

SCHEDIPHONE: CASE STUDY ON A RARE BRASS INSTRUMENT

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ABSTRACT

Josef Šediva (Schediwa), a Czech instrument maker, invented a family of brass instruments with a distinctive construction that allows a player to switch between waveguides to achieve trombone-like (brighter) or euphonium-like (softer) sound. The case study presents the instrument housed in the Czech Museum of Music as a part of unique collection. In order to document this, feature spectra and radiation characteristics are presented, as well as other general characteristics of brass instruments (profiles of the both horns, input impedance, etc.). The acoustic documentation is supplemented by historical background. The case study presents theses of a future wider study.

octave lower. However, this instrument was not very successful due to natural complications of instrument possessing features of two different playing ranges, different required mouthpieces etc. The schediphone (patented in 1901, Czech: šedifon) consists of the combination of two instruments tuned to the same pitch but with varying bores (cylindrical and conical). The waveguides could be switched using so called distribution valve. Šediva built the instruments in four variants (alto, tenor, bariton and bass). Schediphones became a popular part of Russian military bands, as they could replace both euphoniums and trombones in smaller-staffed ensembles. [1, 2]

For this study alto schediphone (alto Eb euphonium combined with alto Eb trombone) was used and original Šediva's mouthpiece was attached. Its parameters correspond more to the fluegelhorn family of mouthpieces causing a bit worse playability of higher notes with the trombone waveguide.

1. INTRODUCTION

1.1 The Maker

Josef Šediva (1853–1915, also Schediwa) was born in Semily (north-east Bohemia) as a son of a brass instrument maker. After his apprenticeship Šediva worked for various master craftsmen, probably including well-known Václav František Červený in Hradec Králové (Königgratz). Following the death of his father Šediva's place of residence became Odessa (Russian Empire, now Ukraine). He started an independent enterprise at the latest by 1882. Šediva's business in Odessa evidently prospered because already in the 1880s he opened a branch of his company in Samarkand (now Uzbekistan). His company mostly supplied its instruments to brass bands from the Russian military. It seems to have been dissolved during the October Revolution of 1917, two years after its founder's death. [1, 2]



Figure 1: Josef Šediva (1853–1915), an undated photograph. (© National Museum – Czech Museum of Music)

1.2 The Instrument

Šediva, the instrument maker, was an inventor of many brass instruments prototypes or their parts and additional devices (quarter-tone cornet, pocket cornet or echo playing device among others). His experimenting with duplex instruments began with creating the duetton, in which he combined a cornet in C or in B-flat with a tenor trombone pitched an



Figure 2 a,b: the alto Eb schediphone used for measurements. The distribution valve is the fourth on the bottom picture and its lever could be seen above the valves on the upper picture.

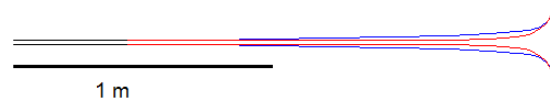


Figure 3: Waveguides proportions (euphonium – blue, trombone – red, conjoint part – black).

Length of the euphonium waveguide cylindrical section is ca. 730 mm (including ca. 450 mm of the conjoint part). Broadening part ends with the bell with diameter of 190 mm. Conversely, length of the trombone waveguide cylindrical section is ca. 1090 mm and the bell have diameter of 200 mm. Total length of the instrument is for the both waveguides ca. 2100 mm (see Fig. 3).



Figure 4: 8th Don Cossack Regiment military band with Šediva's instruments and with Josef Šediva in the middle in 1905. (© National Museum – Czech Museum of Music)



Figure 5: Josef Šediva's Musical Instruments in the Exposition of National Museum – Czech Museum of Music. (© National Museum – Czech Museum of Music)

2. ACOUSTICAL PARAMETERS

2.1 Sound spectra

Overtone of the fundamental (Eb2) were recorded and adjusted to the same psychological loudness before the processing. See the FFT spectra and differences of harmonic spectra in Fig. 13-17.

