How Different are Cornets and Trumpets?

Arnold Myers

In the late nineteenth century, orchestral trumpet parts were frequently played on cornets. Today, orchestral cornet parts are usually played on trumpets. Does this matter? It is generally accepted that the designs of both instruments have converged since the introduction of the cornet, with the differences between trumpets and cornets becoming less obvious. The degree of this convergence, however, has not been so well understood. This article aims to elucidate the essential characters of the principal instruments that have been designated by these names (and by the word "cornopean"). The phenomena of "conical-bore trumpets" and other hybrid instruments are discussed as well.

Nineteenth-century usage in Britain

Part of the problem is that what has been meant by the terms "cornet" and "trumpet" has differed from decade to decade and from country to country. Even at one time and in one place, the names used by instrument makers, players, composers, and arrangers have not always been the same. An instrument maker in late nineteenth-century Britain might have characterized two distinct instruments thus:

Cornet

- Conical-bore profile between mouthpiece receiver and valves
- Pitched in B♭ or higher, possibly with crooks for lower nominal pitches
- Short, horn-influenced wrap

Valve Trumpet

- Predominantly cylindrical bore profile from mouthpiece receiver for at least half the sounding length
- Pitched in 5-ft G, 6-ft F, or lower (later also with shorter tube lengths)
- Long, natural-trumpet-influenced wrap

Probably the most extensive use of the cornet has been in the British brass band tradition, with tens of thousands of bands using B♭ cornets as the principal melody instrument and with eight or nine cornets being the standard complement of a contesting band since the 1870s.[1] In this tradition and in orchestral use the French model of cornet, made by (or based on the designs of) Besson and Courtois (see Figure 1), has been almost universally used since the 1860s. Earlier "cornopeans" and cornet models, such as many of those offered in Henry Distin's 1857 catalogue,[2] failed in the competition with models supplied by or copied from Besson and Courtois, which were often endorsed by star soloists of the late nineteenth century.

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Figure 1: A classic French model B♭ cornet ("Koenig Model" by Antoine Courtois, Paris, 1856–58: GB.E.u 3475). Photo: Antonia Reeve.

The French model shows the above three characteristics of a "cornet"; until the early twentieth century the high B♭ "soprano trumpet" or "trumpetina" was so little used in Britain[3] that for practical purposes instruments recognized as "valve trumpets" (Figure 2 is a typical example) all showed the respective three characteristics itemized above. The mouthpieces, too, were not interchangeable and mostly differed in cup shape.

Although in the late nineteenth century trumpets and cornets were distinguishable, their repertoires were less so; trumpets were not used to play cornet parts, but cornets were frequently used to play trumpet parts. Prout was typical of late nineteenth-century authors in writing of the cornet:

> It is, however, so much easier to play than the trumpet, that parts written for the latter instrument are very often performed on the cornet. In some cases, especially in provincial orchestras, this may be a necessity, as it is not always possible to find trumpet players; but it is none the less a degradation of the music.[4]

The present-day situation in Britain and internationally is quite different. Trumpets have a constricted mouthpipe and thus an expanding bore profile between mouthpiece receiver and valves, and are pitched in B♭ or higher. Cornets have dispensed with the detachable shanks and crooks (which accommodated much of the bore expansion between mouthpiece

Figure 2: A mid-nineteenth-century trumpet in F with crooks (by Thomas Key, London, ca. 1850: GB.E.u 226). Photo: Dominic Ibbotson.

receiver and valves), but the fixed-mouthpipe models have retained the narrower mouthpiece receiver. Mouthpieces will often be provided by makers with exactly the same cup and rim shape for cornets and trumpets (to ease transition for musicians who play both). It is a matter of common experience that orchestral cornet parts are very often played on trumpets, audiences (and perhaps conductors) rarely sensing anything amiss. Other writers have documented the rise in popularity of the small trumpet.[5]

Usage in France and the United States has been broadly similar, although the dominance of the French-model cornet came rather later in America and was subject to modification by several makers. In German-speaking countries and those more influenced by Germany and Austria the word *Kornett* has not generally denoted a model with a narrow mouthpiece receiver as on the French model, and the distinction was never as clear-cut. Indeed, some models for which the word *Kornett* has been used, such as the Swedish *kornett*[6] are more akin to flugelhorns.

