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The musical instrument known as the recorder has been used since ancient times. During the earlier periods of music history, the recorder was considered to be as important an instrument as any other, although today it is played mainly as a hobby. Most of the information gathered together in this paper concerning the recorder is the opinion of certain authors and that acquired from my own observations. It is not known how much is based on fact and how much is opinion.

A recorder is basically an open tube that is blown at one end. Sound is produced by an air stream shaped by a windway, which impinges upon an edge formed by a chamferred surface on the tube. The windway of a recorder is formed by the insertion of a carved plug or block (from which comes the German name 'Blockflote') into the blown end of the tube, which is generally made beak-shaped (from which comes 'flute a bec') to fit between the lips. This block is made of a wood such as red cedar which does not swell when moistened.

Recorders are most commonly made in three parts, although some sporanos are made in two or even in one part depending on the maker. The upper part is referred to as the head, while the lower part is the foot. The joints between the parts are covered with cork, rubber, or waxed thread, and are

usually protected from cracking by bulges of wood, ivory rings, or metal straps. Even though the recorder has a tone-quality of its own which is to be distinquished from that of any other woodwind instrument, there is a considerable amount of variation between one instrument and another. Certain characteristics have become associated with different makers. Therefore, the tone-quality of every recorder is something that has been a deliberate goal of the maker, and is not usually a matter of chance.

A recorder's tone is affected to the greatest degree by three factors. These are its voicing, its bore, and the material from which it is made. Of these, the most important is considered to be voicing. In voicing, the opening of the windway opposite the edge is chamfered slightly to direct the air in the best way against the edge. The most critical factor in voicing is the way in which the edge divides the air into two parts, one vibrating in the bore, the other escaping along the top of the instrument. An uneven division of air will most often favor the tone of the lower notes of the instrument and should minimize differences in quality between the notes of this register. However, this voicing makes it difficult to produce good high notes. These are better produced with an equal parting of the air-stream. The distance between the opening of the windway and the edge can also be a factor in tone production. The higher register is favored by closeness, although too close a voicing stifles the tone. If this distance is increased the lower notes are favored. Too great a distance means that less air is made to

sound, which causes fluffiness.

The cross-sectional areas of the windway and of the bore affect tone because they determine the amount of breath needed to make a note. A greater distance between the roof and floor of the windway will favor the lower notes because of the fact that more vibrating air can be expended on them. What is gained in loudness, however, is lost in expense of breath. The result is a lack of control of phrasing, particularly in the higher register. This is because of a lack of resistance which is caused by the use of a wider windway. Resistance in an instrument gives a better "feel" when playing.

The shape of the cross-sectional area of the windway, which is sometimes straight across and sometimes an arc or bowed shape, is considered by most to have no effect on the tone. Bowed windway advocates, however, claim that moisture will not tend to clog the center of the windway, but rather will roll to the side and leave the middle clear. This is desired, since the slightest impedance to the progress of the breath travelling through the windway causes fluffiness and makes it harder to obtain high notes. Also, the bowed windway models seem to have more resistance than the straight models. Some also say that it allows for longer sessions without the performing tiring.

The second factor influencing a recorder's tone is its bore. The instruments that were illustrated by Virdung in 1511 were fat and almost cylindrical. They must have sounded

loud and clear but a trifle monotonous. Their tone would probably be pure but would have no 'bite' to it. Their range was probably little more than an octave. A wide bore makes it difficult to produce the clear, round harmonics that made the second octave of the recorder. The recorder as it was used in Hamlet in 1604 was much narrower though still made in one piece. It had a more conical shape with a slight flare at the foot. It could certainly have played two full octaves and its tone would be pure, round, and rather dispassionate and abstract—ideal for most Elizabethan consort music. The baroque instrument, such as is in general use today has a much more conical bore, causing it to have an impure, reedy, and more penetrating sound. The shaping of the conical bore would gave been facilitated in the Baroque era because of the fact that it was no longer being made in one piece.

