

VICTOR-CHARLES MAHILLON'S THEORIES ON THE CONSTRUCTION OF MOUTHPIECES FOR BRASSWINDS

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Victor-Charles Mahillon (1841–1924) left his mark on the musical instrument field in many ways. As an instrument maker he managed one of the largest manufacturing concerns of its type in Europe. As a museum curator he was instrumental in founding and systematizing one of the most important collections of instruments in the world, now known as the Brussels Musical Instrument Museum. As an organologist he developed a system of classification for musical instruments that, though modified by Sachs and Hornbostel in 1914, remains viable to a large extent even today [1] [2]. He also wrote extensively on musical acoustics. Today, nearly a century and a half after Mahillon published his first essay on this topic, his theories are primarily of historical interest. It is my objective in this paper to show that his writings reflect two distinct approaches—one theoretical, the other practical—and to show in particular how *one* of these streams of thought dominates his ideas on mouthpieces for brasswinds.

Mahillon's *Éléments d'acoustique musicale et instrumentale* (1874, ²1984) is the most comprehensive of his several publications on acoustics. He also published many smaller studies, including a series of articles in *Zeitschrift für Instrumentenbau* and also in *L'écho musicale*, a periodical he founded and edited himself. Throughout his life Mahillon exhibited a keen interest in scientific matters as they relate to musical instruments. Looking first at the practical side, he was the son of an instrument maker, Charles Borromée Mahillon, who, after training in England, established in Brussels in 1836, in partnership with his brother-in-law, G.C. Bachmann, an instrument-making firm that produced brass and woodwind instruments [3]. By the mid-1850s the Mahillon factory was the largest of its kind in Belgium, with a branch in London. Victor-Charles joined the firm in 1865.

The son's interest in acoustics may have been inspired by his father, who certainly had a keen interest in the practical side of the science. Victor-Charles tells of an experiment his father devised, apparently sometime around 1864, in an effort to prove "to some of his leading adversaries" that the material of which a wind instrument is constructed has no effect on its timbre. The elder Mahillon made an exact replica, in wood, of a brass cavalry trumpet. According to Victor-Charles, the experiment proved his father's point, yet it failed to convince his "adversaries," who refused to believe their ears [4]. The wooden instrument still survives in the Musical Instrument Museum in Brussels (inv. no. 572).

In addition to the practical side, there was also a scholarly side to Victor-Charles's interest in acoustics.

We know little about his early education, but his book on acoustics reveals his extensive knowledge of the subject. He often cites earlier sources—writers such as John Tyndall [5], Claude Pouillet [6], Charles Delezenne [7], Theobald Boehm [8], and Hermann von Helmholtz [9]. Mahillon's debt to Helmholtz, whose *Lehre von der Tonempfindung* had appeared just eleven years before the *Éléments d'acoustique*, is obvious—sometimes painfully so, since our author obviously copied a few illustrations directly from Helmholtz, without indication of attribution [10]. The younger Mahillon's scientific bent is further revealed in the many mathematical formulas and tables he included in his book. Here he was more careful in acknowledging his debt to earlier authors—notably Delezenne, twelve pages of whose logarithmic tables he reproduced as an aid to the calculation of intervals [11].

Mouthpieces are a controversial subject. Not a few brass players have searched for years for that "perfect" mouthpiece, the one which is certain to solve all their problems. Very little of a scientific nature has been written on the subject, however. Moreover, any historical study of this topic is hampered by the fact that hardly any mouthpieces bear a date of manufacture, and only rarely can a mouthpiece associated with a historical instrument be firmly identified as original to it. It may therefore be useful to offer a brief overview of mouthpiece construction before Mahillon's time.

