.

At this stage it is necessary to explain the influence on scales of head-joint positioning (pushing in or, pulling out, to either sharpen or flatten). It is generally accepted that a flute can be pulled out to play at an average pitch of 3 Hz flatter or pushed in to play an average pitch of 3 Hz sharper than the flute was originally built for; this with only minimal distortion to the scale. For example, a 440 flute can comfortably be played from A=437 Hz to A=443 Hz. When a head-joint is pushed in too far, the notes to the left of A (B-flat, B, C, C-sharp, C-sharp vented notes, the trill keys and trill key vented notes) become progressively too sharp; conversely, the notes to the right of A become progressively flat. Due to the fact that many of the third register notes are based on left - hand harmonics and venting by the C-sharp and trill keys, the third register becomes too sharp.

This description describes the typical intonation problems of the flute in general, but of the traditional or long scale flute in particular. The basic rule of flute-making, which was not realized before the work of Albert Cooper, although Boehm developed the idea, was that the higher the mean pitch at which the instrument is to be played, the shorter the instrument must be.

In addition to this the proportions must change in that the tone holes should become smaller and move closer together to retain the correct pitch relationship between the notes. A considerable number of flutes ranging from cheap student flutes through to the most expensive hand-made models were, until recently, built to the traditional long scale. (These are still available - so be aware of this when buying a second-hand instrument.) The only concession made to higher pitch requirements being a shortening of the head-joint or of the body section between the barrel- joint and trill keys. This meant that while A could be played at a higher pitch, the intonation of the other notes becomes progressively worse. Once again, this results in a very flat right-hand and a very sharp left-hand and third register. The distance from A to C left-hand is too long so it plays sharp. The distance from A to C footjoint is too long, so it plays flat.

The Modern or Short Scale

The modern or short scale is, as the term indicates, flute scale which is shortened to the scale-length which is appropriate for the mean pitch at which the instrument is to be played. Most makers advertise their flutes in, for example, A=440 Hz, 442 Hz, 444-Hz and 446 Hz. These flutes, while they might look essentially similar, have different lengths of tubing and, ideally, different sizes of-tone-holes and differential positioning of the tone-holes. Simply stated, the sharper the basic pitch, the more the flute is scaled down in terms of length, tone-hole size and position.

Variations in the Modern Scale

The modern scale stems very largely from the brilliant work carried out by Albert Cooper, which in a sense is the modernization of Boehm's work, and most short-scale flutes are, at the very least, similar in conception to the Cooper Scale.

The pure Cooper Scales (there are a number of variations by Cooper himself) tend to focus on a very exact tone-hole placement with tone-holes that are not overly large. The results are scales which are very even and smooth, have impeccable intonation and hold their pitch well in dynamic extremes. Tonally the scales are very well balanced and because of this they are extremely flexible in terms of colour. Because of the hole sizing and placing, the response is very even and smooth.

The other well-known short scale is the Bennett Scale. The Bennett Scale is, in fact, an offshoot of the Cooper Scale. The scales are essentially identical from the thumb tone hole upwards and from the D-sharp tone-hole downwards. The area of difference is the body-joint where the essential differences are the use of fractionally larger tone-holes and, as a consequence of this, different tone-hole placing. The scale is in effect slightly longer because the larger holes sound higher and the holes are moved downwards to compensate for this and keep the flute in tune.

The Bennett Scale tends to have a slightly darker sound, which is very sought after, intonation and flexibility are however not quite as exact as the pure Coopers.

It is the writer's opinion that the Bennett Scale is the consequence of attempts at retuning old Louis Lot flutes, with existing large tone-holes, to the Cooper Scale. The results have been excellent.

Playing Characteristics of Long and Short Scales

A large degree of debate has taken place with regard to the relative merits of short and long scale flutes. Although the short scale flute is favoured by the majority of players, a short comparison of playing characteristics is in order.

Short scale flutes, because of their greater aerodynamic efficiency, require a large degree of diaphragm support when played. Where a short scale flute is played with inadequate diaphragm support and too much lip pressure, the tone tends to be thin, harsh and too bright. Intonation problems such as octaves sounding flat can occur especially with the larger tone-hole, and undercut tone-hole flutes. A correct approach to playing is thus very important. Short scale flutes are, however, unrivalled for their overall intonation, volume, tonal flexibility, wide dynamic range, clarity and agility.

