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IMPROVED BRASS INSTRUMENT DESIGN METHODS

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ABSTRACT

A combination of tests by semantic differential scaling and instrument bore analyses have produced a method of instrument design which increases the acceptability of the product by the player and significantly reduces the development time.

INTRODUCTION

The most universally acceptable Bb short model cornets were first introduced some twelve years ago by Boosey & Hawkes. Although no tests were made then, we can assume that during this period players' skills may well have improved and probably the tastes of some musicians, including conductors, have changed.

The semantic differential scaling procedures developed for wind instrument assessment (1) have been used for some time by the author to evaluate the requirements of players. Using three of these tests in conjunction with bore profile analyses a rapid method of design (outlined in Fig 1) has developed.

TEST 1

As a coarse indicator, a few leading cornet players were blindfold tested on four popular makes of cornet. These instruments were readily available and their purchase price was far less than the special manufacture of prototypes. As only a rough idea of the players preferences was required, the effect of physical variations such as valve action, weight and balance were assumed to be small. Therefore if the player uses the same mouthpiece for each instrument, any significant differences detected by the player would be a consequence of the different bore profiles of the instruments. Hence a 'preferred' bore profile may be deduced in a rather coarse fashion.

BORE PROFILES

As part of a larger study concerned with the design and analysis of wind instruments, the profile of the complete instrument bore can be represented by a series of mathematical functions blended appropriately together to form an overall composite function (Fig 2). The small number of parameters defining the functions may be related to the subjective and acoustical measurements.

TEST 2

For the next series of tests, six prototypes were prepared encompassing the preferred region of bore profile. New tooling was required for mouthpipes and bells, but this had the advantage in allowing production to start more

quickly once a suitable model had been chosen. The results of these tests would be more reliable than those of the *coarse selection* since the mechanical action of all the pistons was uniform. A standard *large bore* B&H cornet (921) was included in these tests as a reference.

Nine of the best British cornet players (all classed as soloists) were invited to London on different occasions to undergo the test with seven instruments. None had played any of the prototypes previously nor were they necessarily usually playing on B&H cornets. They wore industrial leather gloves and were blindfolded throughout the tests. Each player was presented with each cornet eight times in a prescribed random order and asked to score on a 0-10 scale for both tone quality and response.

The results for *tone quality* (examples shown in Fig 3) show a definite preference for prototype Q by most of the players and although many of the instrument pairs were statistically indistinguishable all players judged the differences between the 'worst and 'best' instruments to be better than at the 10% level. Two players gave outstanding performances reflected in their score for Q above all other instruments at a level higher than 5%, i.e. the difference between Q and its closest rivals (P and O) would have arisen by chance in less than five out of one hundred cases. For the *response* scores the statistical analysis is very similar and, in fact, one of these two players selected Q again at an even higher significance of 3%.

TEST 3

Having found an instrument judged by the best players to be superior to the cornet production and five other prototypes, a final short test was conducted to assess its relationship with two leading American cornets. Fig 4 shows Q (renamed model 928) compared with the standard B&H 921 cornet and its nearest rivals. In both tone quality and response the new model confirms its outstanding position.

Not only has this sequence of development reduced the normal development time from years to just a few weeks, but it has also encouraged the players to look favourably towards the instrument *they* judge to be the best.

REFERENCE

1. R.L. Pratt and J.M. Bowsher 1978 JSV 57, 425-435
The subjective assessment of trombone quality.

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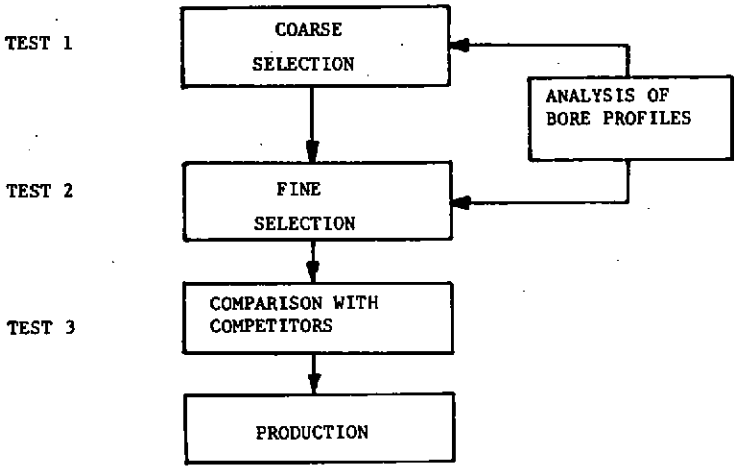

