

# PERCEPTION OF TIMBRE DIFFERENCES IN TRUMPETS

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## ABSTRACT

Can it be verified that sophisticated listeners can perceive the timbre differences among trumpets, pitch and other variables being constant among the performances? It was the purpose of this experiment to determine if there is justification in the requirement for trumpeters to have more than one trumpet. The stimuli were recorded by a full-time professional trumpeter in the Los Angeles area. The 24 subjects were university students with trumpet as their major instrument. The raw data were processed resulting in a  $\chi^2$  of 8.61. The tabled value of 35.17 > 8.61 ( $P = .05$ ), thus indicated failure to reject  $H_0$ . Each subject expressed confidence in his competency to identify trumpets by sound alone. The results did not confirm this. Results: 23 of the 24 subjects had less than 50% accuracy. Data indicated that there is no logicality in requiring trumpeters to have more than one trumpet, when timbre is to be the sole criterion. The implications for music education could also be that early musical training may be concentrating on pitch and rhythm to the detriment of the development of timbre sensitivity acuities.

## 1. INTRODUCTION

Why have composers designated certain trumpets to the exclusion of others? Are these empirically chosen stipulations rational? In the era before valves were common on trumpets, a composer had to write parts utilizing only the notes of the harmonic series. Thus, most compositions in D had parts for D trumpets, most pieces in C had C trumpet parts and on to the point that we now have trumpets (as a result of that heritage) in Bb, C, D, Eb and the piccolo in fairly common usage. Many composers of orchestral music now write exclusively for the C trumpet. This may be of the tonal requirement they have in mind, or pragmatically to avoid having to transpose the part.

In the latter half of the 20<sup>th</sup> century, trumpeters have musical skills that far surpass the limitations placed on composers in earlier times. However, composers continue to write for the various trumpets because: 1) other composers of their "school" write for a particular trumpet; 2) if the part goes high, they write for D or piccolo trumpet (even though the part could just as easily be played (by a competent trumpeter) on a larger trumpet; or, 3) they believe that the desired tone quality (timbre) can best be produced on a certain trumpet. It is the last reason that this study investigates. Designations for a variety of trumpets by composers in this 20<sup>th</sup> century are elucidated by C. Parker (1976).

The crux of the matter, though, is to answer the question of whether or not the desired timbres are sufficiently changed (by not using the designated trumpet) so as to change any of the tonal qualities and thus affect the expected musical event. How does one become equipped to make timbre judgements? The psychological attribute of musical sound, timbre, and its physical

correlate, waveform, is multi-dimensional in its complexity (Radocy & Boyle (1997). Pratt (1974) suggests that timbre be defined as "that attribute of auditory sensation whereby a listener can judge sounds using any criteria other than pitch, loudness, or duration." Because tone quality may alter dramatically in register changes on a given instrument, it can still be easily identified, thus giving credence to theories that factors other than the harmonic makeup of the tones must be involved. However, this study is based on the assumption that identification relating to representative harmonic spectrums is still viable and appropriate. No attempt was made by the performer to play other than in a characteristic manner on each trumpet.

The perception of timbre, in the dynamic situation, is contingent upon stored memories which can be called forth by the perceiver as an adequate label of identification for musical sound sources (Jameson., 1980). For the purposes of this experiment it was surmised that trumpet players would be equipped, through past conditioned responses with cues previously stored, to successfully identify trumpets by their characteristic tone qualities. Identification of trumpets just by hearing an excerpt of thirty seconds duration does involve timbre judgments. This criterion, centered on a pattern of organized perceptions, goes beyond sensation and judgment, requiring the organization of auditory images in conjunction with a generalization of experiences (O. Parker, 1978). Trumpet players, then, would seem most prepared to make the judgments required to identify what trumpet is playing each of the stimuli.

## 2. PROBLEM

It was the purpose of this experiment to determine if there is validity in requiring trumpeters to perform on the instrument designated by the composer, if transposition poses no problem.

