Extending the Tonal Resources of Wind Instruments: Some Contemporary Techniques

Gardner Read

Many so-called "new" instrumental devices have developed from well-established techniques; they are extensions of, or refinements of, procedures long considered part of a composer's repertorium of expressive devices. The newness, then, is not one of kind but of degree, a further and more extensive development of basic effects found in scores from the late nineteenth century to the present day. More patently new, in conception and in method of individual production, are such other techniques as microtones and multiphonics.

Extended ranges

In the phenomenal development of late twentieth-century instrumental techniques it was inevitable that the total range of many of the orchestral and band instruments would be extended. Although these extensions are certainly not available to all instrumentalists, they form an important segment of modern instrumental potentiality. Range extensions are made possible by several means: First, by mechanical resources—longer tubing and extra keys on wind instruments; second, by the development of individual performer technique.

Among the woodwind instruments whose ranges have now been notably increased, the flute has for many years been enabled to

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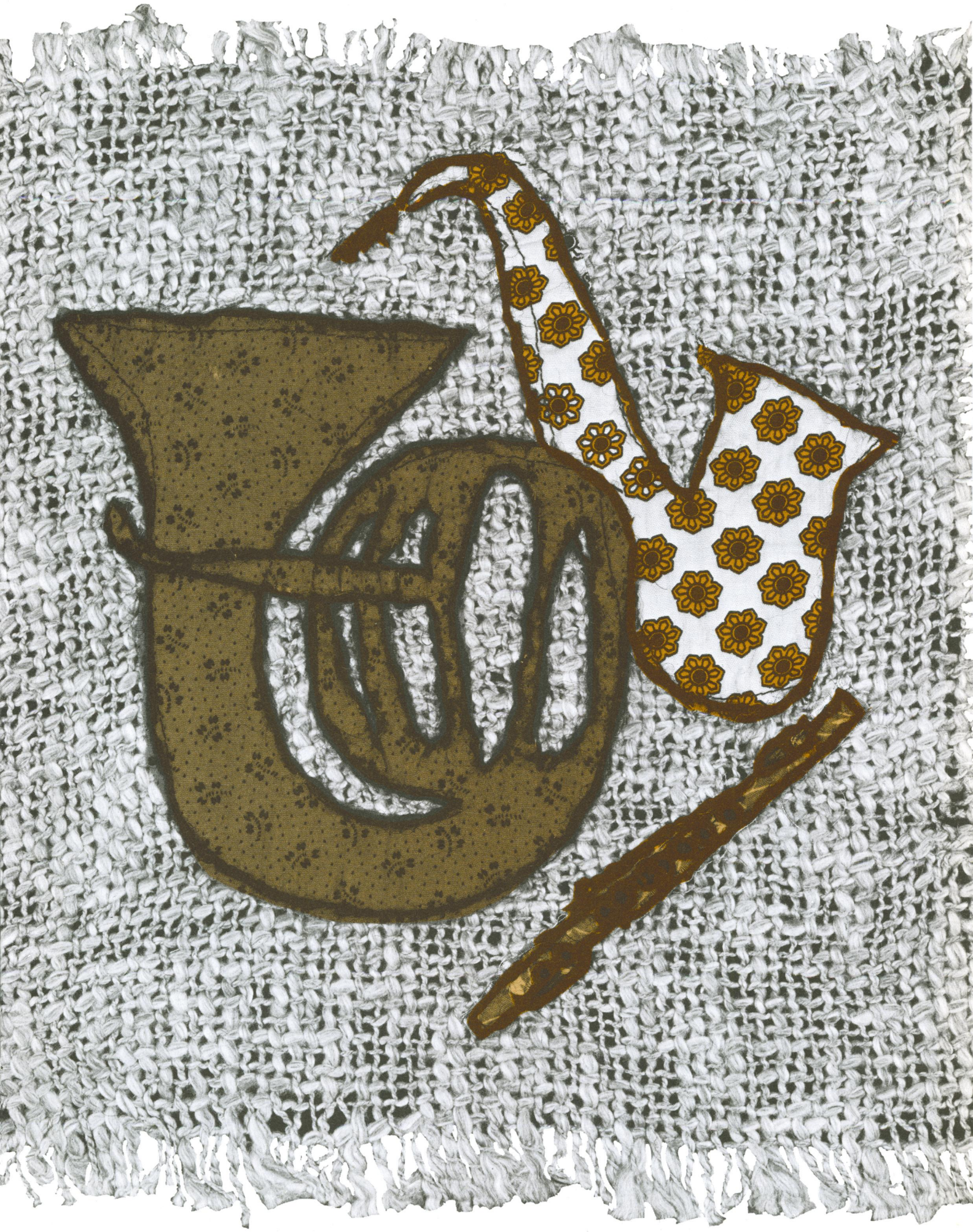
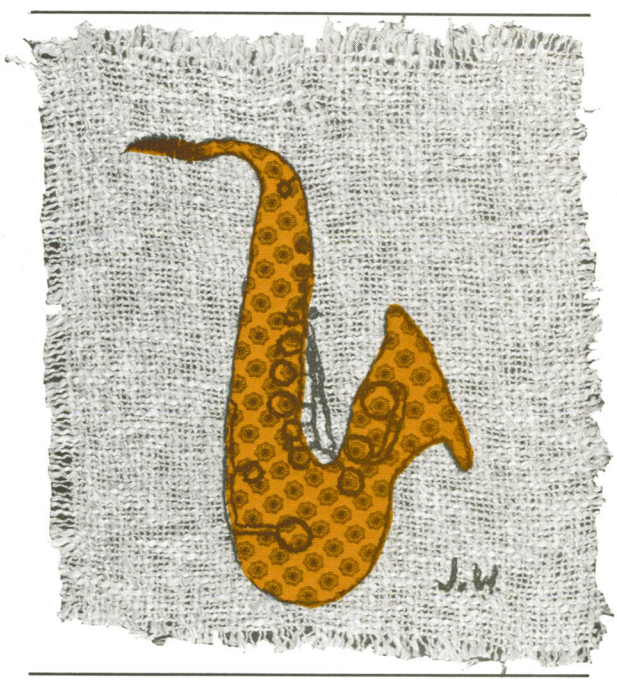