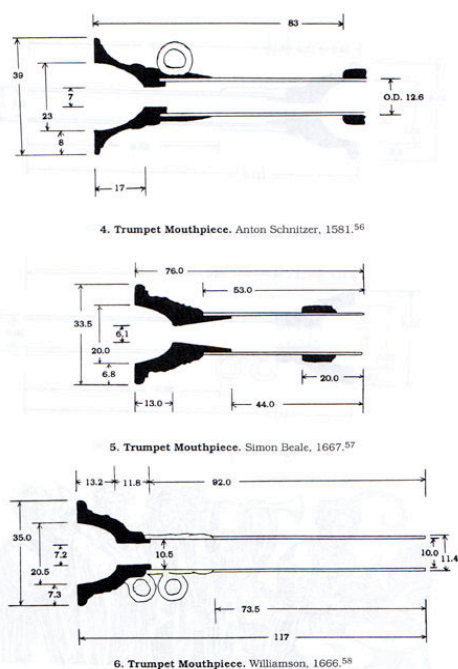


Figure 1: Early mouthpieces for trumpet and trombone, from Smith 1989.

In his 1967 article in the *Galpin Society Journal*, Eric Halfpenny provided cutaway drawings of several trumpet mouthpieces manufactured in Britain in the seventeenth, eighteenth, and nineteenth centuries [12]. In 1989 David Smith fleshed out some of these drawings (providing full cutaway sketches, whereas Halfpenny had provided quarter views only) and added his own drawings of some trombone mouthpieces [13]. Noteworthy in each of the three mouthpieces shown in Figure 1 is a bowl-shaped cup with a relatively sharp-shouldered throat and no backbore. The manufacture of a mouthpiece with a tapered backbore represented a considerable challenge for the technology of the sixteenth and seventeenth centuries.

Moving into the early nineteenth century, there are drawings of mouthpieces in publications by Joseph Fröhlich (1811) and Andreas Nemetz (1827) (Figures 2–5). All the mouthpieces depicted here, except that for the horn, have a backbore—a tapered segment leading from the throat of the mouthpiece to its end. This feature of nineteenth-century mouthpieces provided a smooth transition from the mouthpiece proper to the main bore of the instrument. Additionally, all of the mouthpieces for trumpet and trombone in Figures 2–4 have a relatively sharp shoulder at the throat—a matter to which we shall presently return.

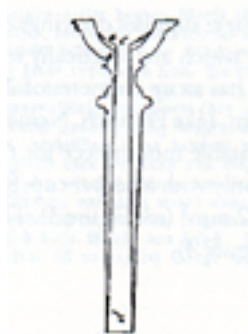


Figure 2: Mouthpiece for trumpet or alto trombone, from Fröhlich 1811 [14]; reproduced in Weiner 1995 [15].

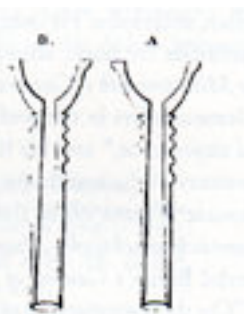


Figure 3: Mouthpieces for trumpet or alto trombone, from Nemetz, *Trompeten-Schule* (1827) [16]; reproduced in Weiner 1995.

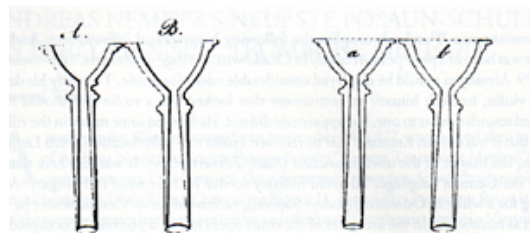


Figure 4: Mouthpieces for tenor and bass trombone, from Nemetz, *Neueste Posaun-Schule* (1827, left) [17], and Fröhlich 1811 (right); reproduced in Weiner 1995.

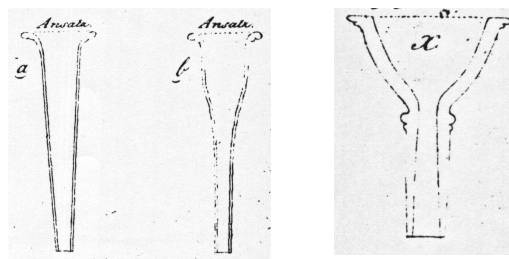


Figure 5: Mouthpieces for horn (left) and serpent (right), from Fröhlich 1811.