Long scale flutes have considerable intonation problems (as described earlier in the article). They also have a smaller dynamic range and tend to have less volume than a short scale flute. Because of the inherent stability of the air column they are capable of extremely subtle shadings across a narrow band of expression. The tone is normally very attractive and sweet, but certain notes are, however, very dull. When fitted with modern head-joints these flutes tend to become much more dynamically flexible and even the intonation improves.

3. Esoteric Options

What is the open G-# key? It is in fact the original G-# key which was found on the Boehm flute as developed by Theobold Boehm. The closed G-# found on the vast majority of flutes today is in fact a survival from the old 8-key flute. I do not intend dwelling on the long and complex history of the change-over, suffice to say that when many 8-key flute-players changed to the Boehm system, they had problems with the open G-#. Many makers, notably Louis Lot and eventually Rudall Carte, were happy to oblige by fitting a closed G-# to flutes of their manufacture. The habit of playing the closed G-# has been passed on by generations of teachers since the turn of the century and thus the closed G-# has reached ascendancy.

The open G-# is found amongst exponents of the Murray System; also in Eastern Europe, a sprinkling in the U.S.A., and a fairly healthy following in Britain. Both historically and currently the British open-G# players have been and are: Robert Murchie, Arthur Gleghom, Geoffrey Gilbert, Gareth Morris, Ken Dryden, Frank Nolan, Simon Hunt and, notably, William Bennett.

In physical terms the closed G# involves a duplication of the G# hole in- the-line, i.e. a second G# hole is bored at the back (underneath).

On the open-G# flute, the G# key in the-line is cut loose from the G key and is operated independently by having the G# lever (pinkie) attached to it. Thus to play G the ring finger is placed down, as well as the little finger; this is what is meant by an open G# key. To play G# the little finger is lifted. There is no G# key at the back of the flute; there is only the G# in- the-line (on top of the flute) next to the G key.
What are the advantages of an open G#? These are fairly numerous once one is used to this mechanism and are as follows:

- The fingering for G and G# is chromatic: the ring-finger down gives G# and when the little finger is added one has G. There is also no contrary finger motion.
- The pinkie moves many more times than on a closed-G# flute. While this may seem to be a disadvantage, the finger becomes much more practised and adept at moving.
- Because the open G# can be closed independently of the G, a perfect high E can be played without an E-mechanism.
- Because there is one tonehole, one pad and pad cup, as well as one spring less, the flute is lighter and mechanically simpler and more reliable.
- The extra tonehole in a closed-G# flute causes turbulence at a critical point in the flute-bore. This causes a stiffness of tone in both the right-hand notes and the third register. A modern open- G# flute always has a better right hand and third register than a closed-G# flute. This is very noticeable when a third register F# is played. The G# in the bottom and middle register is not veiled as on a closed G#-flute.

To quote from Albert Cooper: "A regular closed-G# flute with its extra hole and heavier sprung key, and without a split E, can be argued is a more complicated flute, giving an incorrect fingering for high E. Add to this a split E, and not only is the flute even more complicated but you have spoilt two fingerings for high G and A trill. It would appear the open-G sharp flute has much to recommend it. After all, it is the original system Boehm designed." Or in the words of David Wimberly "Why not just be correct from the start". I think that William Bennett would agree.

4. The E Ring or ‘Donut’ - An Improved High E3 Using the Donut

Two of my recent articles have dealt with the problems surrounding E3 on the flute. I have discussed both the split-E mechanism and the open G# in previous articles.

This article examines an alternative which is highly effective in taming the E3, and is also effective in terms of cost. In American parlance it is called a "Donut".

Let us re-examine why E3 is a problem: it is because the note is over-vented. This means that two holes are open, G and G# in the line, when only one, the G, should be open. Both the split-E mechanism and the Open G# close the G# hole in the line, thus improving the E. To improve E3 we must close the G# hole - or at least reduce its size, and thus the venting. This is what the "Donut" does.

Explained simply, the "Donut" is a round plate the size of the G# in-the-line tone-hole, which is fitted into the tone-hole. This plate has a hole in it, and its effect is to make the G# hole smaller. It is called a "Donut" because it looks like a donut.

The "Donut" is nearly as effective as a split-E mechanism, and is available for fitting to flutes at a fraction of the cost of a split-E conversion. When the "Donut" is properly fitted, the E3 has a feel to it which is approximately similar to F3.

I have been through various stages in "Donut" design and I believe that I have now developed the optimum design:

1. The least effective "Donut" is the half plate: This "Donut" is soldered onto the upper half of the in-line G# tone-hole. It is very effective in controlling the pitch of E3, but it can impair the response of the right-hand notes. This is due to its angular shape.
2. The next "Donut" is the crescent, which is shaped like a half moon. This "Donut" is generally satisfactory.
3. The best "Donut" is a full-plate, with an elliptical or oval hole; a round hole is also satisfactory. The hole may be offset.