sound a low B by means of an extra key,[1] and to sound pitches higher than d^4, formerly considered the uppermost limit of the instrument. By means of embouchure manipulation and diaphragm control, certain flutists have recently been able to extend this limit to f^4—even on rare occasions to $f\sharp^4$, though the quality of sound is predictably rough and breathy. On the other hand, e^4 is both "safe" and of acceptable quality.

A normally blown low B♭ is now possible by pulling out the head-joint about an inch and fingering low B. Thus the several B♭'s in three of Mahler's symphonies and the one in Ravel's orchestration of the Mussorgsky *Pictures at an Exhibition* can no longer be regarded as notational errors.

Stokes and Condon maintain that the flute range can be extended downward by an octave (from c^1) through the use of so-called subtones;[2] that is, buzzing with the lips into the aperture as though it were a brass mouthpiece. They also suggest stopping the open end of the flute with a cork or pressing it against the player's leg to produce a soft pitch one octave lower than the blown note.



Key slaps, although primarily a percussive device, can also lower the pitches fingered into the octave below the instrument's normal range. Vigorously slapping the G-key with the left-hand fourth finger, while at the same time covering the blowhole with the tongue or the chin and fingering any one of the pitches from b to $a\sharp^1$ with the right hand, results in a percussive tone a major seventh below the fingered note.

George Crumb instructs the alto flute player in *Night of the Four Moons* to cover the air hole with the mouth while clicking the keys of certain specified pitches to produce tones an *octave* lower than notated. Anthony Gilbert includes a parallel directive in his *The Incredible Flute Music:* "Block headjoint hole with tongue and finger energetically an 8va above notated pitch."

Under normal circumstances it is not possible to lower the bottom B♭ of the oboe, but Barney Childs in his *Nonet* tells the player to insert a long cardboard tube in the bell and use the B♭-fingering; the resultant pitch is indeterminately lower than B♭ and is extremely rough and blatant. At the opposite end of the range, high B♭, B, and C are now available to certain oboists, the result of special fingerings and an ultratight embouchure.