Main formant of both waveguides at ca. 500 Hz for the euphonium and ca. 800 Hz for the trombone waveguide are apparent. The euphonium waveguide (blue) formant is broader in low frequencies and its maximum is lower than the spectral peak of the trombone waveguide (red). Hence the dominance of fundamental in higher euphonium waveguide registers, which never occurs on the trombone waveguide. On the other hand, the trombone waveguide formant is broader in higher frequencies causing more harmonics to be recognized. The euphonium fundamental is always stronger than the trombone fundamental.

2.2 Efficiency of the distribution valve

Šediva's system allows player to change waveguides immediately, even during the sound production (see

spectrogram on Fig. 6). It shows his mastery in brass instrument making: small mistake in any of waveguides shape is enough to make smooth switch complicated. Good correspondence in input impedance peaks (on playable tones) assures that no major impedance changes occur when the distribution valve is used (see Fig. 7, measured by BIAS system).

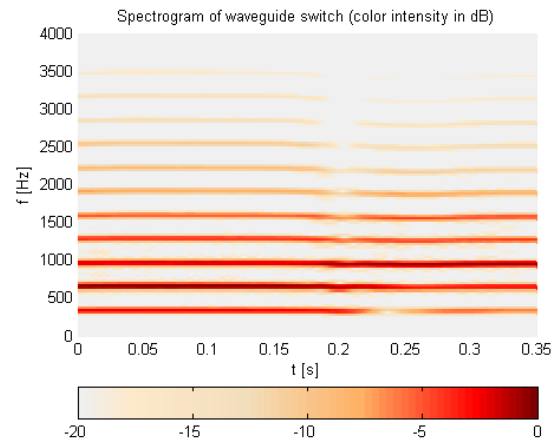


Figure 6: recorded sound spectrogram, waveguide switch at ca. 0.2 s.

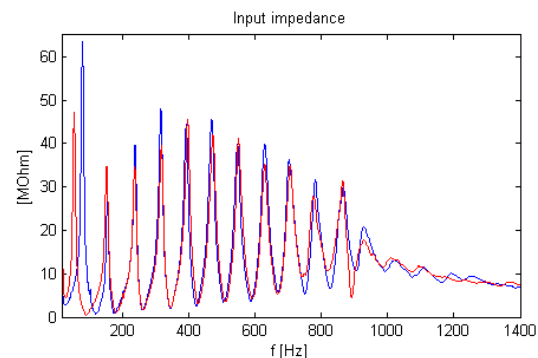


Figure 7: acoustical input impedance of the euphonium (blue) and the trombone (red) waveguides (unweighted, without any valve pressed).

2.3 Directivity

Radiation patterns measurement was conducted in an anechoic room, 12 microphones were used in one plane. The data in figures 8-12 are splined, 0 dB corresponds to the radiation maximum (recomputed for every waveguide and every frequency band), 0° corresponds to the player's line of sight. Since the both bells are placed above player's head there is no expressive radiation shadow caused by his body. Radiation patterns in the horizontal bells including plane are presented (see Fig. 8-12). More pronounced directivity of higher frequencies is observable as well as effect of small diversion between euphonium (blue) and trombone (red) waveguide caused by different bell angle. It is apparent (see e.g. Fig. 12) that the trombone-like bell is better suited for higher frequency radiation.

3. CONCLUSIONS AND FUTURE GOALS

Features and efficiency of alto schediphon were presented and documented. Acoustic spectra show expected behavior: the trombone waveguide formant is placed higher than the euphonium waveguide formant, the euphonium waveguide has generally stronger fundamental frequency. Input impedance

peaks of both waveguides agree well. It can be concluded, that Šediva's mechanism works as planned.

Collection of Šediva's instruments in the Czech Museum of Music provides an opportunity to realize similar measurements with the other members of the schediphone family and related instruments to make this study complete in the future.