"Donuts" which I favour are the second or third. The ellipse (second type) gives an excellent response where the pitch of E3 is not the major problem. Where pitch and response are the problem the oval (third type) is the better. This is because the upper half of the plate is more closed and the bottom more open. This has the effect of moving the G# hole down the flute towards the foot and consequently lowering the pitch.

What are the disadvantages? These are as follows:

- If the hole in the "Donut" is too small it can "cloud" middle and low A. When properly fitted this is not a problem as the hole in the "Donut" is cut until the A's are clear and E3 sounds easily and in-tune.
- It can only be made by very skilled persons. It is also more difficult to do on flutes with soldered tone-holes.

I believe that the "Donut" offers very real advantages and flautists who are interested in this modification should not hesitate to contact me.

5. Split-E mechanism

The flutes high register E is a difficult note because the note is over-vented. There are a number of ways of improving this. One is to use an E ring or Donut. Another is to use a split E mechanism.

Jack Moore Flute No. 399 featuring under-slung split E connection between split E and G#

The basic problem with the current Boehm flute, which has a closed G-sharp key, is that when top E is played, both the G and G-sharp keys in the line are open (caused when the right-hand ring finger is lifted). This over vents top E and makes it difficult to sound. To make the E sound properly the G-sharp in the line should close, leaving only the G open. This problem only occurs on a closed G-sharp flute - it doesn't occur on an open G-sharp flute due to the fact that the G and G-sharp operate independently.

It is important to note that on the closed G-sharp flute there are two G-sharp holes, one on the top next to G, and one on the back. On a closed G-sharp flute there is only one G-sharp hole on top of the flute next to G; there being no G-sharp hole at the back of the flute.

Jack Moore Flute No. 399 featuring under-slung split E connection between split E and G#

The split-E mechanism is applied to the flute by splitting the G and G-sharp keys in the line. The G-sharp key is attached to both the G and E keys by dependent clutches. This means that if the E key is depressed the G-sharp goes down as well, but not the G. If the G key is depressed the G-sharp goes down as well, but not the E key. Because of this it should more correctly be called the split-G mechanism.

The split-E mechanism is very successful in improving the top E, but this brings us to another problem. Top F-sharp is also an over-vented note - in this case both the B-flat and A holes are open. The A should, however, be closed. This can be achieved by a split-A mechanism, where the A closes while the B-flat remains open - impossible on a normal flute.

The problem with the two over-vented notes is that if one is corrected the other seems twice as difficult.

The major objections to the split-E are made on mechanical grounds:

1. The mechanism becomes more complex and prone to mechanical stress due to the introduction of an extra spring (G-sharp).
2. Regulation becomes more of a problem due to an extra clutch between G and G-sharp.
3. On the off-set G flute the key rise of the G and G-sharp keys becomes so high that A is sharpened to the point where it may be out of tune. This is caused by the lengthening of the fulcrum between the levers controlling the mechanism when the G keys are off-set. The in-line split E does not have this problem.
4. The feel of the G key becomes very spongy and unpleasant due to the fact that two springs are operating under one axle in close proximity to each other. A number of independent flute-makers overcome this by putting the posts for the G and G-sharp further apart, allowing the springs to be made longer.
5. From an acoustic point of view there are five ways of trilling top G to A in the third register on a standard flute. The use of a split-E removes three of these options and leaves only two. This is why a split-E is so often paired with a B to C- sharp trill or a G to A trill.

There is however little doubt that the split E is a useful and popular addition to the flute.

6. G to A Trill

This is a key which makes the playing of third register G to A, far more easy, and allows the use of one touch piece.

This is built by boring two extra tone holes in the rear of the flute tube, one between the thumb and the regular trill keys, and another between the thumb and G-sharp key.

The G-A trill key gives an excellent third register G-A trill - however, it is of little other value.

The two tone holes are operated together and are connected by a rod. From a mechanical point of view it takes an experienced repairer to set the two pads in the two interconnected pad-cups correctly. A further problem is that on some flute-makes a rather thin silver rod connects the two trill keys in an attempt to save weight. Due to the thinness of the rod, and the fact that the cups are sprung closed by two springs, the connecting rod often flexes. This results in an unpleasant spongy feel and a trill which does not alternate notes as clearly as desired.

7. B to C# Trill

B C# trill seen between trill keys and thumb key. Jack Moore No. 299. what is of particular interest is the construction. One rod has 3 axles allowing for 3 keys to be controlled. The B C# is normally strung on a separate axle.