Acoustical characterization

Although it has long been known that differences in bore profile result in differences in timbre, and indeed that bore profile is the most significant characteristic in the taxonomy of brass instruments, it is only in the last six years that an objective measure has been found which can prove effective in characterizing the bore profiles of any brass instrument in a way that corresponds to its acoustical behavior. Attempts to distinguish trumpets and cornets by the proportion of their tube length that is "conical" have failed.[7] This is not surprising, since the degree of conicity can vary from pronounced to almost imperceptible, and tube-length proportions take no account of *how conical* the tubing is. The bell flares of a large number of B♭ trumpets and cornets have been measured and show no consistent difference.[8]

A large part of the perceived brightness of trumpet timbre results from the conversion of sound energy at lower frequencies to sound energy at higher frequencies as sound waves travel over the length of the tube (technically, a result of non-linear propagation). This spectral enrichment is greater when the tube diameter is narrow (relative to the initial diameter) and thus is higher when there is little or no increase in diameter for much of the tube length (as in a natural trumpet) than when there is an early expansion (as in a flugelhorn). At high dynamics the spectral enrichment is experienced as a *cuivré* or brassy sound, but spectral enrichment also occurs to a less obvious degree at moderate dynamics, thereby contributing to the characteristic timbre of an instrument. There is hardly any enrichment in pianissimo playing, making instruments hard to distinguish when played quietly. The spectral enrichment due to non-linear propagation is a phenomenon of the behavior of sound over the whole length of the instrument and is largely independent of the player and of the mouthpiece (which accounts for a tiny proportion of the tube length).

A "brassiness potential" parameter for instruments has been defined theoretically and tested experimentally. This work has been described in the recent literature.[9] The brassiness potential parameter depends entirely on bore geometry, and thus on the design of an instrument adopted by its maker. It can be straightforwardly derived from physical measurements.[10] For a brass instrument whose sounding length is divided into N sections with arbitrary lengths l_n $(1 \leq n \leq N)$, the dimensionless brassiness potential parameter B can be closely approximated by

$$B \approx \sum_1^N \frac{l_n}{L_{ecl}} \left({2D_0} \middle/ {(D_n + D_{n+1})} \right)$$

where D_0 is the initial bore diameter, conveniently taken as the minimum bore in the mouthpipe (generally a couple of centimeters from the mouthpipe end), D_n is the bore diameter at the start of the nth section, and D_{n+1} is the diameter at the exit of the final section (the bell). It is found that physical measurements of the bore at ten or more points along the length of the tubing give sufficient accuracy for the comparison of instruments. The wider tubing of the bell flare makes relatively little contribution to non-linear propagation effects, and precision is less important here than in the proximal (narrower) part of the bore. The final factor in the calculation of B is the equivalent cone length L_{ecl} which is the length of a cone, complete to the vertex, whose lowest resonance frequency matches the nominal fundamental frequency of the instrument. L_{ecl} is the same for all instruments in the same key and at the same pitch standard, whereas the physical length L varies slightly among those instruments, depending on their individual bore contours. L_{ecl} is generally about 10% longer than L, the excess being the "end correction" for that contour plus the effective length of the mouthpiece. The values of B lie between 0 and 1, and are higher when there is little or no increase in diameter for much of the tube length (as in a natural trumpet) than when there is an early expansion (as in a flugelhorn).

The brassiness potential parameter can thus be determined for any brass instrument, using simple measuring tools and simple calculations. It accounts for an important effect of the variations in bore diameter over the whole length of an instrument on timbre, and is thus a very useful parameter for the characterization of instrument models.

Looking at typical "mainstream" instruments in 4-ft C and 4½-ft B♭, some calculated values of B are:

Museum	**Instrument**	**Maker, Place, Date**	**D_0 (mm)**	**B**
	Soprano horn	Paxman, London, 1968	7.5	0.38
GB.E.u 223	Flugelhorn	Hawkes & Son, London, ca. 1925	8.5	0.46
GB.E.u 3483	Flugelhorn	Higham, Manchester, ca. 1893	9.5	0.47
GB.E.u 4523	Flugelhorn	Besson & Co, London, ca. 1912	9.8	0.49
GB.E.u 3857	Flugelhorn	King, Cleveland, late 20th century	8.1	0.51
GB.E.u 4206	Flugelhorn	Boosey & Co, London, 1904	9.9	0.52
F.P.cm E2006	Cornophone	F. Besson, Paris, ca. 1890	7.3	0.55
GB.E.u. 6033	Cornophone	F. Besson, London, ca. 1893	7.7	0.59
GB.E.u 3273	Cornet	Conn, Elkhart, 1924	8.6	0.57
GB.E.u 5735	Cornet	Kohler, London, ca. 1865	8.2	0.57
	Cornet	Besson, London, 1997	8.4	0.58
B.B.mim 1290	Cornet	Charles Sax, Brussels, ca. 1830	8.3	0.61
GB.E.u 3475	Cornet	Antoine Courtois, Paris, 1856–58	8.8	0.61
GB.E.u 3275	Cornet	York, Michigan, ca. 1935	8.8	0.61
	Trumpet	Yamaha, Japan, ca. 2002	8.7	0.58
	Trumpet	Amati, Czech Republic, ca. 1992	10.0	0.66
GB.E.u 1701	Trumpet	Vega, Boston, ca. 1955	10.15	0.66
GB.E.u 3210	Trumpet	Boosey & Hawkes, London, 1933	9.8	0.68
GB.E.u 5772	Trumpet	York, Grand Rapids, 1925–27	9.8	0.70
D.B.im 4905	Valve trumpet	Eschenbach, Berlin, 1886	10.0	0.70
A.W.t 15580	Valve trumpet	Uhlmann, Vienna, late 19th century	10.0	0.72
GB.L.hm 398	Valve trumpet	C. Mahillon, Brussels, ca. 1900	9.4	0.73
D.HA.h 318	Valve trumpet	Schuster, Markneukirchen, ca. 1885–90	11.5	0.73