Low C on clarinet,[3] A_1 and G_1 on bassoon, and A_2 on contrabassoon are achieved mechanically by means of cardboard tubing or a rolled cylinder of stiff drawing paper, about a foot in length, inserted into the bell of the instrument.

In Donald Martino's solo clarinet work [*B,A,B,B,IT,T*], nine cylinders of different lengths are required at various times to enable the player to lower drastically the normal range of the instrument, the nadir being B♭ be-

Contemporary Instrumental Techniques
These excerpts from Gardner Read's new book represent only a small portion of the topics he deals with in discussing unconventional playing techniques for conventional instruments. In addition, while this article concerns only wind instruments, the book also covers percussion, stringed, keyboard, and harp and other plucked instruments. The first major section of the book, on generalized techniques, discusses extended ranges, muting, glissandi, harmonics, percussive devices, microtones, amplification, and extramusical devices. The second part, on idiomatic techniques, deals with flutter-tonguing variants, vibrato, fingering devices, breath and air sounds, multiphonics, tuning of unpitched instruments, methods of striking, registration devices, bowing devices, pizzicato variants, and many other subjects. Music examples and lists of compositions are included throughout. The 259-page hard cover volume, priced at $17.50, is published by Schirmer Books, 866 Third Avenue, New York City 10022.

[1]Possibly the earliest example of low B occurs in the *Intermezzo* of Mendelssohn's incidental music to *A Midsummer Night's Dream* (1843).

[2]Sheridon Stokes and Richard Condon, *Special Effects for Flute* (Culver City: Trio Associates, 1970).

[3]All note references are at concert pitch.

low the bass staff. According to the composer, the instrument bell is to be removed and the cylinders inserted into the end-joint as needed, held in position with masking tape.

The bass clarinet in William Albright's *Danse Macabre* is given a low C, achieved by pulling out the instrument neck a half-step and fingering D. Even lower pitches, however, have been requisitioned by other composers. Presumably these composers had especially constructed instruments in mind or else the players resorted to mechanical extensions to produce such subterranean pitches.

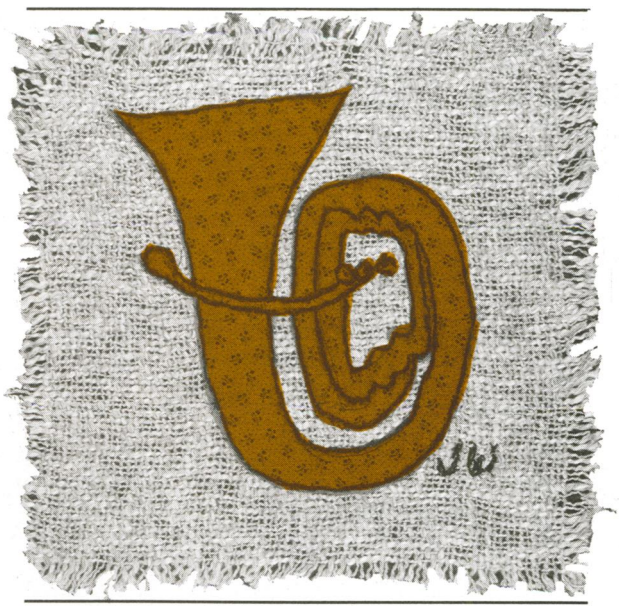
The upper ranges of the several saxophones have now been extended by a full octave and the lower ranges by a minor second.[4] On the baritone saxophone an added whole-step below the normally available low concert D♭ is attainable by placing a specially designed cone in the instrument bell. Though the use of this device slightly dampens the resonance, it does provide a welcome extension to the bottom area of the instrument.

Pitches higher than the conventional limits of English horn, clarinet, and bass clarinet are achieved by ultratight embouchure and/or unusual fingerings worked out by the individual player; hence they vary in quality according to the performer's ability. On bassoon, pitches above e^2 require almost superhuman lip control; predictably, they appear sparingly even in contemporary scores. In all such instances, intonation is shaky, tone quality is strained and rough, and pitch is frequently approximate rather than precise. If these conditions can be regarded as desirable from the vanguardist's point of view, however, there is no reason why they cannot be exploited in his works.

