

# EVALUATION OF TONAL QUALITIES

A Honek and J Million seek to compare the Cremonese and modern violins by using a sound level meter and chart recorder.

Most research carried out to objectively evaluate the tonal qualities of string instruments has concentrated on the spectral analysis of tone. It is necessary, however, to realise that the tone quality of a string instrument is not an intrinsic property, but the result of the skill of the player. The same instrument is capable of differing qualities depending on whether it is played by a beginner, a competent artist or whether the tone is artificially excited for experimental purposes.

This fact, together with the complexity of interpreting the results from spectral analysis experiments, explains why the objective evaluation of string instruments remained, up to now, the prerogative of research establishments.

Old Italian instruments are not unique in being capable of producing beautiful tones, although these instruments possess a whole range of definite qualities which enable an artist to produce these beautiful tones.

Most of these qualities are hidden in the body or 'soundbox' of the instrument. Practice violins, without the soundbox, produce a sound which is very quiet and decays rapidly. The soundbox amplifies the sound and lengthens the period of decay. The amplitude and the decay time are concrete properties of the instrument which are easily observed and evaluated using simple experiments.

In an attempt to find a simple and quick method for the objective evaluation of string instruments we have concentrated on the study of just two important tonal qualities. To simplify the analysis of our experiments we have divided the tested instruments into two groups. The first group contained four old Italian instruments and the second group two instruments of contemporary Czech violin makers and two instruments from the middle of last century, one German and one French. The sound of all instruments was well known to us from the concert hall and the selection of these very instruments served to enable a comparison with the objective evaluation.

The instrumentation used for these experiments was a Bruel and Kjaer sound level meter (type KD 91/227) together with a chart recorder. The experiment consisted of obtaining a trace of the sound level versus time for each instrument, after exciting each instrument in an identical manner by suspending and then releasing a 250g weight from the string under test. For this purpose the violins were secured in an upside-down position and the measuring transducer attached to the bottom side of the violin, always in the same position.

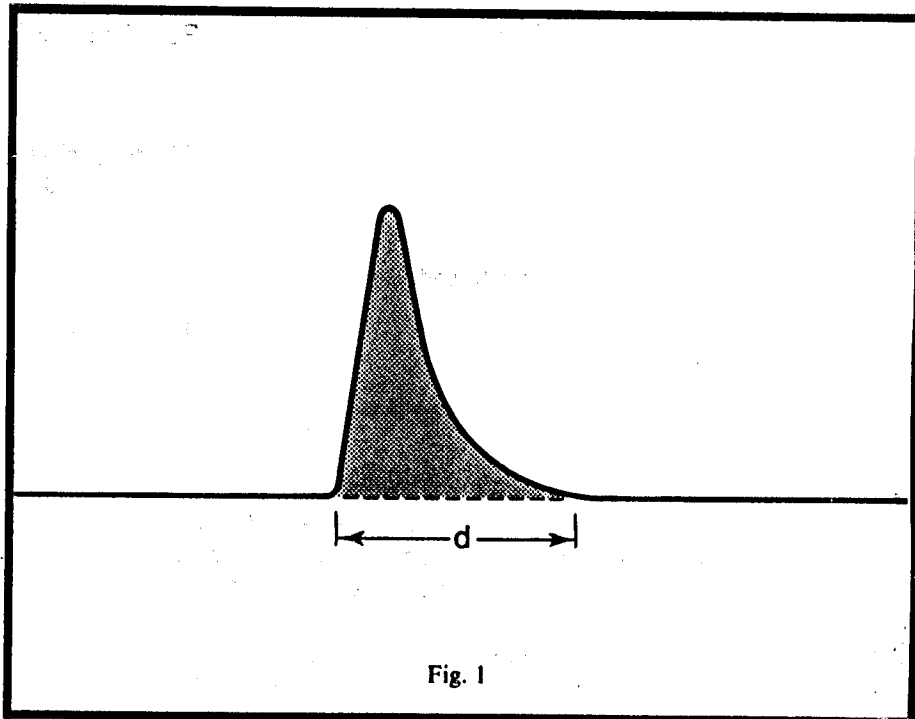


Fig. 1

A typical trace of the amplitude of the sound level versus time is shown in fig. 1. The important parameters for evaluation are the area under the curve (representing the energy of the sound produced) and the time taken for the sound level to decay to zero.

Readings were taken for the E, A and G strings and the results are shown in fig. 2. The

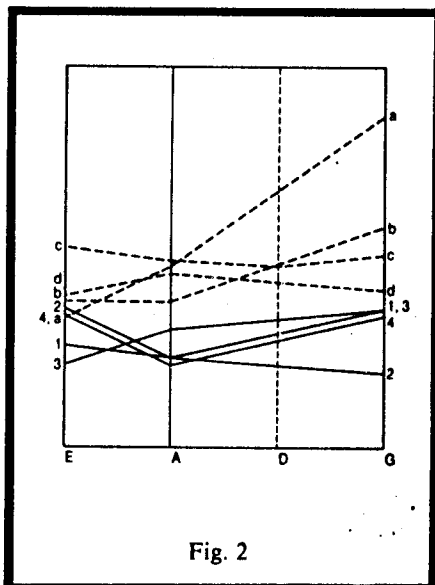


Fig. 2

decay time for each string is plotted on the vertical axis with the old Italian violins designated A to D and the modern violins 1 to 4. For clarity, the readings for the different strings of a particular instrument are shown joined up.