In spite of Mahillon's scientific approach to many aspects of musical instruments, his discussion of mouthpieces and their construction is almost exclusively empirical—even anecdotal. Here the practical man—Mahillon the maker of musical instruments—speaks. He says,

- A shallow cup produces a brighter tone.
- A sharp-shouldered throat produces a brighter tone, a smooth-shouldered throat, a sweeter one.
- A player should avoid frequent changes of mouthpiece.
- The higher the pitch, the faster the lips must vibrate, *because the lips vibrate at the same frequency as the air column of the instrument* (italics mine).
- Thin lips are better suited to smaller instruments.
- A large instrument requires a large mouthpiece.
- Pressure with either hand is required to give the mouthpiece sufficient pressure against the lips. This is necessary for surety of attack.
- “The cup in conical form is necessary for instruments with sweet and velvety sounds, among which the horn holds the highest rank. This is the brass instrument whose tone approaches most closely the sweet sonority of the woodwind instruments, with which it combines admirably.... [I]ts mouthpiece is the deepest of all; the throat is so open (*écarté*) that there is little difference between [the throat] and the lower extremity” [18].

In the 1874 edition of *Éléments d'acoustique*, Mahillon provided cutaway drawings of six different mouthpieces (Figure 6). In 1916 he drafted extensive revisions to his treatise, apparently with the objective of publishing a sec-

ond edition that unfortunately did not come to fruition until long after his death. These revisions take the form of handwritten annotations to both text and drawings on pages extracted from the 1874 edition, along with nearly 300 newly typewritten pages. Moreover, he added some fifty new illustrations to his draft. Daniel Bariaux used this compilation to prepare a second edition of *Éléments d'acoustique*, published in 1984 [19].

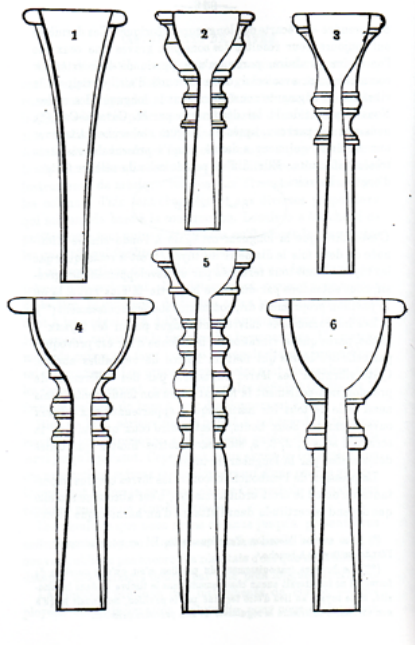


Figure 6: Mouthpieces from Mahillon 1874, 96. No. 1, horn; no. 2, cornet; no. 3, bugle; no. 4, tuba; no. 5 trumpet; no. 6, trombone.

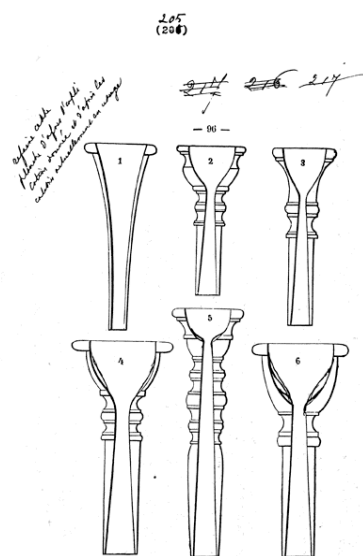


Figure 7: Mahillon's 1916 sketches for revisions to 1874 mouthpiece drawings, from Mahillon 1984, 344.