US.V.n 4822	Valve trumpet	Courtois (Mille), Paris, patented 1889	10.7	0.74
F.P.cm 727	Valve trumpet	A. Sax, Paris, patented 1843	11.0	0.76

Here D_0 is the bore diameter at the narrowest part of the mouthpipe. A group of flugelhorns, a soprano French horn, and two examples of the cornophone cornettito (all in 4½-ft B♭) are included for comparison. The data can be graphically presented as a scatter diagram with *B* plotted against D_0 (see Figure 3).

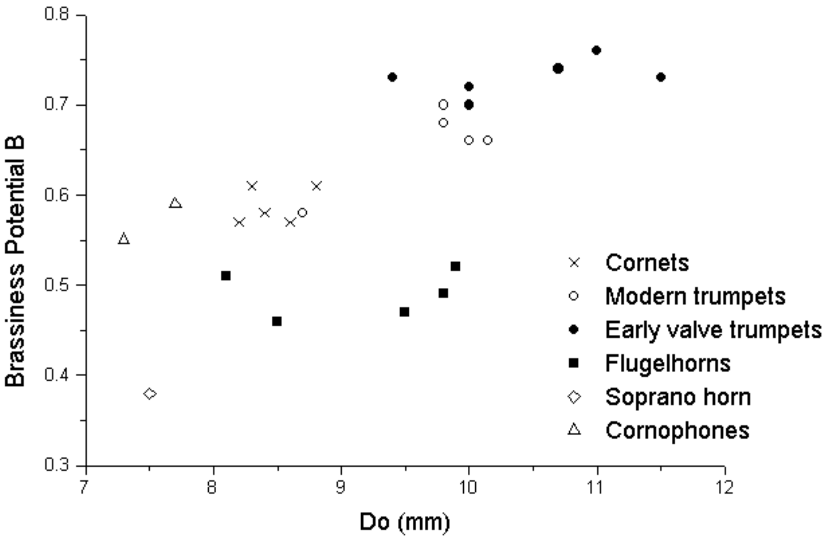

Figure 3: Scatter diagram of *B* plotted against D_o for representative sample of C and B♭ cornets and trumpets.

There is a clear distinction between the group of cornets (*B* in the range 0.57 to 0.61) and the group of early valve trumpets (*B* in the range 0.70 to 0.76). The later valve trumpets show a progression through the twentieth century to more constricted mouthpipes and lower values of *B*, probably to allow playing at higher dynamic levels without excessive *cuivré* effect. The remaining differences between cornets and these later trumpets are limited to wrap (and thus general appearance) and mouthpiece receiver taper. The timbral difference between a cornet and a late valve trumpet with the same D_0 and *B* depends not on properties of the instrument but on the player's mouthpiece choice and technique.

The cornopean

According to the *Oxford English Dictionary*, “cornopean” is “another name for the *cornet à piston*” and the earliest recorded use of the word was in 1837, when it was stated that “The cornopean was first introduced into England ... about four years ago.”[11] The identification of “cornopean” with the early cornet is longstanding (see Figure 4) and widespread, though some present-day writers reserve the term for instruments equipped with a single “clapper” key (operated by the left hand and primarily used to play trills on any note),[12] and others more loosely for any cornet-like instrument with Stölzel valves.

Figure 4: Fingering chart for the cornopean published by Thomas Glen, Edinburgh, mid-nineteenth century.

There is, however, a distinct form of instrument, sharing its sounding length and predominant use in bands with the *cornet à piston,* distinguished by its wide mouthpiece receiver and virtually cylindrical shanks and crooks, for which it would be useful to reserve the term “cornopean.” The wide mouthpiece receiver allows the cornopean to be played with a wide-fitting, deep funnel-shaped mouthpiece indistinguishable from that used for keyed bugles, or alternatively with a trumpet mouthpiece that commonly had the same shank taper.

