MEASURING PITCH FLEXIBILITY ON THE SAXOPHONE

by

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TABLE OF CONTENTS

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Introduction

Every discerning band director, stage band musician and saxophonist knows that saxophones are hard to play in tune, especially with satisfactory sonority. Yet the instrument, under certain circumstances, has great pitch flexibility. This flexibility can be impressively illustrated by testing and measuring it on a strobotuner, and the great pitch variations throughout the range of the instrument can be illustrated on series of charts. A degree of innate ability is undoubtedly necessary for the sensitive production of music in any medium, and the ability to concentrate upon pitch and sonority is fundamental. Even the talented student is led to realize more acutely the musical import of what he does and can do to sound by graphic illustrations which stimulate his attention in these directions.

Upward mobility of the tone is essential. Given a satisfactory instrument, very little mechanical adjustment is necessary. But the adjustment of pitch by means of the embouchure is crucial. The question arises as to how much adjustment is possible on the various tones of different kinds of saxophones supplied with different kinds of mouthpieces.

The purpose of this study is to illustrate the control embouchure adjustment can have on achieving good intonation on the saxophone. This is shown by offering visual representation to the student and teacher of upward mobility of saxophone tones that can be achieved by the embouchure.

A series of charts is supplied in which every tone in the range of the alto, tenor, and baritone saxophones is measured in terms of cents by a strobotuner. Various grades of saxophones and mouthpieces in different combinations were tested and the possible tonal divergencies were charted.

Intonation was checked by an assistant, and all of the tests were conducted by the same tester.

In all instances but one, it was found possible to play each saxophone in tune, regardless of the mouthpiece used.

Any references to evaluation of tone quality is based solely on the judgment of the tester.

The most flexible tones were measured in relation to the tones both directly above and below the measured tone. For example, on Chart 1, $f\#^2$ on the alto saxophone was produced in tune with satisfactory sonority. Then the strobotuner was moved up to g^2, and the $f\#^2$ on the alto saxophone was produced in approximately the same volume while moving the pitch upward by means of the embouchure. In this instance, it was found that the $f\#^2$ was being produced within thirty-five cents of the g^2. Thus, the $f\#^2$ was being played sixty-five cents sharp. Many of the tones on some of the tests could be dropped well over one hundred cents, but one hundred cents was considered sufficient to show downward mobility because intonation is mostly controlled by exploiting the upward mobility of tones.

It seemed necessary to coin two terms for this study: <u>area of stability</u> and <u>area of instability</u>.

<u>Areas of stability</u> are those in which the upper pitch variation over tones in a certain range may be measured by the same, or nearly the same values in terms of cents. Such an area may be seen in Chart 1 between

$d\#^2$ and $a\#^2$.

Areas of instability are those in which the upper pitch variation over tones in a certain range vary significantly in terms of cents with each tone. An area of instability may be seen in Chart 1 between $g\#^1$ and $d\#^2$.

Two alto saxophones were used, the first, a Selmer professional model, and the second, a Buffet student model. The mouthpieces used were a Selmer "E" professional model, a Vito stock model, and a Sigurd Rascher "legitimate" mouthpiece.

Two tenor saxophones were used, the first, a Selmer professional model, and the second, a Vito student model. The mouthpieces used were a Brilhart "5" professional model, and a Vito student or stock model.

An Otto Link hard rubber mouthpiece, especially faced for the tester, was used on a Selmer professional model baritone saxophone.

Since the essence of this study is found in the charts, and since distributing them through the text is impractical, reference to them seems more convenient if they are grouped in a section immediately preceding the text proper.