### 2.1. Hypotheses

$H_0$  There are no significant differences to be perceived by trumpet majors (both graduate and undergraduate) in the timbres of the Bb, C, D, Eb, and piccolo trumpets, where tonality (the trumpeter transposes) and other musical elements remain the same.

$H_1$  There will be differences perceived so that the subjects can identify the trumpets on the basis of timbre perceptions.

### 2.2 Method

The 24 subjects were university students, both graduate and undergraduate with trumpet as their major instrument. The taped stimuli were presented to the subjects individually and each subject marked his sheet, indicating his identification of the specific trumpet playing the trumpet solo (bars 133-151 of R.

Strauss's *Don Juan*). Before beginning the actual identification testing, each subject heard recordings of the first 16 measures of the fourth movement ("Tranquillo") of G.P. Telemann's *Heroic Music*, as performed on each of the five trumpets.

## 2.3 Procedure

The subjects were tested singly, i.e., one at a time. Once the test administrator was assured that the subject understood the identification procedures, the test stimuli tape was started.

The excerpt from *Don Juan* was performed two times on each trumpet—Bb, D, Eb and the Bb piccolo—for a total of ten test stimuli. The order of presentation was randomized. Each excerpt was of 30 seconds duration. Each space between the test stimuli was spliced to be 60 inches (4 seconds at the tape speed of 15 i.p.s.

## 2.4 Results

The raw data were processed to both obtain and check the  $\chi^2$  (Chi Square) which was found to be 8.61. The tabled value of 35.17 > 8.61 ( $P > .05$ ) indicated failure to reject  $H_0$ . For the group, correct responses (ten possible) reflected:

Accuracy—23.75; Mean—2.33; Median—2.00; Mode—1.00  
And 3.00; Range—7.00; and, Standard Deviation—5.9.

Trumpet	Correct Identifications	Incorrect Identifications
B-flat	16	32
C	7	41
D	8	40
E-flat	9	39
B-flat piccolo	17	3

## 3. SUMMARY AND CONCLUSIONS

Perhaps the poor identification performances are, in part, in agreement with a theory espoused by Schmid (1977), viz., that invariants (consistent parameters) will change in importance with each identification event because humans continually adapt their feature utilization during processes of recognition. The "importance" of the particular trumpet used by each trumpet player may be based on pragmatic reasons (such as the only one available), yet that governs all future experiences. Reflective of diversity of "choices" among trumpeters is a report by Davidson (1975) where in he profiled 33 professional trumpeters. Sixteen utilized more than three trumpets, ten used either the B-flat or C exclusively, and seven used the B-flat and the B-flat piccolo trumpets, but no other.

Each subject in this experiment, when quizzed by the researcher, expressed confidence in his competency to identify trumpets by sound alone. This did not prove to be the case in that only one subject marked six (out of the ten possible) correct responses

and none marked five correct—thus, 23 of 24 subjects had less than 50% accuracy. This, along with the failure to reject  $H_0$  and the information under "Results" indicated that, under the given parameters' limitations of this experiment, there is no real validity for requiring trumpeters to have more than one trumpet, when timbre is to be the sole criterion.

## 4. RECOMMENDATIONS

### 4.1 Replication

This study should be repeated with professional trumpeters being the subjects and, in general, trumpeters who have had playing experiences on these five trumpets. Another setting should also include the flugelhorn and the cornet to better illustrate the timbre continuum.

### 4.2 Attacks

Are the beginnings of the trumpet tones (attacks) influential in the timbre identifications, i.e., clues? Thayer (1974) reported that the trumpet, in comparison with other wind instruments, is least accurately identifiable without its attack. In future studies of this nature this variant should be investigated.

### 4.3 Curriculum

Decision makers in curriculum making need to ensure that music educators design curricula sequences that provide for timbre sensitivity acuties, just as are the musical elements of pitch and rhythm now so inculcated. Bloom opines, after 40 years of study, that about 95% of the population are relatively close in abilities. The differences among people are more a result of the opportunities and conditions of support which are provided by the teachers and parents. If we even partially agree, then music educators should move decisively, through redistribution of emphases, to rectify the gap in our curricula that permits the disparities in timbre perceptual abilities.

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