The experiments have clearly divided the instruments into two groups. The Italian instruments (dotted lines) are characterised by longer periods of sound decay.

Fig. 3 has been constructed by adding together the decay times for each instrument and depicts the difference between the two groups more markedly.

Also of interest is the examination of the sound impulses, amplified by the soundbox, as represented by the area under the curve in fig. 1. Fig. 4 shows the energy levels for the three strings that were tested and it can be seen that these are somewhat higher for the group of Italian instruments than for the contemporary group.

This experiment, attempting to evaluate the amplification of the sound using a single 250g weight, has not produced such clear-cut results as was the case with the period of decay, although the result of tests using a range of weights proved most revealing. Starting with a weight of 250g, the mass of the weight was progressively reduced until the sound produced did not register on the sound level meter.

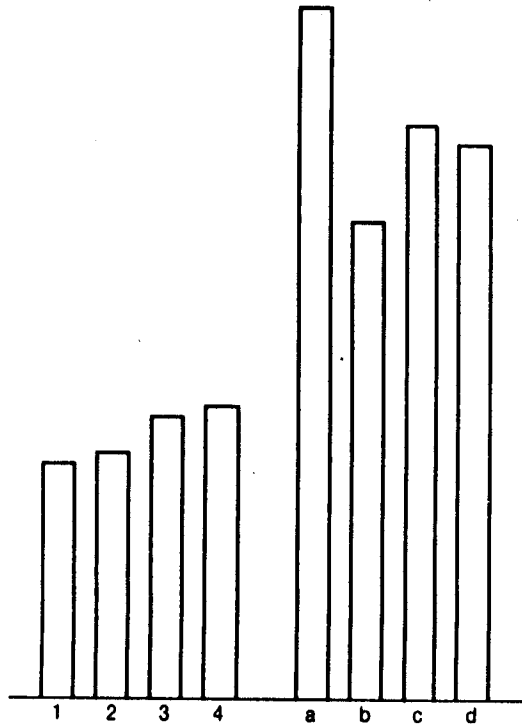


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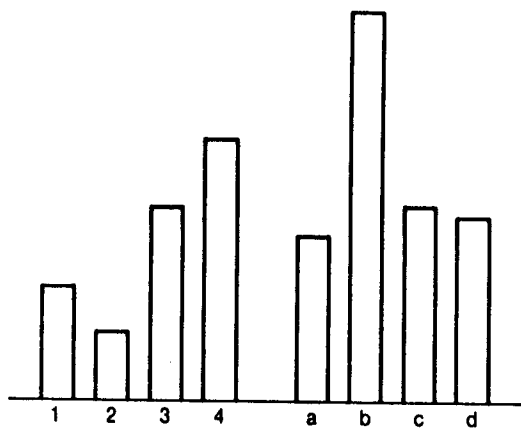


Fig. 4

Fig. 5 shows the results for instrument C from the group of old Italian instruments and for instrument 3 from the contemporary group. For the Italian instruments it is characteristic that the maximum sound level produced by the 250g weight does not diminish immediately the smaller weights are applied, but remains almost constant at the 250g level until the weight is reduced to 150g. In contrast, the sound level produced by the contemporary instrument diminished in an almost proportional manner to the reduced weight applied. Also, the smallest weight of 10g registered a significant sound level on the Italian instrument, whereas the sound level produced by the contemporary instrument was almost negligible. This explains the greater responsiveness and qualities of projection which are characteristic of old Italian instruments.

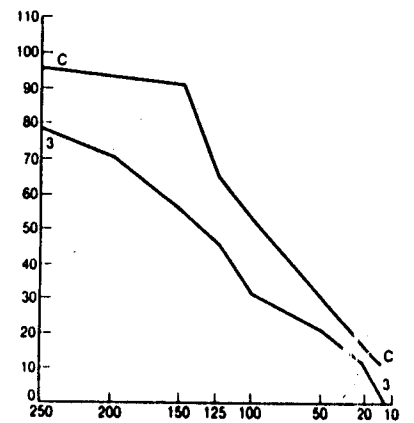


Fig. 5

#### Details of the Old Italian Instruments:

- (1) Gia Bapt. Grancino Contrada Largha di Milano 1694,
- (2) Joannes Baptista Guadagnini cremo-  
nensis fecit Taurini 1761,
- (3) Joseph Guarnerius fecit Cremonae anno  
1742,
- (4) Paolo Antonio Testore 1760.

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#### Acknowledgement

The author is grateful to Ing J Mellion CSc from the Department of Physics at the Agricultural College in Prague for his assistance and the loan of the instruments.