Cornopeans are almost always pitched in B♭ with a short shank (in some cases the mouthpiece fits directly into the instrument or with a short bit for B♭) and a shank for A,

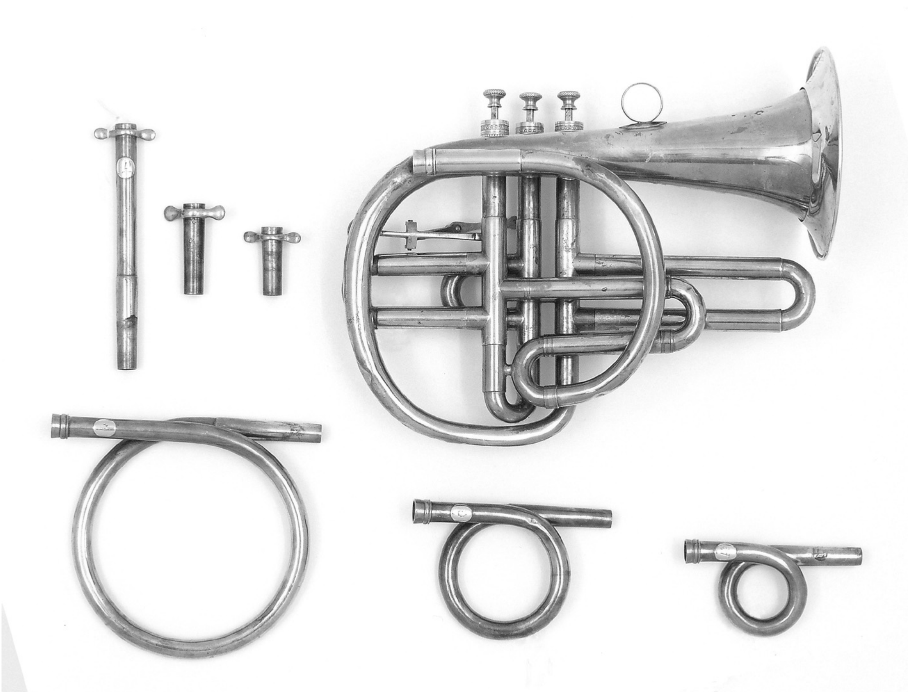

Figure 5: A classic cornopean in B♭ with bits, shank, and crooks (by Charles Pace, London, ca. 1845: GB.E.u 2485). Photo: Raymond Parks.

shank or crook for A♭, and crooks for G and F, sometimes with crooks or couplers to give E and E♭ (see Figure 5).[13] The wide mouthpiece receiver and nearly cylindrical shanks and crooks give the cornopean the acoustical characteristics of the trumpet; present-day revivals of cornopean playing confirm its significantly brighter timbre than that of the cornet with tapering shanks and crooks. Comparable data for typical B♭ cornopeans are:

Museum	Instrument	Maker, Place, Date	D_0 (mm)	B
GB.E.u 1136	Cornopean	Charles Pace, London, ca. 1840	9.70	0.64
GB.E.u 218	Cornopean	probably England, ca. 1845	11.0	0.66
GB.E.u 215	Cornopean	by Glen, Edinburgh, ca. 1840	11.3	0.68
GB.E.u 2485	Cornopean	Charles Pace, London, ca. 1845	10.65	0.69

Figure 6 shows that there is a clear distinction between these typical cornopeans and the French model cornet, with typical D_0 of 8.8mm and B = 0.61.

Many British makers produced cornopeans, most prominently the Pace family.[14] Very few wide-mouthpiece-receiver instruments with short, horn-influenced wrap appear

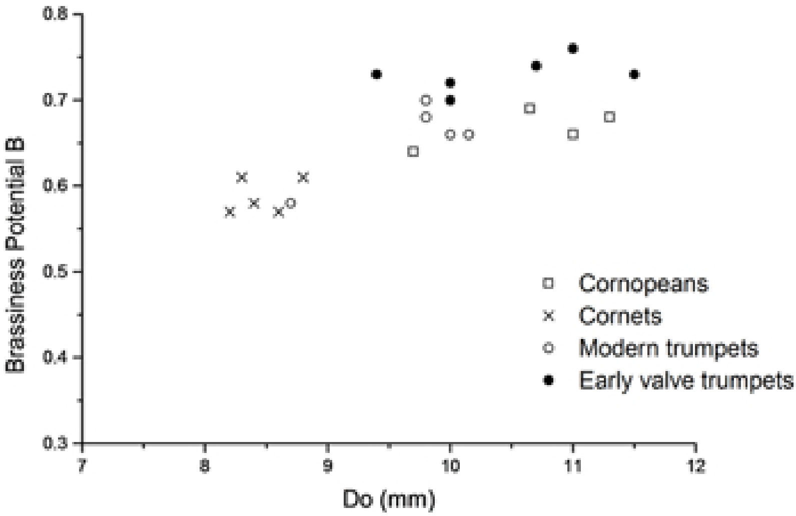

Figure 6: Scatter diagram of *B* plotted against D_o for representative sample of cornopeans, cornets, and trumpets.