As with woodwinds, extended ranges in the brass instruments are accomplished through combinations of embouchure control and special fingerings. Although f^2 should still be regarded as the highest feasible pitch available to the average hornist, some players can achieve up to a $b\flat^2$, but only at a relatively high dynamic level. In point of fact, none of the brasses can exceed their normal upper limits at a moderate amplitude, nor without a progressive loss of stable intonation.

Both trumpet and trombone are now freqently required to exceed their traditional upper frequency boundaries. One cannot assign a precise and fixed limit for these stratospheric pitches; it depends almost wholly upon the individual player's embouchure and breath control. Certain jazz trumpeters can reach c^4 without undue difficulty, and $b\flat^2$ is available to skilled trombonists. Beyond these demonstrated possibilities, however, lies *terra incognita*.

The lower ranges of all the brass instruments have likewise been extended. The horn can now descend to G_1, as in Ligeti's *Ten Pieces for Wind Quintet*, though the tonal quality is quite rough. To enable his trumpet player to go lower than the conventional f♯ or e, Barney Childs in *Nonet* instructs the player to insert a cardboard tube in the bell. Pedal tones (down to E_1) have been required of trombonists since the early part of the twentieth century, but composers must remember that the sound quality of these notes is far less focused than for those low pitches available by means of the modern F-attachment. As for tuba, although both ends of its total range have been somewhat extended, no specific boundary-notes can be cited; they vary according to individual performer techniques. Whereas $b\flat^1$ is available to most players, even higher pitches can be obtained by certain virtuoso performers on the instrument.



Harmonics

By far the most common use of wind instrument overblowing is to produce harmonics on members of the flute and oboe families. Formerly, harmonics were overblown only at the twelfth from the fingered fundamental (as is required, for instance, in Ravel's *Daphnis et Chloé* and Stravinsky's *Le Sacre du Printemps*. More recently, flute harmonics have been available at the octave (from b^1 up to f^2; those at the twelfth begin with $f\sharp^2$). Even more recently, certain flutists have devised ways of producing "artificial" harmonics, beginning with $d\sharp^1$ and extending to b^1, when overblowing at the octave takes over.[5]

Octave partials on the flute often result in the harmonic sounding with its fundamental

[4]For fingering charts, see Larry Teal, *The Art of Saxophone Playing* (Evanston: Summy-Birchard Company, 1963).

[5]See three articles by John C. Heiss, "For the Flute: A List of Double-Stops, Triple-Stops, Quadruple-Stops and Shakes," *Perspectives of New Music*, Vol. 5, No. 1 (1966); "Some Multiple Sonorities for Flute, Oboe, Clarinet, and Bassoon," *Perspectives of New Music*, Vol. 7, No. 1 (1968); and "The Flute: New Sounds," *Perspectives of New Music*, Vol. 11, No. 1(1972).

(termed a residual tone); they are produced by enclosing the blow-hole tightly with rather loose lips and blowing with strong pressure. The general effect of all harmonics on wind instruments is a weaker tone and a reduced amplitude.

For the closely related technique of "whistle (or whisper) tones" on piccolo, flute, and alto flute—very high and clear, but soft, pitches—the air column is directed over the mouthpiece without lip pressure. Actually, "whistle tones" are part of the harmonic series, being the fifth to tenth partials of the overblown fundamental.

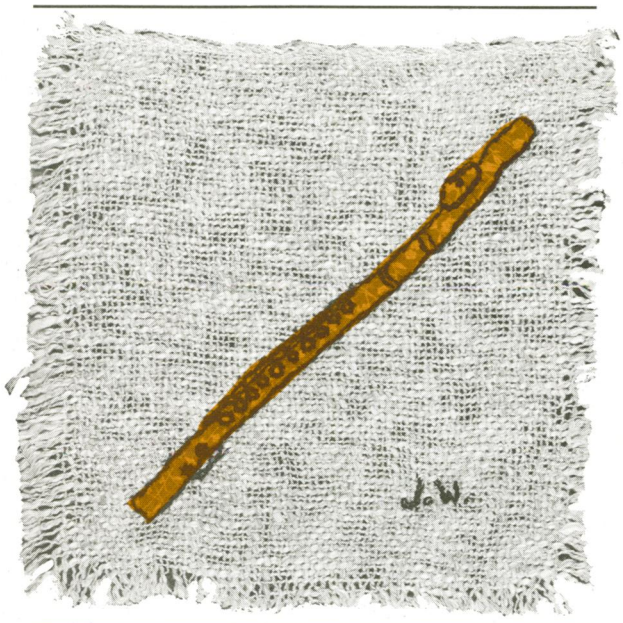
Octave harmonics on oboe are produced by overblowing the fundamental (from b to d≠1) and adding the octave key. Above d≠1 more complicated fingerings and octave key additions are required.[6] Certain double harmonics are possible on the flute and oboe, and several composers have called for trills on these structures.