The third factor influencing tone is the material from which the instrument is made. Wood is considered to be the most satisfactory material for making recorders. The best wood for recorders is that which has no knots and a close and parallel grain. This allows a surface to be made which will stay smooth even under conditions of frequent wetting and drying, without splintering or swelling. It should not be so hard that it has too violent a resonance of its own. Neither should it be so soft that it absorbs or dampens sound. The woods most nearly meeting these requirements that are commonly used are boxwood, rosewood, palisander,

and grenadella. Slightly softer woods such as maple, pear, cherry, walnut, and plum are also suitable for recorder making. This is especially true if they are made impermeable to moisture by heat treatment followed by impregnation with paraffin wax. But although such impregnated instruments, if well made produce a delicate tone, they are, according to some, less satisfying to play upon than naturally seasoned wood. Naturally seasoned wood is considered to have greater individuality and vitality.

What is the difference in the performance of the different kinds of wood and is it worth the difference in price for different woods? The following observations were made by Arthur Nitka, president of Terminal Musical Supply, Inc. in New York, and a leading authority on recorders and recorder playing.

> Maple and plum have a full and lovely sound. The maple is more subdued than plum and the plum is brighter than maple. The same performance with a lot more "soul" can be gotten from Rosewood. Rosewood is a darker wood, has a darker sound, and probably has the most versatile tone to fit most any situation. Grenadilla is a hardwood that often is not suitable for consort work unless the whole consort also has grenadilla. But it is great for solo. Grenadilla recorders carry soundwise as well as many orchestral instruments.

Some woods can cost almost twice as much as others. But price should not be a factor in making a choice. Often the lower costing instrument will be better. Some say that certain woods do not produce a characteristic tone quality. The differences in tone between instruments which are made by the same maker depend more on the relationship between the voicing and the nature of the piece of wood used for each

instrument.

Cheaper recorders are usually made out of plastic. The tone of a plastic instrument is rarely as good as desired. Authors do not agree exactly on why plastic instruments generally produce inferior tone. A possible explanation of the tone problem is that the shrill, strident timbre is the result of increased overtone content. A number of things might cause this. One of the authors suspected that harmonics generated at the wind window could not well be damped out by plastic instruments, whereas wood would tend to absorb some of these harmonics.

In chossing an instrument, as many makes of recorders as possibly should be tried because of the large variation in tone quality. The following test was given by A. Rowland-Jones as a method of choosing an instrument. (The notes referred to are those of an alto recorder.)

> (i) Tone. Play lower C and upper C'. If the instrument does not give the tone you are looking for, discard it.
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> (ii) Intonation. Check octaves for intonation. If F to F', A to A', C to C', and D to D' are in tune, test the scale of F major going down, listening carefully for each interval; bottom F is a note that tends to be out of tune. Next test the sequence C#, D#, E, F#', G#', making sure the last interval is not too wide.
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> (iii) Speech. Rapidly repeated staccatto C#'s will reveal if an instrument is slow in speech (i.e. playing pure note instantaneously upon breath being put into the recorder.) Give the instrument a chance by using light tonguing. Try the speed of reaction of notes with forked fingerings such as B and of low notes such as F, as well as of high notes (E', F'', G'').
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> (iv) Volume. Do a rapid crescendo on F,C, and C' to see how loud you can get before the note 'breaks'.

(v) Alternative fingerings. See that alternative G, E, ane D are usable as regards intonation and tone-quality.

(vi) Construction. Check that the instrument has no incipient cracks, that there are no loose splinters of wood round the windway edge and the holes, that the joints are smooth and snug, that the plug is not loose, and that the instrument is well designed and solidly made.

New recorders differ less than those which have been played on for some time. Some cheap recorders may sound better when new than more expensive recorders. Expensive recorders, made in harder woods, however, will last much longer and will develop better tone quality as they are played.

As a part of the research, six recorders constructed of different materials and made by different manufacturers were compered. The instruments compared were as follows: 1. Dolmetsch, plastic, soprano. 2. Adler, maple, soprano. 3. Mollenhauer, rosewood, soprano. 4. Aura, pear or cherry, alto. 5. Moeck-Rottenburgh, plum, alto. 6. Dolmetsch, plastic, alto. The following facts were observed about each instrument.

1. Dolmetsch, plastic, soprano.

The tone of this instrument was thin and edgy and lacked warmth. The volume could not be varied to any extent before the tone would break. It offered a minimum of resistance, making it very difficult to control the tone. All notes played easily throughout the range of the instrument with a fairly consistant tone quality. The two lowest notes were

noticeably out of tune. The reason for this was in the construction of the instrument. The finger-holes for these two notes were much closer together than those on the other two sopranos, causing these notes to be sharp. The instrument had a straight windway which was longer than the others. The surface of the tube was less chamfered and the over-all length of the instrument was shorter. The only other thing noticeable was that moisture condensed much more readily in this instrument.