to have been made for use in other countries.[15] As suggested by the reference to "French Cornopean Crooks" in Figure 4, cornopeans were also made in France for the British market.[16]

The term "cornopean" was also adopted by some instrument makers for later models of instrument such as the "Cornutum or Drawing Room Cornopean" (Joseph Pimlott Oates in 1845),[17] the "Albion Cornopean" (Frederick Pace, patented 1847), the "Serpentine valved cornopean" (Bradshaw, Registered Design, 1849),[18] and "Macfarlane's Patent Cornopean" (Köhler):[19] these latter models however tend to have the tapering mouthpipe of the French model cornet, which replaced the cornopean in the 1850s.

Conical-bore trumpets

The earliest instrument with a pronounced conical mouthpipe that was specifically intended to do justice to trumpet parts was "Bayley's Improved Acoustic Handelian Trumpet," the subject of Registered Design No. 4464 of 8 April 1862 and manufactured by John Augustus Köhler (later Köhler & Son) over a period of at least twenty years.[20] This was pitched in 6-ft F with tuning-slide crooks for E♭ and possibly D, and received a standard-fitting cornet mouthpiece. The design combined the bore profile of the cornet with the tube length of the trumpet; to remove doubt about identity, the inscription on each instrument included the words "Handelian Trumpet."

An even bolder piece of acoustical engineering was Rudall Carte's Patent Conical Bore (PCB) trumpet, a model made from 1904 to 1939.[21] Some of the earlier instruments were pitched in 6-ft F with slides ("shunts") for E, E♭, and D, and were probably intended for band use rather than oratorio,[22] but most were pitched in B♭ with shunt for A and were probably intended for dance band use (see Figure 7). In Rudall Carte's PCB instruments the bore increases incrementally through the bows of the main and valve tuning-slides and the *coquilles* (valve passages), giving an approximation of a conical bore through the valve cluster whether the valves are operated or not. The mouthpieces supplied with the PCB trumpets have a fairly shallow (trumpet) cup but a narrow (cornet) shank. From 1920, again to remove doubt about identity, the inscription of each instrument included the words "Webster Trumpet." Webster was the craftsman employed by Rudall Carte to make brass instruments.

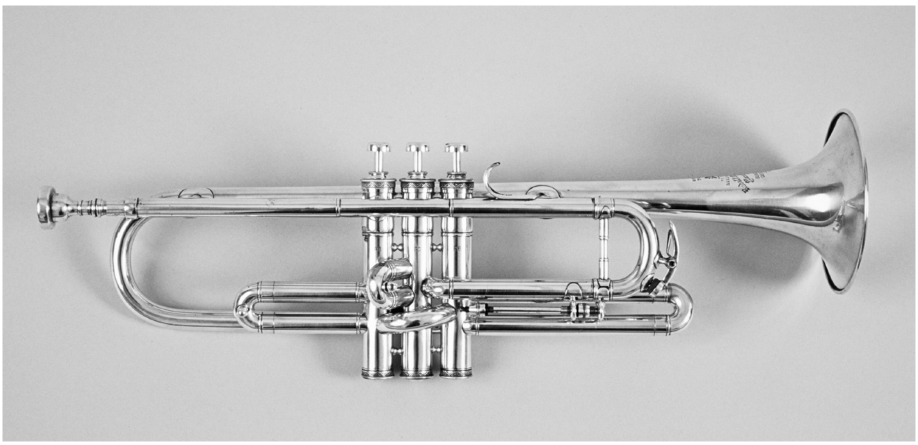

Figure 7: Rudall Carte & Co. Webster Trumpet No. 6995 (1929) (GB.E.u 4210) with probably original mouthpiece (GB.E.u 4211). Photo: Antonia Reeve.