Normally, harmonics are not available to the clarinet or bassoon, but in his *Concerto for Wind Quintet* Donald Martino asks the clarinetist to produce artificial harmonics by closing all the finger holes and muffling the instrument bell against his calf while overblowing the required fundamental of the harmonic. Hans Werner Henze also calls for clarinet harmonics in his orchestral *Heliogabalus Imperator*, but does not instruct the player as to their technical execution or tonal effect.

Microtones

Microtonal pitch inflection is a staple of the current avant-garde in both instrumental and vocal music. Formerly restricted to the string instruments and sparingly used even in the serious music of the early twentieth century, quarter-tones and even smaller subdivisions of the half-step are now an integral part of wind-instrument techniques. Though few works by our Western composers are restricted solely to microtonal pitch inflection (as, for instance, Julian Carrillo's orchestral *Preludio a Colón* and the *Cuarteto in 1/4 de tono*, and several of the string quartets of Alois Hába), quarter-tone "bends" and glissandi are now fairly common phenomena in recent vanguard scores.[7]

Microtonal bends—the gradual flatting or sharping of a given note—are achieved by the woodwinds through the embouchure, the lip pressure being tightened or relaxed according to the designated direction of the minute pitch inflection. Flute players generally roll the instrument slowly away from the lips, for upward bends, or into the lips, for downward bends, thus minutely altering the degree and angle of the air stream directed into the mouthpiece. This action affects the blown and fingered pitch, causing it to rise or sink by a quarter-tone, a third-tone, or other designated fractional interval, according to the distance the instrument is moved.



A slight change in normal embouchure is usually sufficient to produce microtonal bends on the horn; the effect can also be obtained by partial handstopping. On trumpet, quarter-tone inflections are produced by adjustments of the tuning slides, and on trombone by maneuvering the slide between positions. Embouchure adjustment takes care of microtonal inflections on tuba.

An effect allied to the microtonal bend, available to both woodwind and brass instruments, is the quarter-tone vibrato: the player's normal vibrato is exaggerated to the extent that an actual quarter-tone "beat" is perceived (as in Husa's *Apotheosis of this Earth*). A wide vibrato on the trombone, produced by slide action, can also create a microtonal wavering of pitch (required in the *Eonta* and *Metastasis* of Xenakis, for example).

Furthermore, many composers request passages of unstable pitch, timbre, and/or frequency from their wind players. Unstable pitch would be accomplished by liberal recourse to microtonal bendings, while unstable timbre results from a flexible mixing of tonguing techniques, embouchure control (irregular pressure of lips and varied breath force), fingering variants, and rapid alternations of degrees of vibrato and non-vibrato. These requirements form a conspicuous part of the technical procedures in Earle Brown's *Available Forms 1 and 2*.

To date composers have not notably exploited the possibilities of consistent micro-

[6]For fingering charts, see Bruno Bartolozzi, *New Sounds for Woodwind* (London: Oxford University Press, 1967).

[7]According to Bruno Bartolozzi (in his *New Sounds for Woodwind*), quarter-tones are now possible on the four standard woodwinds as follows: flute—from d1 to g≠3; oboe—c1 to f≠3; clarinet—a≠ to g≠3; and bassoon—E to d2.

tonal tunings of the brass instruments, either individually or sectionally. Only a handful of recent experimental works exhibit this special tonal concept, such as Alcides Lanza's *Eidesis II,* in which the second players of horn and trombone are to tune their instruments a quarter-tone flat in relation to the instruments of the first players.