4. REFERENCES

- [1] Keller, J.: "Čeští hudební nástrojaři v Rusku" [Czech Instrument Makers in Russia], In: Sborník Národního muzea v Praze XXXIII (1979), pp. 17–29.
- [2] Žůrková, T.: "Josef Šediva (1853–1915) a jeho sbírka hudebních nástrojů v Národním muzeu - Českém muzeu hudby v Praze" [Josef Šediva (1853–1915) and His Collection of Musical Instruments at the National Museum – Czech Museum of Music in Prague], (Forthcoming, 2016).

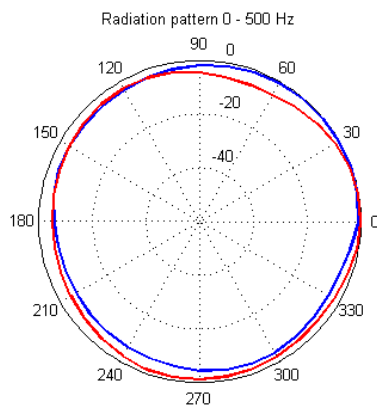


Figure 8: radiation pattern at 0–500 Hz, euphonium (blue), trombone (red), radial axis in dB

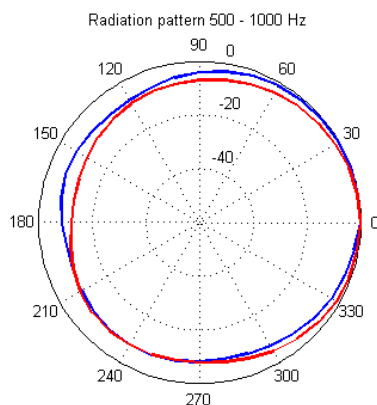


Figure 9: radiation pattern at 500 Hz–1000 Hz, euphonium (blue), trombone (red), radial axis in dB

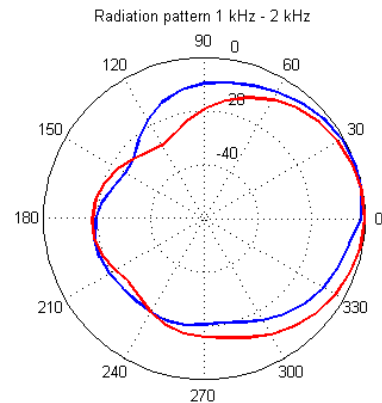


Figure 10: radiation pattern at 1 kHz–2 kHz, euphonium (blue), trombone (red), radial axis in dB

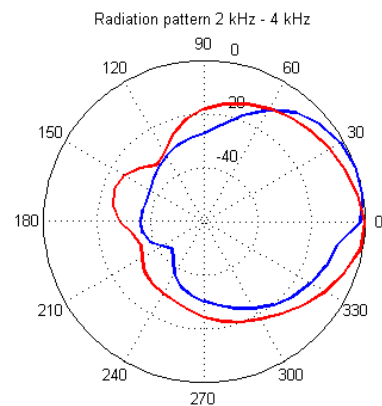


Figure 11: radiation pattern at 2 kHz–4 kHz, euphonium (blue), trombone (red), radial axis in dB

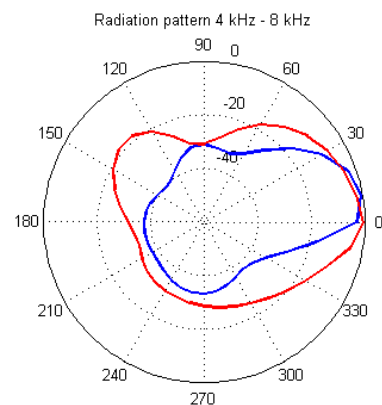


Figure 12: radiation pattern at 4 kHz–8 kHz, euphonium (blue), trombone (red), radial axis in dB