Taxonomic data for some B♭ PCB instruments are:

Museum	Instrument	Maker, Place, Date	D_0 (mm)	B
Private coll.	PCB cornet	Rudall Carte, London, 1904	8.5	0.60
GB.E.u 2988	PCB cornet	Rudall Carte, London, 1907	8.7	0.63
GB.O.ub 711	Webster trumpet	Rudall Carte, London, 1914	8.9	0.58
Private coll.	Webster trumpet	Rudall Carte, London, 1921	8.5	0.65
GB.E.u 3460	Webster trumpet	Rudall Carte, London, 1926	9.0	0.60
Private coll.	Webster trumpet	Rudall Carte, London, 1927	8.8	0.58
GB.E.u 4210	Webster trumpet	Rudall Carte, London, 1929	9.0	0.63

There is apparently no distinction here between cornets and trumpets. However, at least for the post-1920 trumpets, the bell is much narrower and more highly flared than with standard cornets and trumpets. This has the effect of increasing the peak value of the horn function and thus the cut-off frequency of the bell.[23] The cut-off frequencies for the bells of the later four Webster trumpets listed above are in the region of 1700–2000 Hz, whereas cut-off frequencies for the bells of standard cornets and trumpets are in the region of 1200–1400 Hz. The higher cut-off frequencies favor the preferential radiation of the high-frequency components of the sound energy and thus counteract the relatively low (for trumpets) brassiness potential. High cut-off frequencies also increase the support given by the instrument for high note playing.

Ernst A. Couturier in the United States patented a range of conical-bore instruments, including cornets, trumpets, and slide trombones.[24] The bore expansion is even more continuous than in the Rudall Carte PCB instruments, to the extent that in some models the valve tuning-slides (vts) with their usual cylindrical sections are eliminated, and the main tuning-slide is very short (see Figure 8).

Figure 8: Couturier conical-bore trumpet No. 1690 (ca. 1920) (GB.E.u 5771). Photo: Dominic Ibbotson.

Taxonomic data for some Couturier conical-bore instruments are:

Museum	**Instrument**	**Maker, Place, Date**	D_0 **(mm)**	B
GB.E.u 3274	Cornet (with vts)	E.A. Couturier, Elkhart, 1913	8.7	0.62
GB.E.u 3694	Cornet (no vts)	E.A. Couturier, Laporte, ca. 1920	9.0	0.63
GB E.u. 5771	Trumpet (no vts)	E.A. Couturier, Laporte, ca. 1920	9.05	0.63

There is again apparently no distinction between cornets and trumpets. The trumpet has a normal bell flare with a cut-off frequency of 1200 Hz. Any timbral difference between the cornet and the trumpet will depend only on the player's mouthpiece choice and technique.

Trumpet-cornets

Since the necessary and sufficient distinction between a cornet and a trumpet is whether the bore expands through the proximal half of the tube (including the mouthpipe) or not, and in terminally crooked instruments most or all of any expansion can be in the crook, the possibility exists of providing one instrument with alternative shanks and crooks which could be used equally effectively as a trumpet or a cornet. A proper cornet mouthpiece can be used with the cornet shank and a proper trumpet mouthpiece can be used with the trumpet shank. One example of an instrument supplied with alternative shanks for use as a cornet or a trumpet is an instrument by Harry B. Jay in the Utley Collection of the National Music Museum.[25] In this trumpet-cornet the B♭ shanks are secured in the instrument by a ligature screw (as in soprano cornets and flugelhorns); the tenon is quite long, allowing a gentle bore expansion in the case of the cornet shank.

The term "trumpet-cornet" has also been applied to long-model cornets and other cornets that are designed to have the external appearance of a trumpet. These are, taxonomically, simply cornets.

Problems of Identity

The instruments discussed above probably account for the greatest numbers that have been in musical use. Numerous instruments in museum collections, however, do not correspond to the models that can be confidently identified as cornopeans, French-model cornets, or early valve trumpets in 4-ft C or 4½-ft B♭.

Some of these are hybrid or transitional models. One such is an instrument in B♭ by Hall & Quinby, Boston, 1865–76: GB.E.u 2502 (Figure 9). This has D_0 = 10.85mm and B = 0.65: the mouthpiece receiver is too wide for a cornet and the bore profile shows too

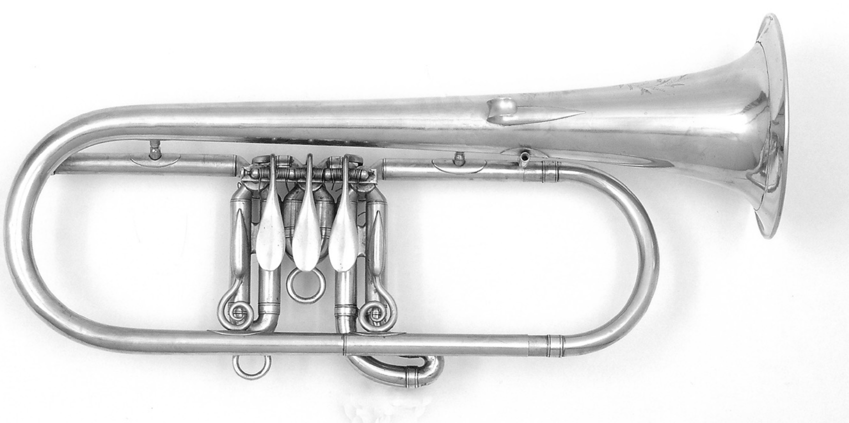

Figure 9: Orchestral cornet in B♭ (by Hall & Quinby, Boston, U.S.A, 1865–76: GB.E.u 2502). Photo: Raymond Parks.

much expansion for a trumpet of the period. This model is sometimes termed "orchestral cornet." Nineteenth-century American instruments tend to be more widely scattered over a plot of *B* against D_0 than French and English instruments.