Multiphonics

Of all the newer techniques applicable to the wind instruments, none figure more prominently in the scores of the avant-garde than multiphonics. The result of certain combinations of embouchure, unusual fingerings, and auxiliary keys or valves, multiphonics create sounds that extend from a simple interval of two pitches to complex chords of four, five, or six notes.[8] Thus, instruments that have long been considered as strictly unisonal have been liberated to the extent that they can now produce harmonic structures, though admittedly the individual tones vary considerably in amplitude and timbre, not to say in certainty of production.

Multiphonic chords are composed, in reality, of a blown fundamental plus certain harmonics of theoretically equal amplitude. Such structures can be completely homogeneous in timbre, but they may be heterogeneous as well, each note in the structure having a subtly different coloring. These chords result from fingering patterns that in principle provide several tube-lengths on which to produce composite tones. Double harmonics, as well as microtonal inflections, can be incorporated into multiphonic chords, and multiple trills can often be created between two such multipitched structures. Parenthetically, it may be noted that all varieties of tonguing, including flutter-tongue, may be applied to most multiphonics, though usually at a low level of intensity. No multiphonic structures, however, can utilize vibrato, as the air flow must be stable to produce such chords.

All of the standard woodwinds can produce multiphonics, though the complexity of the structures, the ease with which they are produced, and the relative quality of sound vary considerably from instrument to instrument. The majority of the examples found in recent scores relate to the four regulars—flute, oboe, clarinet, and bassoon. Fewer instances of multiphonic structures for piccolo, alto flute, English horn, bass clarinet (see Henze's *Heliogabalus Imperator),* saxophone, and contrabassoon are to be located in new compositions; this imbalance may in time change as the technique itself is more thoroughly developed and refined for all the instruments of the section.

The concept of multiphonics also includes sung and hummed pitches superimposed on blown tones. That is, the wind player is asked to sing or hum either the same pitch he is blowing or a different note, thus creating a simple two-voiced polyphony with two distinct timbres. The brass instruments as well as the woodwinds are capable of utilizing this technique; indeed, multiphonics for the brasses are limited to this type of multiple-tone production and thus to two-note structures only. Owing to the basic construction and the sound-producing principle of the instruments, the brasses cannot create the more complex sonorities generally available to the woodwinds. Although a "difference tone" is theoretically present when a blown brass note is coupled with a sung or hummed pitch a tenth higher, it is so faint as to be virtually inaudible.

A composer may direct in his score that either the vocalizations or the blown tones gain the ascendant; that is, the player may gradually stop sounding various pitches and end by only singing or humming, or he may accomplish the direct reverse.

The sung or hummed pitch may also waver above or below a lipped pitch after beginning in unison, or it may contract into a unison after commencing at a certain interval from the blown pitch (as in David Cope's *Indices* and James Heinke's *Music for Trombone and Percussion).*

The problem of accurately notating multiphonics is twofold: first, the composer must know what structures are possible on the various wind instruments and, second, he must know how to indicate clearly the required fingering patterns.

Curiously, multiphonic chords for various of the woodwinds in Harrison Birtwistle's *Verses for Ensemble* are notated on three staves each. The reason—and necessity—for this visual complexity is not clear.[9]

There is one further problem for the notator of multiphonics that include hummed or sung pitches, albeit a minor one: to be realistic, two vocal pitches ought to be indicated, one for a high (or female) voice and another at the lower octave for a low (male) voice. This is not a token gesture to Women's Liberation but is a matter of compositional accuracy; the register relationship of the vocal to the blown tones will naturally vary according to the gender of the performer.

[8]See Robert Dick, *The Other Flute: A Performance Manual of Contemporary Techniques* (London: Oxford University Press, 1974). According to Dick, every known flute fingering can produce at least one multiple sonority, and more commonly from four to six such structures. At least 1,000 flute multiphonics have so far been catalogued.

[9]Additional technical expertise, both as to possible structures and to their notations, is available in the following reference sources: Bartolozzi, *New Sounds for Woodwind;* Dick, *The Other Flute;* Heiss, "Some Multiple Sonorities for Flute, Oboe, Clarinet, and Bassoon"; Thomas Howell, *The Avant-Garde Flute* (Berkeley: University of California Press, 1974); James J. Pellerite, *A Modern Guide to Fingerings for the Flute* (Bloomington: Zalo Publications, 1972).