2. Adler, maple, soprano.

This recorder was constructed of a light-colored wood, which was thought to be maple. However, it seemed to react like a harder piece of wood. The tone was bright and penetrating. A good differentiation of volume levels was gotten and the instrument was in tune throughout its range. It offered good resistance and played easily throughout its range. The windway was straight, with a narrower edge than that found in the others, and the last two finger-holes were not doubled.

3. Mollenhauer, rosewood, soprano.

The tone of this instrument was much mellower than the other two sopranos. The quality of the tone was consistant throughout its range with no noticeably out of tune notes. The volume control was fairly good but not as good as the Adler. The windway was straight, with a greater distance between the roof and the floor than the others. This instrument

offered a little resistance but not much because of the size of the windway. Either end of the range gave some trouble at times, however, this may be the fault of the player rather than the instrument.

4. Aura, pear or cherry, alto.

The tone of this instrument had a pure sound and was not as airy as some of the others. It had a consistant quality throughout its range and carried well. The volume could be varied quite a bit. Notes didn't break easily but went extremely sharp. At a normal volume there were no out of tune notes, however. It offered some resistance but not as much as the Rottenburgh. The windway was straight and shorter than the others.

5. Moeck-Rottenburgh, plum, alto.

The tone of this instrument had a slight edge to it but seemed to be a little muffled. It was hard to hold a straight tone on the two lowest notes. This may have been the fault of the player, however, rather than the instrument. It was possible to increase the volume without causing serious intonation problems. Also notes did not break easily. This instrument offered much more resistance than the others. This is possibly because the instrument was constructed with a bowed windway. There were no noticeably out of tune notes.

6. Dolmetsch, plastic, alto.

The tone of this instrument was very similar to that of the wooden instruments. However, it seemed to lack a

certain warmth that the others had. The volume of this instrument could not be varied. Notes would break easily upon attempting to increase the volume. It offered a minimum of resistance causing it to be difficult to control the tone. There were no noticeably out of tune notes. However, low A was considerably weaker than the others. The low range of this instrument played more easily than the others. The windway was straight and the over-all length of the instrument was shorter. This plastic instrument was a much better constructed one than the plastic soprano.

Of the three soprano recorders, the tone of the Mollenhauer instrument was preferred over the others. However, the ease in playing the Adler made it a more desirable instrument for most purposes. Of the altos, the Aura was preferred because of the tone and the greater ease in playing the lower range. However, the feel, or resistance, of the Moeck-Rottenburgh made it a more satisfying instrument to play upon. It was found that after playing on an alto recorder for a period of time, that the soprano instruments seemed to respond with less trouble than they had previously. Of the entire group of instruments that were studied, the Aura was probably the over-all favorite of this writer. Both plastic instruments were considered to be unsatisfactory although the alto would suffice if a more expensive recorder was not available. All of the wooden instruments were well made and any of them would be a desirable instrument for playing.

The purpose of this study was to show how varied in tone and quality these instruments could be, although they

are all "recorders." It makes a great deal of difference how a recorder is made and what it is made of, and these things should be considered when purchasing an instrument. The type of wood chosen will depend greatly on the type of tone quality desired. The tone quality desired will depend upon what the purchaser intends to use the instrument for. For solo work a different quality would be desired than for ensemble or consort work. In choosing an instrument for ensemble work, it must be taken into consideration what kind of instruments others in the group are using. One would have to be chosen that would blend well with the other instruments in the group.

A hobbist would probably choose a different kind of an instrument than a semi-professional or professional player. A hobbyist would more often than not choose a less expensive instrument, not wishing to put as much money into a hobby as someone would who played professionally. Many times a recorder will be purchased simply because the wood from which it is constructed "looks pretty." This should never be done. There are many, many other factors, as shown here, which should also be considered when purchasing a recorder. Whether you are a soloist or a consort player, a semi-professional (or professional) or someone who plays for a hobby, it is still important that a well-constructed instrument be used. Many more hours of enjoyment will be recieved by all.

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