An example of the many instruments that remain organological puzzles is the instrument by Gautrot, France, probably ca. 1850, GB.E.u 219 (see Figure 10). This has D_0 = 11.25mm and *B* = 0.72. The bore profile is thus that of a trumpet, but the short wrap and lack of any correspondence with trumpets illustrated in Gautrot trade catalogues leaves a question mark over this identification.

Figure 10: Trumpet or cornet in B♭ (by Gautrot, France, after 1845, probably ca. 1850: GB.E.u 219). Photo: Raymond Parks.

Conclusions

Some instruments denoted by the words "cornet" and "trumpet" have been discussed, and accepted terminology has been related to objective acoustical properties. The parameters D_0 (minimum bore of the mouthpipe) and *B* (brassiness potential) have proved effective in categorizing recognized instrument models. No simple combination of two parameters can account for the full variety and acoustical complexity of the realm of brass instruments: in one case the cut-off frequency of the bell flare had to be taken into consideration. When historic instruments cannot be unambiguously identified and named, the brassiness potential parameter can provide an objective measure of timbre. In the late nineteenth century, orchestral trumpet parts were frequently played on cornets; even with careful mouthpiece selection and playing techniques, the timbre will not have matched that of the trumpet of the period. Today, orchestral cornet parts are usually played on trumpets: since the designs of cornets and trumpets have converged, this matters much less.

Arnold Myers completed his doctorate at the University of Edinburgh with research into acoustically based techniques for the taxonomic classification of brass instruments. He contributed the chapter "Instruments and Instrumentation in Brass Bands" to the book The British Brass Band: a Musical and Social History *(Oxford, 2000). He has contributed articles to* The Cambridge Companion to Brass Instruments *(Cambridge, 1997), the* New Grove Dictionary of Music and Musicians, *and the* New Dictionary of National Biography. *He is one of three authors of the book* Musical Instruments: History, Technology and Performance of Instruments of Western Music *(Oxford, 2004). He is the Chairman of the Edinburgh University Collection of Historic Musical Instruments, edits an ongoing Catalogue of the Collection, and teaches as a professor in the University of Edinburgh. He was the recipient of the 2007 Curt Sachs Award of the American Musical Instrument Society.*

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Museums which have allowed study of instruments have included:

B.B.mim	Musée des Instruments de Musique, Brussels
D.B.im	Musikinstrumenten-Museum SIMPK, Berlin
D.HA.h	Händel-Haus, Halle
F.P.cm	Cité de la Musique, Musée de la Musique, Paris
GB.E.u	Edinburgh University Collection of Historic Musical Instruments
GB.L.hm	Horniman Museum, London
GB.O.ub	Bate Collection, University of Oxford
US.V.n	National Music Museum, University of South Dakota, Vermillion
A.W.t	Technisches Museum für Industrie und Gewerbe, Vienna

(The sigla used here are from the Sigla for Musical Instrument Collections being used for the forthcoming *New Grove Dictionary of Musical Instruments*.)

Other instruments studied include:
Cornet (Besson, London, 1997) – lent by Newtongrange Silver Band
Trumpet (Yamaha, Japan, ca. 2002) – property of University of Edinburgh School of Physics
Trumpet (Amati, Czech Republic, ca. 1992) – property of University of Edinburgh School of Physics
Soprano horn (Paxman, London, 1968, serial number 4682) – lent by Paxman Horns
Instruments in the private collections of Frank Tomes (Merton Park) and John Webb (Padbrook)