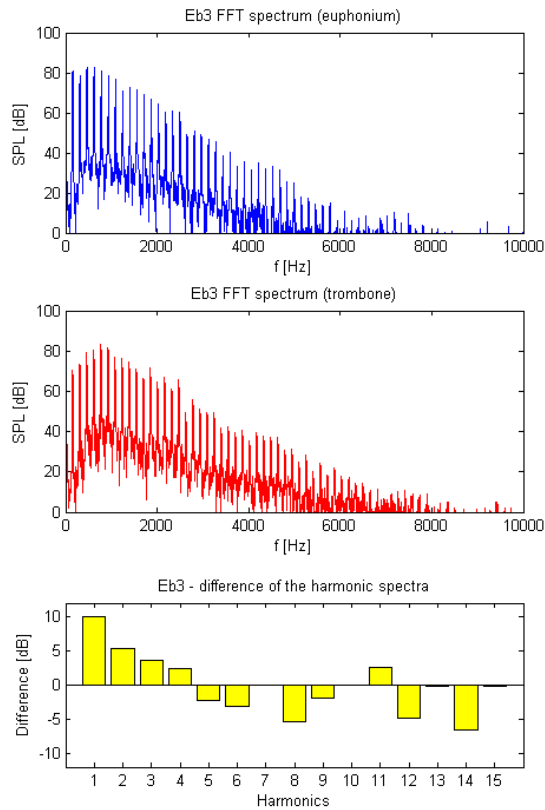


Figure 13: FFT spectra and difference of harmonic spectra on Eb3.

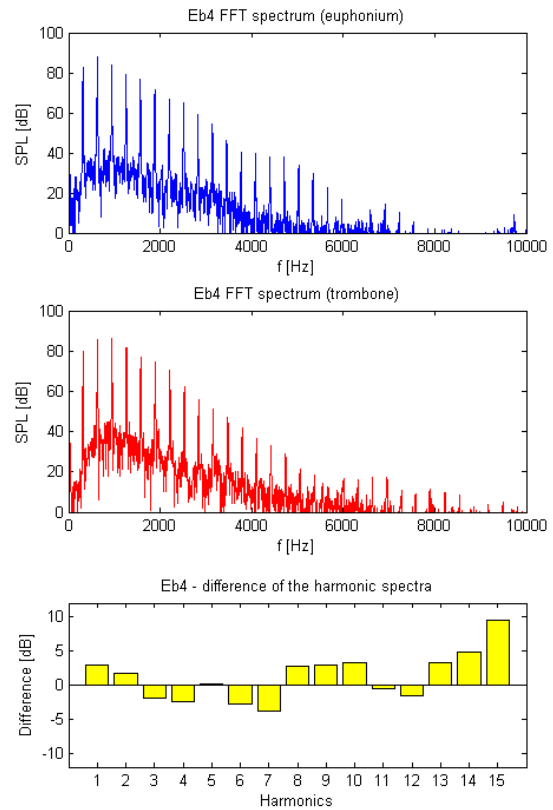


Figure 15: FFT spectra and difference of harmonic spectra on Eb4.