CHART 1

Selmer E♭ Alto Saxophone, Professional Model
Selmer "E" Mouthpiece

CHART 2

Buffet E♭ Alto Saxophone, Student Model

Selmer E♭ Mouthpiece

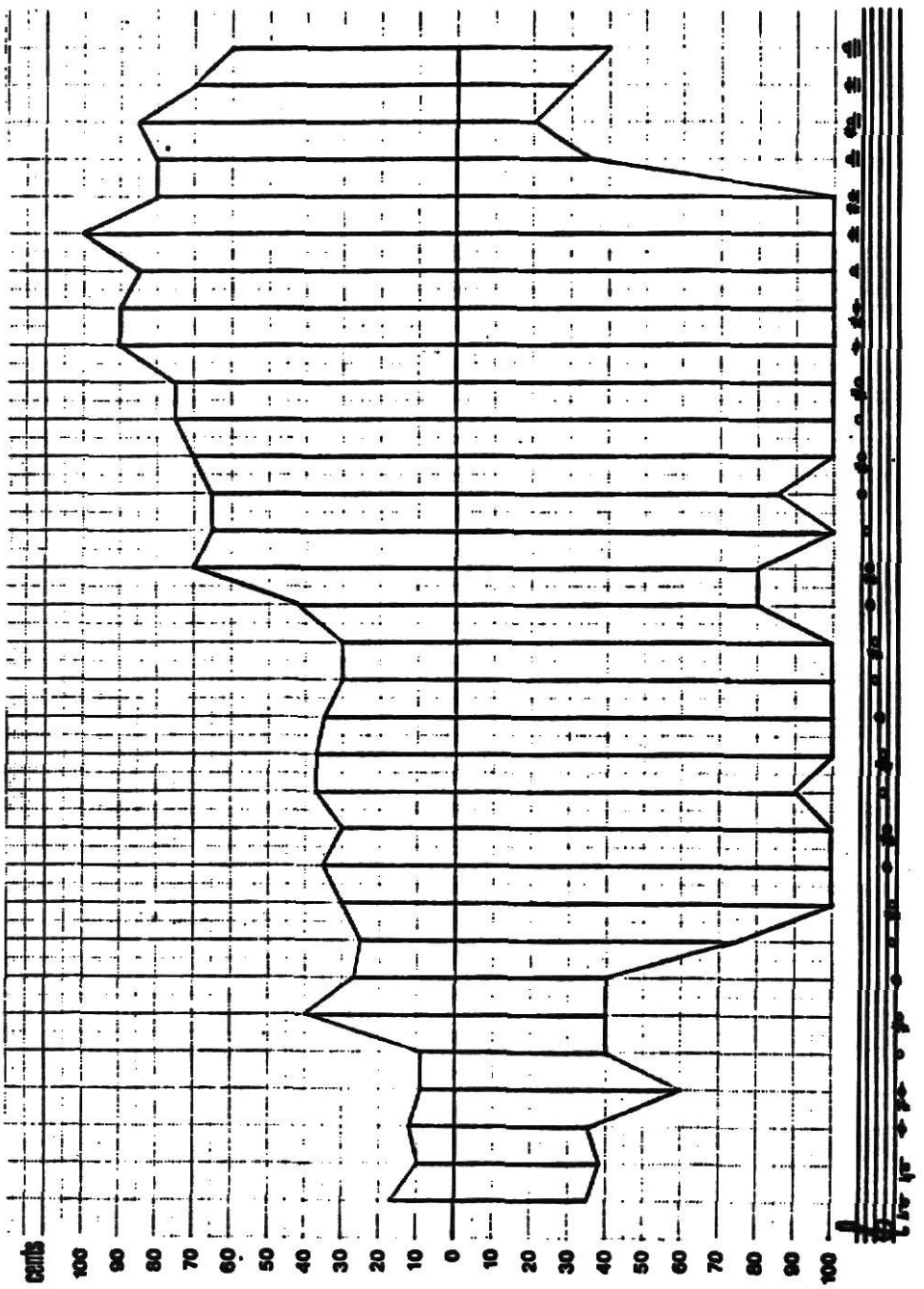


CHART 3

Selmer E♭ Alto Saxophone, Professional Model

Vito Stock Mouthpiece

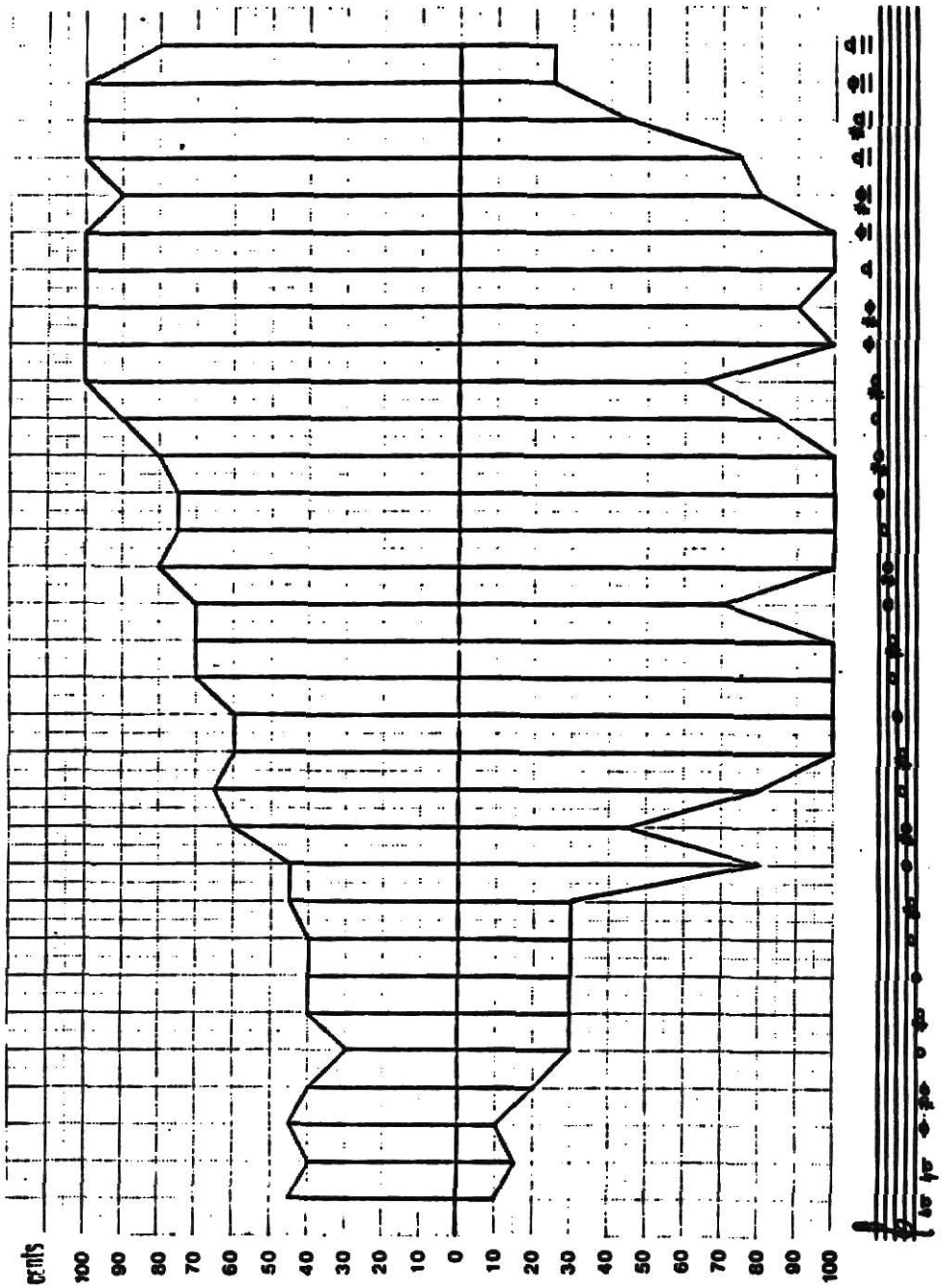


CHART 4

Buffet E♭ Alto Saxophone, Student Model

Vito Stock Mouthpiece

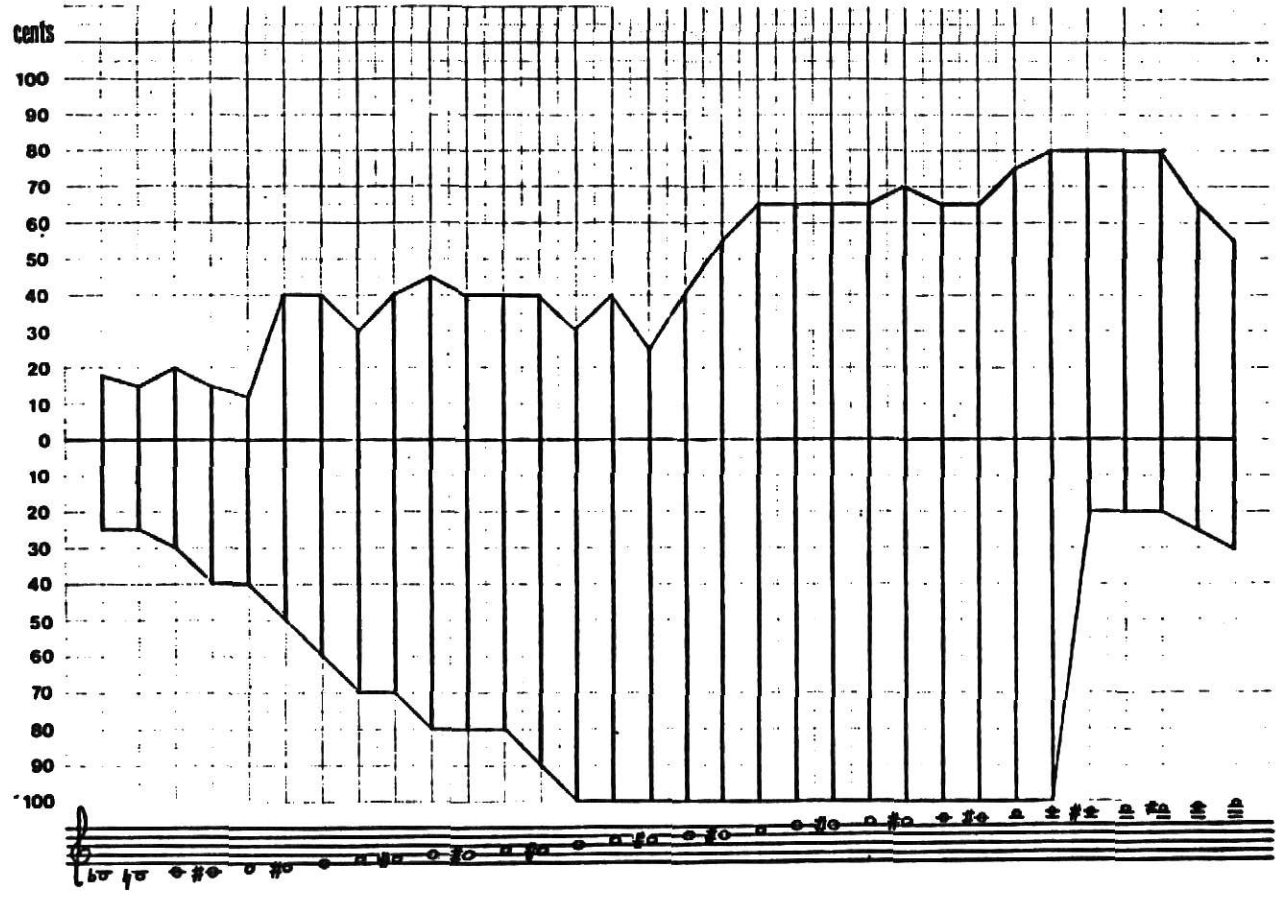


CHART 5

Selmer E♭ Alto Saxophone, Professional Model

Sigurd Rascher 'Legitimate' Mouthpiece

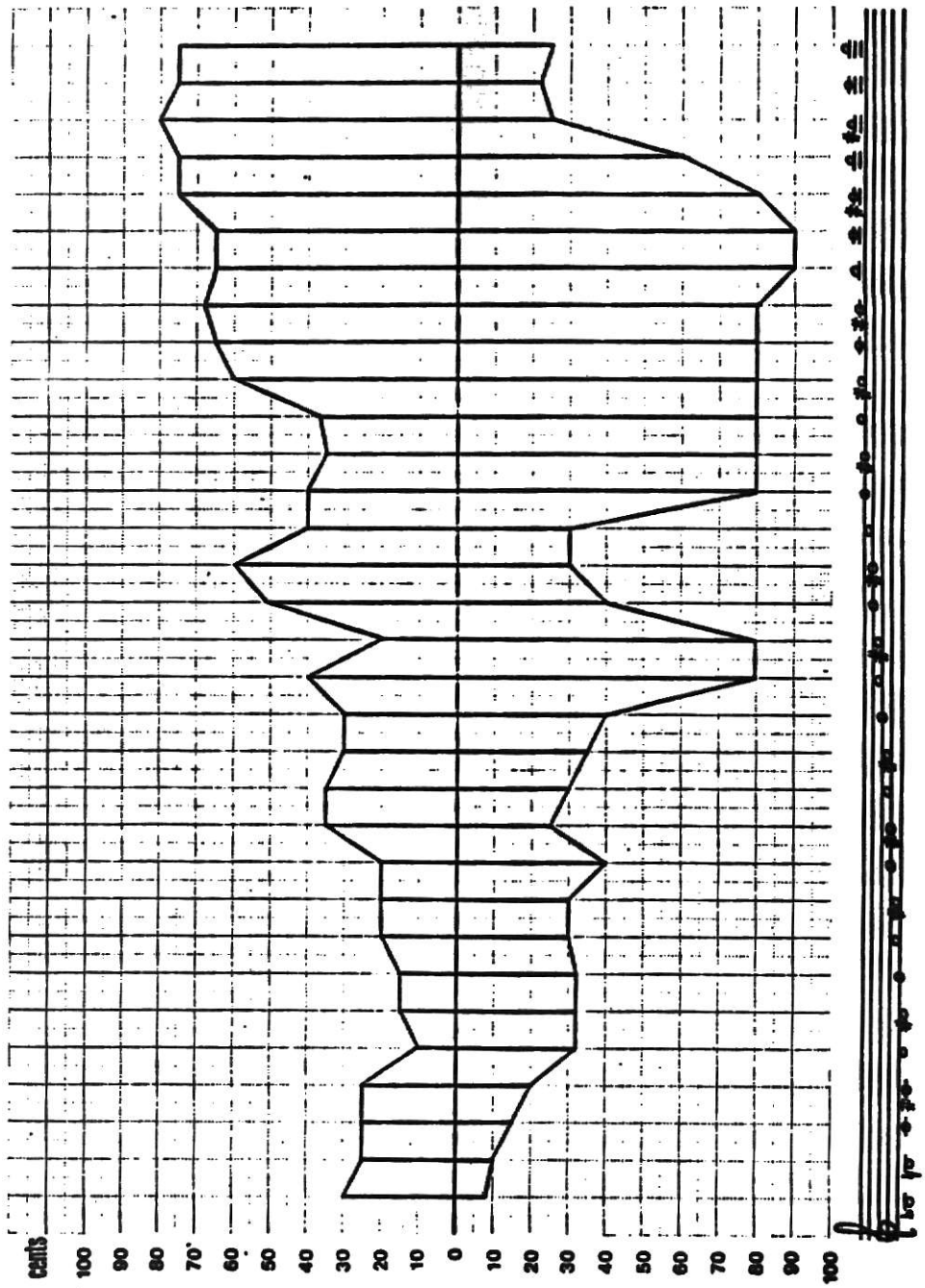