Fig. 1 Outline of instrument development procedure

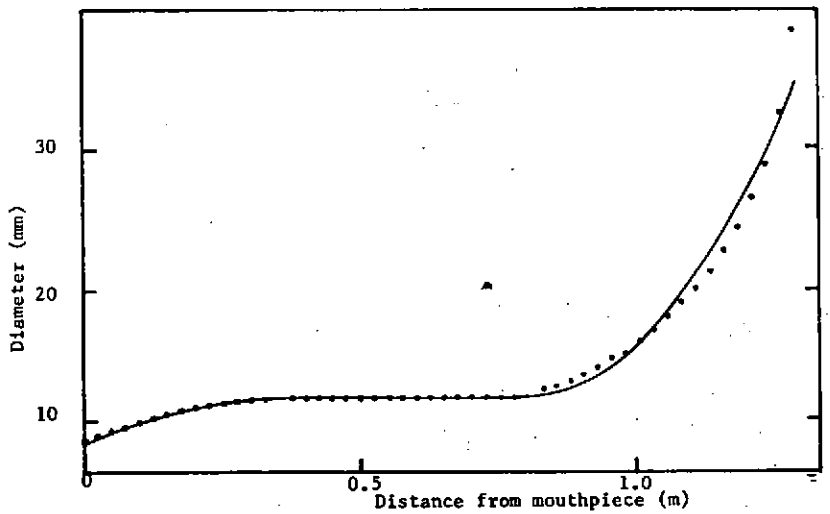

Fig. 2 Mathematical representation of bore profile.

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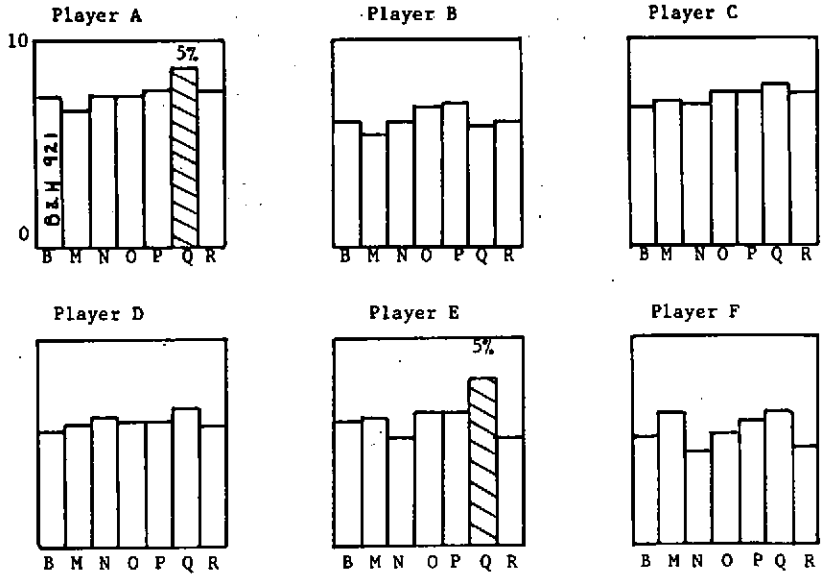

Fig. 3 Sample of results for six cornet soloists (Tone Quality Scale)

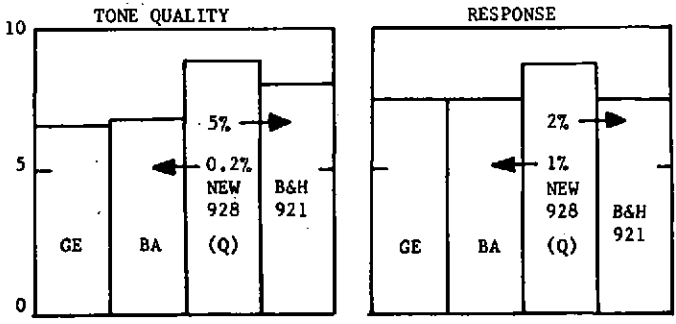

Fig.4 Final comparison of Cornets