NOTES

[1] Arnold Myers, "Instruments and Instrumentation of British Brass Bands" in *The British Brass Band: a Musical and Social History,* ed. Trevor Herbert (Oxford: Oxford University Press, 2000), 155–86.
[2] Henry Distin, *Complete Catalogue of Military Musical Instruments* (London, 1857). National Library of Scotland 3/1399.
[3] Arnold Myers, "Brasswind Innovation and Output of Boosey & Co in the Blaikley Era," *Historic Brass Society Journal* 14 (2002): 391–423.
[4] Ebenezer Prout, *The Orchestra* (London: Augener, 1897).
[5] Such as John Wallace, "The Emancipation of the Trumpet: Louis Armstrong, and the Influence of Jazz on 20th Century Trumpet Performance and Composition," *Scottish Music Review* 1 (2007): http://www.scottishmusicreview.org/index.php/SMR/article/view/12
[6] Helen Albertson, *Om den s.k. "svenska" Kornetten* (Institutionen for Musikvetenskap vid Uppsala Universitet, 1984).
[7] Robb Stewart has measured many of the most common cornets and trumpets and demonstrated that there is no significant difference in percentage of conical tubing, see http://www.robbstewart.com/Essays/Schmumpet_abridged.htm (accessed 31 December 2011).
[8] Arnold Myers, "The Horn Function and Brass Instrument Character," in *Perspectives in Brass Scholarship: Proceedings of the International Historic Brass Symposium, Amherst, 1995,* ed. Stewart Carter (New York: Pendragon, 1997): 239–62.
[9] For a non-technical account, see Arnold Myers and D. Murray Campbell, "Brassiness and the characterization of brass musical instrument designs," *Echoes: The Newsletter of The Acoustical Society of America*, 18, issue 3 (Summer 2008), http://scitation.aip.org/journals/doc/ASALIB-home/corp/pdf/echoes/vol18no3.pdf; and for the definitive treatment, see Arnold Myers, Robert W. Pyle, Jr., Joël Gilbert, D. Murray Campbell, Shona Logie, and John P. Chick, "Effects of Nonlinear Sound Propagation on the Characteristic Timbres of Brass Instruments," *Journal of the Acoustical Society of America* 131, issue 1 (2012): 678–88 [DOI: 10.1121/1.3651093].
[10] Measurements with simple bore gauges, a calliper, and a tape measure are entirely adequate. More sophisticated techniques using pulse reflectometry have also been used for bore profile reconstruction; see David B. Sharp, Arnold Myers, Raymond Parks, and D. Murray Campbell, "Bore Reconstruction by Pulse Reflectometry and Its Potential for the Taxonomy of Brass Instruments," in *Proceedings of the 15th International Congress on Acoustics, Trondheim, Norway, 26–30 June 1995,* ed. Mike Newman (Trondheim: ICA '95, 1995): 481–84; and David B. Sharp, Arnold Myers, and D. Murray Campbell, "Using Pulse Reflectometry to Compare the Evolution of the Cornet and the Trumpet in the 19th and 20th Centuries," *Proceedings of the Institute of Acoustics* 19 [5] (1997): 541–48.

[11] *Musical World* 7 (29 December 1837): 254; cited in *Oxford English Dictionary* (1933), s.v. "Cornopean."

[12] The history of the clapper key is documented in Sabine K. Klaus, "Henry Courtenay (1820–1881) of Alton: His Life, his Cornopean, and Further Thoughts on the 'Clapper Shake Key'," *Galpin Society Journal* 59 (2006): 248–51.

[13] An unusual cornopean by Thomas Key of London with a shank for 4-ft C is described by Sabine K. Klaus, "The Utley Collection: New Jewels Include a Rare Keyed Trumpet by E.J. Bauer, Prague," *National Music Museum Newsletter* 31, no. 1 (February 2004): 1–2.

[14] Louise Bacon, "The Pace Family of Musical Instrument Makers, 1788–1901," *Galpin Society Journal* 57 (2004): 117–26.

[15] One anonymous wide-mouthpiece-receiver "cornopean" without clapper key of French provenance and with the full set of shanks and crooks typical of French cornet is GB.E.u 3269.

[16] The *Glen Account Book* mentions French- and German-made cornopeans with three valves and key bought by Thomas Glen from Wood & Ivy in London (transcription of the *Glen Account Book* published by Edinburgh University Collection of Historic Musical Instruments, 1985).

[17] John Webb, "The Cornutum," *Galpin Society Journal* 37 (1984): 112–13.

[18] John Webb, "Bradshaw's Serpentine Valved Cornopean," *Galpin Society Journal* 35 (1982): 154–56.

[19] Lance Whitehead and Arnold Myers, "The Kohler Family of Brasswind Instrument Makers," *Historic Brass Society Journal* 16 (2004): 89–123.

[20] Ibid., 103.

[21] Frank Tomes and Arnold Myers, "Rudall Carte's Patent Conical Bore Brasswind and Webster Trumpets," *Historic Brass Society Journal* 7 (1995): 107–22.

[22] A conical-bore trumpet made in 1920 in the Edinburgh University Collection of Historic Musical Instruments (GB.E.u 4661) was originally sold to the Birmingham Police Band according to the firm's stock books now in the Boosey & Hawkes Archive at the Horniman Museum, London.

[23] Myers, "The Horn Function."

[24] The trumpet without valve tuning-slides is specified and illustrated in U.S. Patent 52,473: *Design for a Trumpet*, patented 24 September 1918.

[25] "Columbia" model (US.V.n 6918).