CHART 6

Buffet E♭ Alto Saxophone, Student Model
Sigurd Rascher Legitimate Mouthpiece

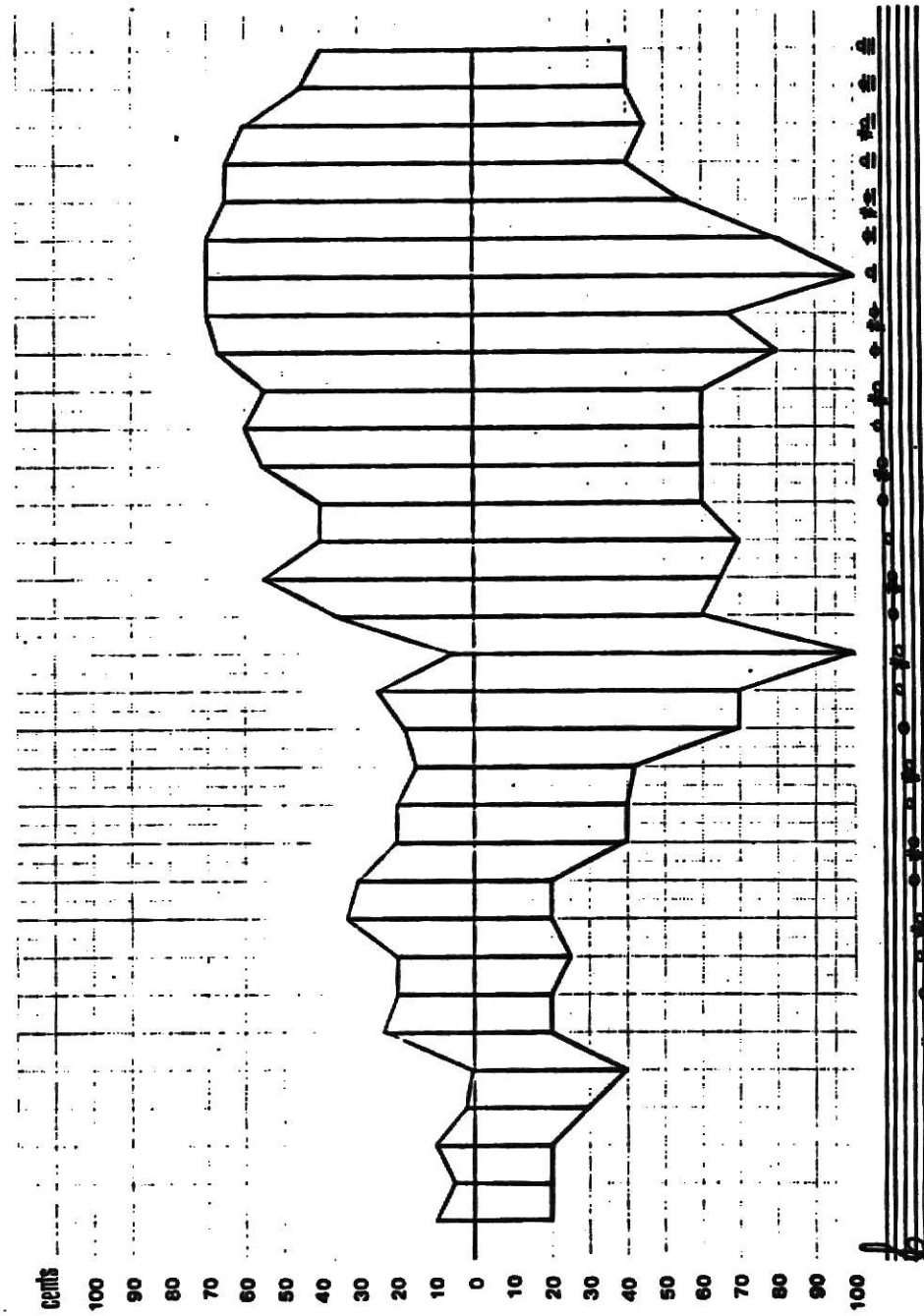


CHART 7

Selmer B♭ Tenor Saxophone, Professional Model

Brilhart 5* Mouthpiece

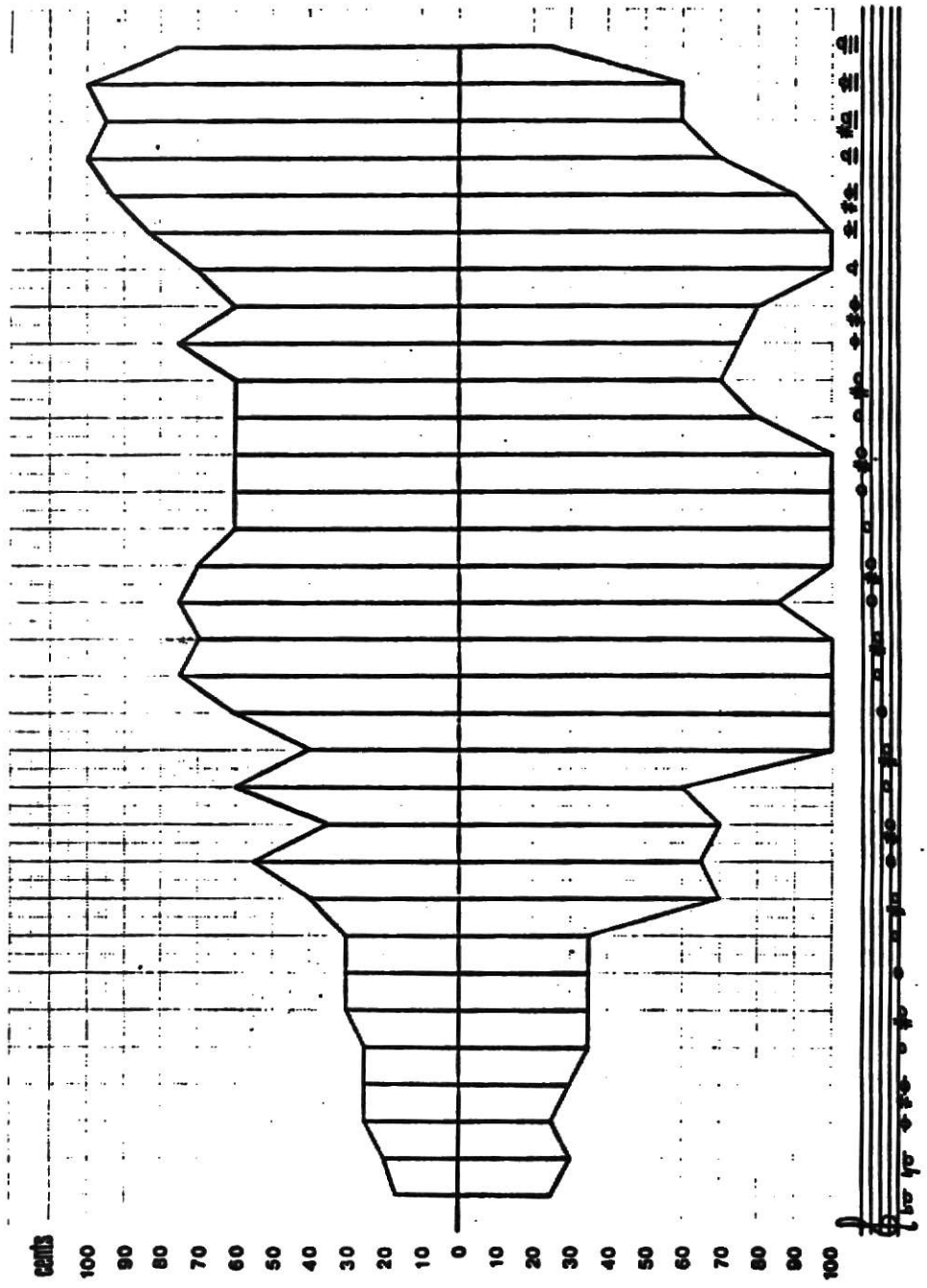


CHART 8

Vito B♭ Tenor Saxophone, Student Model

Brilhart 5* Mouthpiece

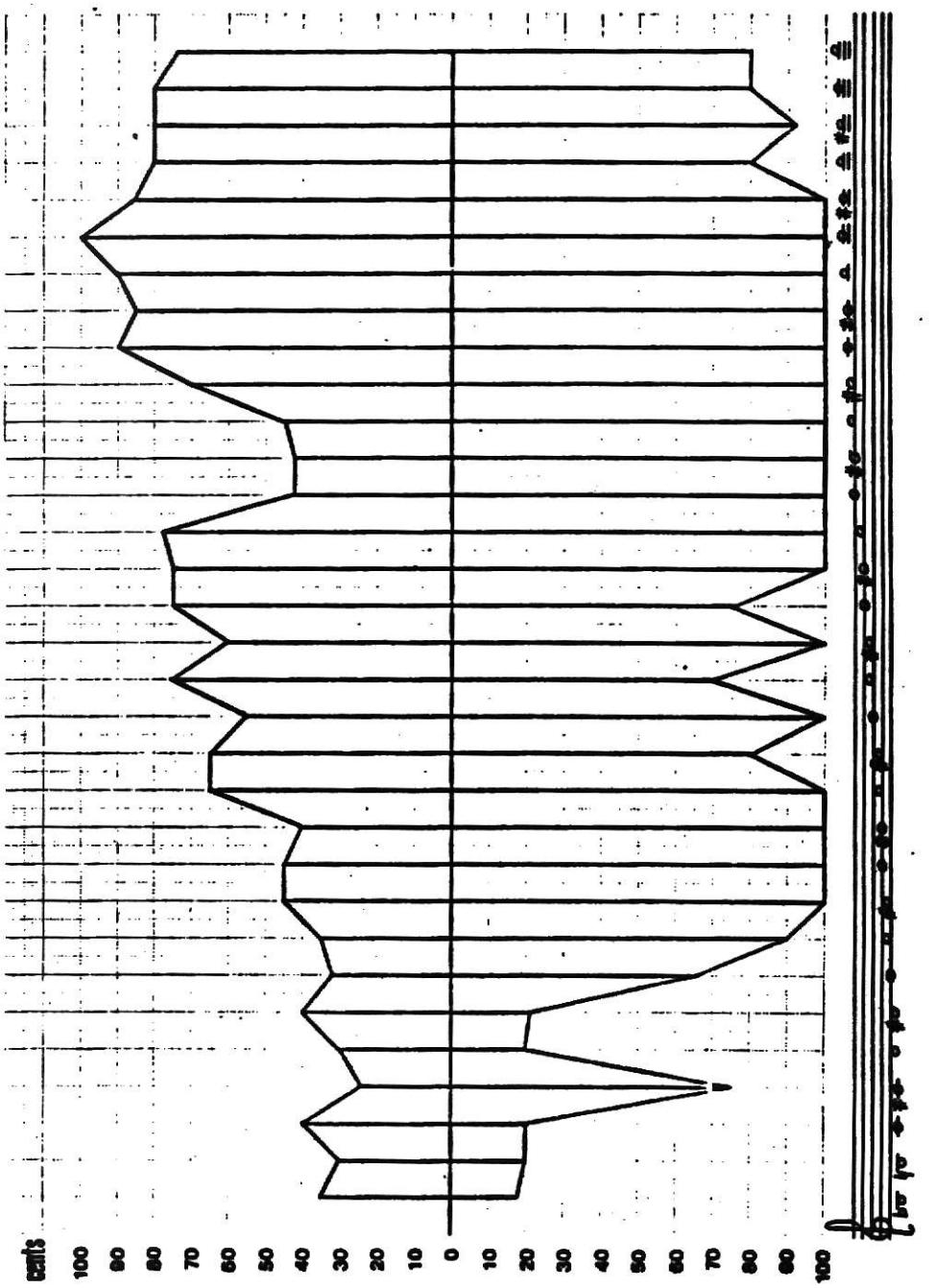


CHART 9

Selmer B♭ Tenor Saxophone, Professional Model
Vito Stock Mouthpiece

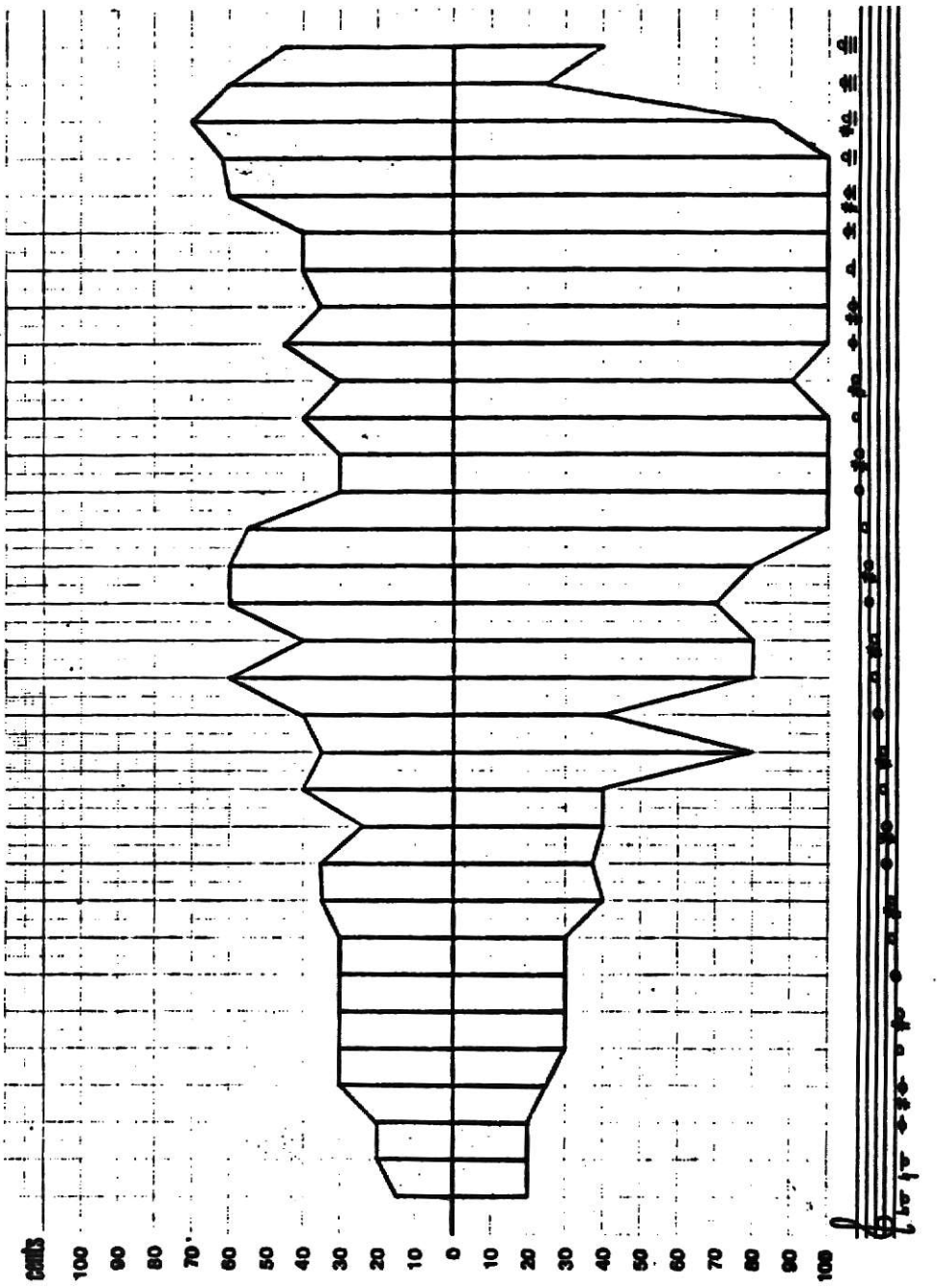


CHART 10

Vito B♭ Tenor Saxophone, Student Model

Vito Stock Mouthpiece