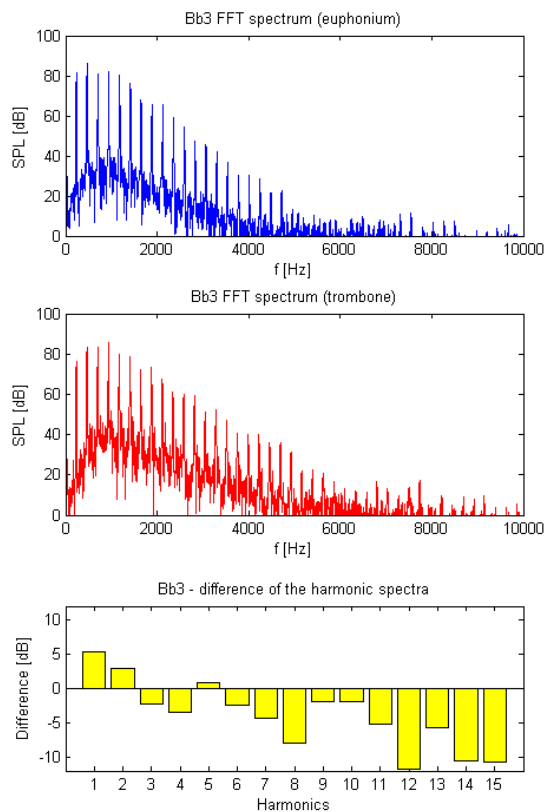


Figure 14: FFT spectra and difference of harmonic spectra on Bb3.

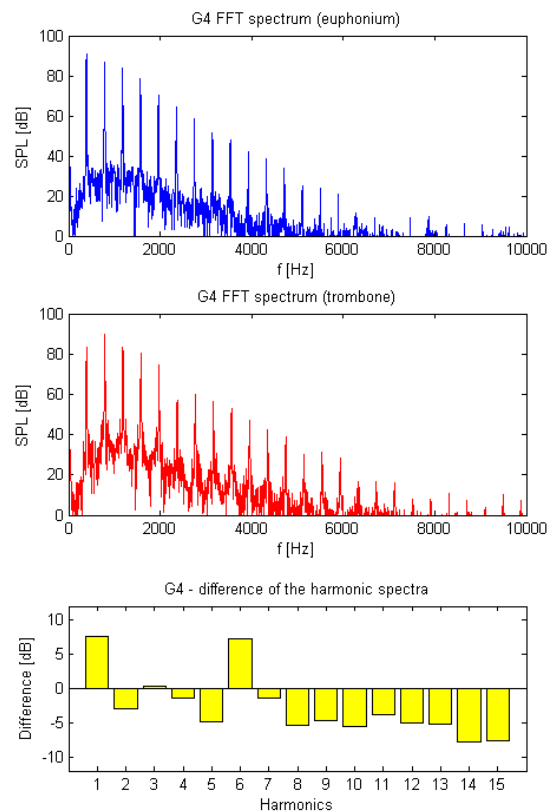


Figure 16: FFT spectra and difference of harmonic spectra on G4.

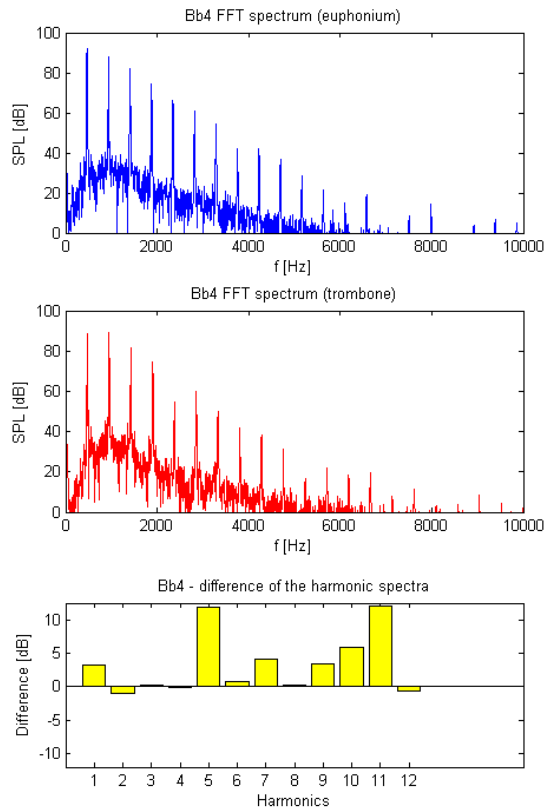


Figure 17: FFT spectra and difference of harmonic spectra on Bb4.