The B to C# trill is difficult because both the thumb and the first finger of the left hand are used and it is often difficult to balance the movement of the two fingers. This is often due to different hand placement. The B to C# trill solves this problem.

Whilst on the subject of additional trill keys we may as well examine the B to C# trill. This trill is constructed by introducing a large tone hole between the thumb key and the trill keys. It is sprung closed and is activated by the first finger (forefinger) of the right hand. It gives an excellent B to C# trill.

Having learnt to trill B to C# successfully with the thumb and forefinger of the left hand, and to do quick turns with the C trill key I question the necessity of the B to C# trill key for the following reasons:

1. It gives a good C# when B is fingered and the trill key is opened; however, regulation has to be exact or the note is sharp. A better C# is obtained by playing the note in the normal way with the addition of putting the first, second and third fingers of the right hand down.
2. I dislike the large hole near the top of the flute because its size creates turbulence which has a negative effect on the response of notes further down the flute. I usually overcome this by fitting a domed washer which displaces some of the volume of the tone hole.
3. Regulation is critical. Because the tone hole is large, the key-rise must be set low or the C# will be sharp. The low key-rise also makes the trill feel uncomfortable.
4. The B to C# cup very often develops leaks which, due to its size, its position and the fact that it is sprung closed, have a devastating effect on the rest of the notes, so it can be a problem.

Construction of trill keys and B C#. B C# is the silver tube while the trill keys are mounted on steel rods; one running in the other.

8. B Footjoint

The B footjoint refers to the extra semi-tone added to the lower footjoint of the flute.
This must be the most seductive of all options for the flute - I know as I have succumbed on two occasions.

The logic of the extra semitone, the excellent top C, the joy of filling the space ahead of the C roller with a B roller, the elegance of the extra cup and the beauty of a well turned Gizmo, as well as the sheer glamour of the extra length of tube.

Are there problems with a B foot-joint?

On the down side the problem is that the air column is lengthened and may be dysfunctional for the following reasons:

1. The flute's response becomes slower and articulation is less crisp. The test for this is to try a B-foot flute with a C foot-joint - the improvement is dramatic.

2. The C foot allows for more flexibility of sound, and the flute develops more volume.
3. A deeper embouchure hole helps a B-foot flute to play better. This is, however, at the cost of tonal flexibility.
4. The B-foot flute demands more diaphragm support to activate the longer air column. How many flautists feel that they are really adequate in this area?
5. In all fairness I must point out that the problems associated with the B foot-joint are at their worst at high altitudes where the high altitude exaggerates the problem. At sea-level a B foot-joint is not as problematic as it is on the Reef. I have rebuilt a number of B foot-joints to C foot-joint specifications, and the owners have been astounded at the performance improvement in flutes which they had previously come to regard as problematic. It is my opinion that the worst thing that can be done to a flute is to put a B-foot- joint on it. As a consequence of hard experience, my own and others', I disbelieve utterly that the weight of a B foot joint "does something" for the sound of a flute. Weight is not good for a flute and the weight or mass of additional tubing or thicker tubing must never be confused with material density.

One final point, if one must have a B foot-joint the flute must have the thinnest possible tube. On the positive side, where one has a good responsive flute, the B foot presents no problems. The B foot is good with Cooper, Bennet and other modern short scales. The problems described occur more frequently with older long scale flutes. So, when buying a flute try it with B and C footjoints.

9. Tube Wall Thickness

This article refers to the thickness of the tube out of which a flute is made.
Most flutes will play well with a number of different wall thicknesses. The cardinal error to be avoided is to buy a silver flute with a very thick heavy wall in the mistaken belief that it will play like a flute with a gold tube. It won't. The flute will be dull, sluggish and unresponsive. The tube of a gold flute is dense and very thin. Because it is thin it is responsive. A thick silver tube, even though it is less dense lacks the responsiveness of a thin gold tube because it is thick. The issue is density, and a thick silver is not denser than a thinner tube.

Due to small differences in tone-hole placement, bore size, the mass of key work, embouchure design and material hardness, there is no one wall thickness which is best for all makes of flutes. I offer the following thicknesses as a guide. Measurements are expressed in millimeters.

Most thicknesses between 0,35 mm (0,14”) soldered holes and 0,42 mm (,018”) drawn holes are suitable for silver flutes; but specific makes do work better with a certain thickness. Gold tubes vary in thickness between 0,28 mm to 0,35 mm because of their greater density and hardness.