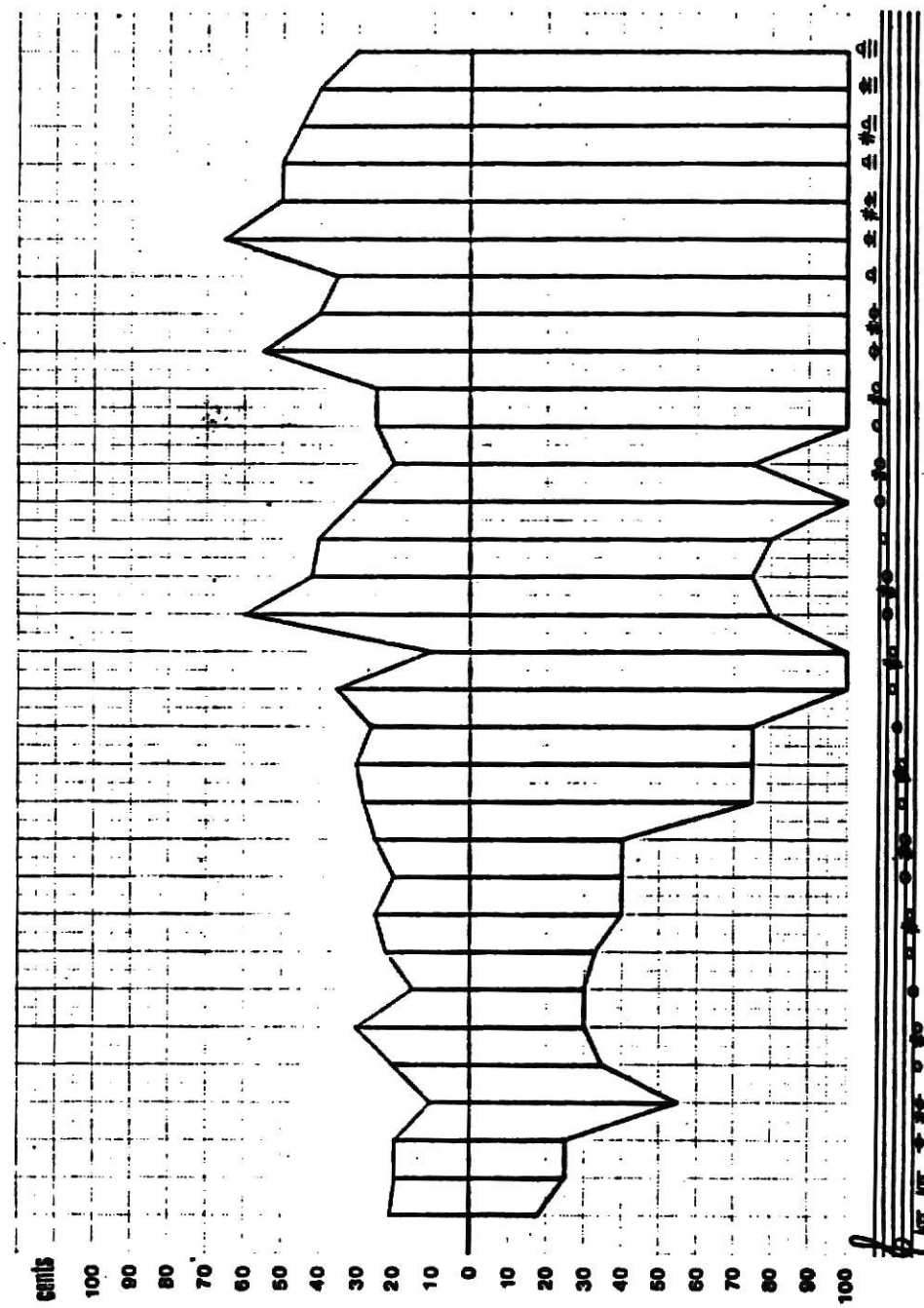
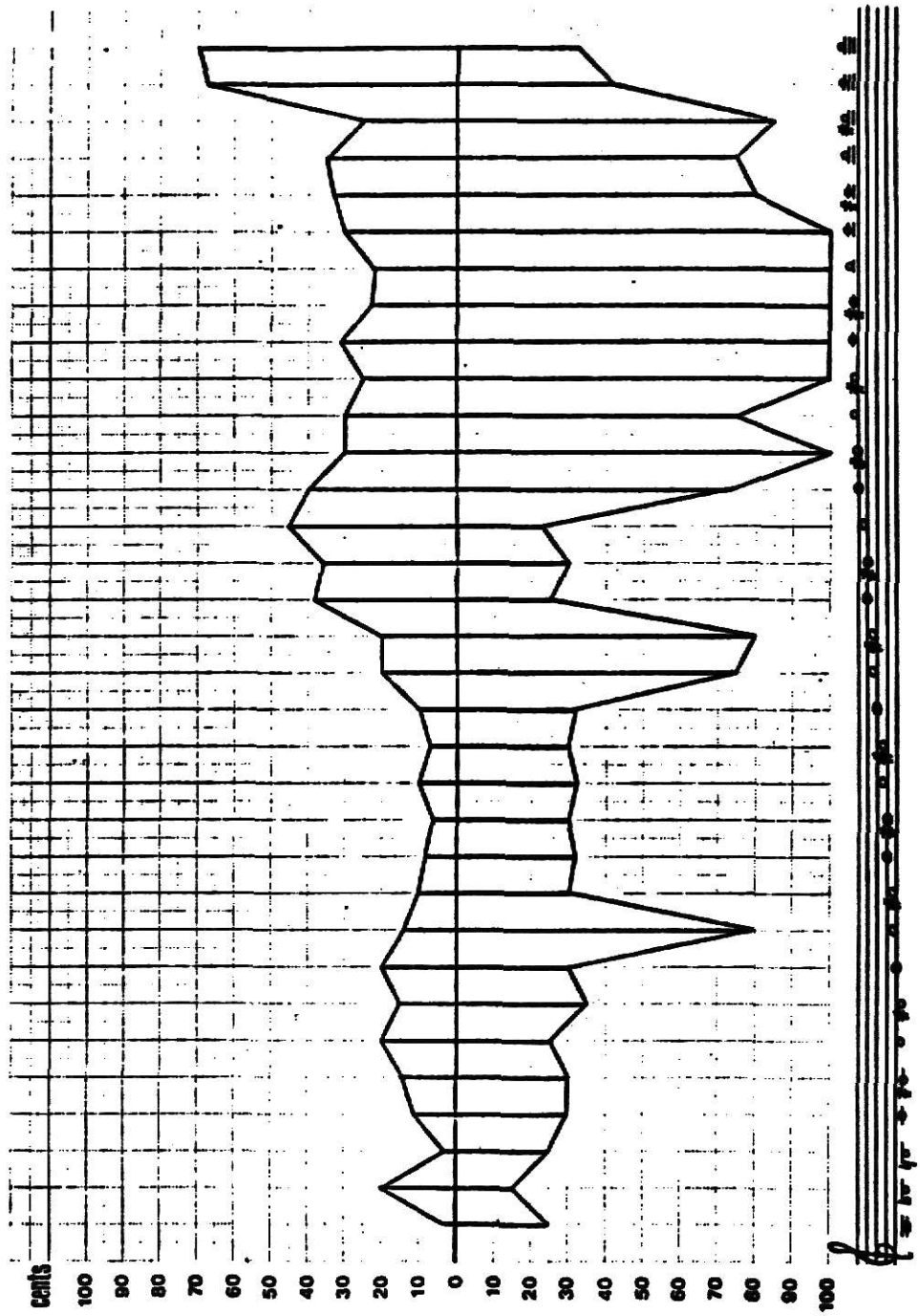


CHART 11

Selmer E♭ Baritone Saxophone, Professional Model
Otto Link 'Special' Mouthpiece



Discussion of Data

The above series of eleven charts illustrates the upward mobility of the several combinations of saxophones and mouthpieces.

In each chart, the upper profile reveals areas where the upward mobility is the same, or about the same, for several consecutive tones as well as areas in which there is a wide fluctuation in the upward mobility between consecutive