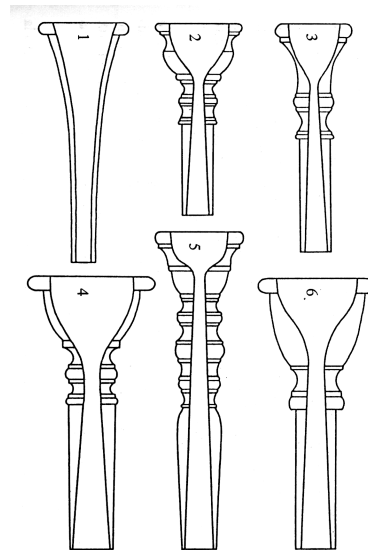


Figure 8: Mahillon's new mouthpiece drawings (compilation of 1916), from Mahillon 1984, 147.

Let us now consider mouthpieces 4, 5, and 6 further. In his 1916 compilation, Mahillon sketched some modest alterations to these three mouthpiece drawings on a page from the 1874 edition (Figure 7). Furthermore, on one of the new pages he added to the 1916 compilation he provided a new set of mouthpiece drawings. He redrew mouthpieces 4, 5, and 6, while leaving 1 through 3 essentially intact (Figure 8). Looking again at Figure 7, we see that Mahillon jotted a note in the upper-left-hand corner. It appears to read “refaire cette planche d’après l’application [sic] données et d’après les [indéchiffrable] actuellement en usage” (“redo this plate according to the application given and according to those ... actually in use”). In light of this remark, it seems that mouthpieces 4, 5 and 6, as redrawn in Figure 8, reflect a change in the design of certain types of mouthpieces between 1874 and 1916. The most significant aspect of this modification is the elimination of the sharp-shouldered throat for the trumpet and trombone mouthpieces in favor of a more curvilinear design.

What is the significance of this modification? I think the key lies in the trumpet mouthpiece, no. 5. In the late nineteenth century the trumpet and cornet became more similar in pitch, shape, bore characteristics, and tone color—particularly as trumpets in B-flat, the most common key for cornets, became more widely used. Mahillon's redesigned 1916 trumpet mouthpiece, with its curvilinear throat, probably was an attempt to endow this instrument with a mellower timbre, nearer that of the cornet. The redesigned trombone mouthpiece then followed the same tonal trend.

Again it must be noted that Mahillon's acoustical theories are today largely of historical interest. We have seen his learned side, reflected in his logarithmic tables, but we have also seen his practical side, reflected particularly in his discussion of mouthpieces. When it came to designing mouthpieces for brasswinds, practical considerations clearly dominated his thinking, but he was widely regarded as an instrument maker with a solid un-

derstanding of the physics of sound. In other words, he had a reputation for “bridging the gaps” between acoustical science and practical instrument-making.

1. REFERENCES

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- [2] For additional information on Mahillon, see De Keyser, Ignace. “De geschiedenis van de Brusselse muziekinstrumentenbouwers Mahillon en de rol van Victor-Charles Mahillon in het ontwikkelen van het historisch en organologisch discours omtrent het muziekinstrument.” Ph.D. diss., University of Ghent, 1996.
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- [10] Compare, for example, Helmholtz’s drawing of a reed pipe of an organ (Helmholtz-Ellis 1885, p. 96) with Mahillon’s (1874, p. 84).
- [11] Mahillon 1874, 252–63.
- [12] Halfpenny, Eric. “Early British Trumpet Mouthpieces.” *Galpin Society Journal* 20 (1967): 76–88.
- [13] Smith, David. *Trombone Technique in the Renaissance*. San Francisco: The King’s Trumpetts and Shalmes, 1989, 32–34.
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- [17] _____. *Allgemeine Posaun-Schule*. Vienna: Diabelli, 1827.
- [18] Mahillon 1847, 95–98.
- [19] Mahillon, Victor-Charles. *Éléments d’acoustique musicale & instrumentale*. 2nd edn. Brussels: Les Amis de la Musique, 1984.