tones. In general, the charts for each group of saxophones such as the alto, tenor, or baritone, show the regions in their respective ranges where areas of stability, and especially, areas of severe instability occur, regardless of which combination of saxophone and mouthpiece is used. These instable areas include tones in which intonation may be hard to control. However, the charts show that the detailed character of these areas changes as the combination of instruments and mouthpieces changes. The extent of the upward mobility is not always the same, and the number of tones within areas varies. In some cases the variation between tones in some areas of instability is comparatively more erratic.

Perhaps the greatest factor regarding intonation shown by the charts has to do with the embouchure adjustment. An experienced saxophonist finds that big changes in the upward mobility profile indicate significant changes in the embouchure adjustment are needed to achieve satisfactory intonation. For instance, in Chart 1 the wide change in upward mobility between $c\#^2$ and $d\#^2$ calls for considerable embouchure adjustment. On the other hand, in areas such as between $d\#^2$ and c^3 where the upward mobility is consistent, good intonation is achieved with little embouchure adjustment.

Where little upward mobility is shown in the profile, as on d^1 in

Chart 1, the amount of physical exertion on the reed (biting and squeezing) to achieve good intonation is great. The embouchure tension is firm. But as upward mobility increases, physical exertion on the reed itself decreases and the tension of the embouchure is increasingly transferred to the corners of the mouth.

In Chart 1, the comparative evenness of the upward mobility profile indicates that good intonation is easily achieved. The tone quality produced by this instrument and mouthpiece was excellent. The longest area of stability found in any of the tests is indicated on Chart 1, and includes the ten tones between $d\#^2$ and c^3. One possibility for this particularly long area of stability might be that the tester was especially familiar with this instrument and mouthpiece combination. It is also possible that this particular combination of instrument and mouthpiece is an especially workable one. It is interesting to note that the ten tone area of stability is well above the zero cent line. There is also an area of stability one octave lower consisting of the six tones from $d\#^1$ through $g\#^1$. Areas of instability are especially noticeable between the b^b and $d\#^1$, as well as between b^1 and $d\#^2$.

In Chart 2, the point of special interest concerns the change made by a different instrument with the same mouthpiece used in Chart 1. The lower register, b^b to d^1, requires more physical exertion on the reed. No great intonation problems occurred between $d\#^1$ and d^2. In the extreme upper register, b^2 to f^3, where the profile fluctuates, intonation is rather trickish. The tone quality was harsh.

In Chart 3 the lowest tones are shown to be well above the zero cent line, and comparatively easy to play in tune. The upward mobility in the high register of the instrument seems extreme, and the tone is

thin. The ten tone area of stability on Chart 1 is reduced to a four tone area on Chart 3.

Although the tone is thin, the instrument and mouthpiece combination used in Chart 4 is quite easy to play in tune. It is interesting to note that the upward mobility profile on the student model alto saxophone seems to be better controlled and stabilized with the stock mouthpiece, while the upward mobility profile of the professional model alto saxophone seems better controlled and stabilized with the professional mouthpiece.

Chart 5 illustrates that the professional model alto saxophone with the Sigurd Rascher mouthpiece can be played in tune, although there is an especially erratic area of instability between b^1 and e^2. Pitch flexibility is greatly reduced with this mouthpiece. This results in a refined tone that is also extremely thin.

Chart 6 shows that not all mouthpiece and instrument combinations are playable in tune. Although the upward mobility profile shows some area of stability between a^2 and d^3, there is also an area of erratic instability between b^1 and e^2. Correct intonation in the lower register is exceedingly difficult.

The instrument and mouthpiece combination used in Chart 7 was found to be especially easy to play in tune with excellent tone quality. Although there are two wide areas of instability it is important to note that the area of stability between e^2 and $g\#^2$ is in exactly the same area of upward mobility as g^1 and c^2, the most common tones used in tuning the tenor saxophone.

Good intonation is not as easily achieved using the student model tenor saxophone and professional mouthpiece in Chart 8, but the tone quality is quite satisfactory. The upward mobility profile shows that

more embouchure adjustment is necessary in order to play in tune with this combination of instrument and mouthpiece.

On Chart 9, with the exception of an area of stability between d^1 and g^1, the upward mobility profile is erratic and indicates some difficulty with intonation. The tone quality is satisfactory with the stock mouthpiece, but it does not compare favorably with the tone produced on either tenor saxophone using the professional mouthpiece.

The tone quality produced with the student model tenor saxophone and stock mouthpiece on Chart 10 is poor, and intonation problems can be extreme. It should be noted that, with this particular combination, moving from $c\#^2$ to d^2 requires greater than usual embouchure adjustment than might be impossible for the less advanced saxophonist to achieve.

Chart 11 shows the lowest seventeen tones in the upward mobility profile of the baritone saxophone to be quite close to the zero cent line with the a and b especially critical, and requiring a very firm embouchure. Upward mobility in the higher register is more limited than might be expected. Intonation in the lower register can be difficult, but the tone quality is excellent.

Conclusions

On all of the charts involving the alto saxophone, the d^1 is shown to be among the most critical tones in regard to intonation. If a saxophonist adjusts the mouthpiece in an effort to compensate for his overly firm embouchure when tuning either to "A concert" or "B^b concert", he is destroying any possibility of playing some of the lower tones on the instrument in tune. One possible approach to correcting this situation might be to have the saxophonist tune to d^1, thereby making embouchure adjustment in the higher registers a necessity.

If a comparison is made of the differences in upward mobility between the professional alto saxophone mouthpiece on either alto saxophone and the professional tenor saxophone mouthpiece on either tenor saxophone, it is found that the professional tenor saxophone mouthpiece has a much greater effect on the upward mobility profile than does the professional alto saxophone mouthpiece. The tone quality using the professional tenor saxophone mouthpiece is superior to the tone quality of the stock mouthpiece with either tenor saxophone, but the tone quality is better on the student model alto saxophone with the stock mouthpiece than it is with the professional mouthpiece. The tone quality of the professional model alto saxophone with the professional mouthpiece is far superior to any of the other combinations. The stock alto saxophone mouthpiece seems to increase upward mobility on the professional model alto saxophone, but the stock tenor saxophone mouthpiece on the professional model tenor saxophone seems to decrease upward mobility.

These comparisons are helpful in showing that it is of utmost importance to select an instrument and mouthpiece combination that work well together and offer the student the best opportunity of playing in

tune with as little difficulty as possible. The tone quality achieved is almost always more satisfactory when using a professional model instrument, regardless of the mouthpiece used. In Chart 6, where the student model alto saxophone was tested with the legitimate mouthpiece, the combination proved to be unworkable. This shows the extreme importance of using a top quality instrument, especially when trying to use a mouthpiece that has been designed for a specific purpose. One suspects this would be equally as true if a "rock" mouthpiece designed to produce a raucous sound were used.

One of the most important points brought out by this study is that long areas of relative stability are both important and desirable, for if the upward mobility profile is stabilized, so is the embouchure adjustment. From the standpoint of the student, if he has a saxophone and mouthpiece combination that has an erratic upward mobility profile, his chances of playing in tune are greatly diminished.

Assuming that the saxophonist is playing with adequate breath support, and listening intently to the pitch and sonority of his instrument, the elastic characteristics of the embouchure are essential for good intonation. In all ranges of the saxophone breath support and embouchure pressure may be great, but it is the difference in the actual amount of physical exertion applied directly to the reed between the lower and higher tones that gives the saxophonist the control he must have in order to achieve correct intonation.

A study of all the charts will reveal that there is an area of stability on the saxophone including f^2, $f\#^2$, and g^2. It is suggested that this is the area of tones in which every aspiring saxophonist should first work to establish both upward and downward mobility on the

instrument. It may be that upward mobility will not be possible without the saxophonist first experiencing the feeling of downward mobility. Once this feeling of mobility is achieved, intonation problems can be reduced.

By studying these charts, producing all tones with adequate breath support, and learning to adjust the embouchure in much the same way as the violinist who makes extremely minute changes in finger placement to improve intonation with a musically "listening ear", it seems certain that better tone, intonation, and over-all control of the saxophone may be achieved.

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