

# Sound,

Postwar contemporary composers, such as Cardew, Cage and Crumb, have left an exuberant legacy of seductive graphic scores that still puzzle and fascinate the artists and musicians of today. By John L. Walters

# image

1-3. Private languages for public performance. Graphic scores can range from indeterminacy to precision in their instructions.

1. *Castanopeia* by George Cacioppo. Some scores seem closer to a psychologist's Rorschach test or an architect's preliminary sketches than standard music notation. This example, by American composer Cacioppo; and collected in John Cage's compilation *Notations*, 1969, is both detailed and ambiguous. Such works, which appear to dispense altogether with the idea of a horizontal time line, seem to be more in the business of inspiring feeling in the performing musicians.

2. *Per tre sul piano* by Sylvano Bussotti, from *Sette fogli*, 1959. Bussotti, an Italian Modernist, had great graphic flair and had created graphical versions of other composers' music before applying the technique to his own. Works such as this, for three players and one open piano, recall the rapacious bachelors of Marcel Duchamp's *Large Glass*.

3 (opposite). Detail from John Cage's *Concert for piano and orchestra*. (See page 27).

Score-writing is a powerful form of visual communication that reaches across the barriers of language, space and time. The mark-making of western musical notation has an intrinsic aesthetic appeal generated by elements that are simpler – more primeval perhaps – than the Roman alphabet: a rhythmic procession of thick and thin lines, open and closed ellipses, Arabic numerals, commands and ornaments scattered along a rigid grid. A score assumes shared knowledge, a body of skilled expertise – it is a diagram, a recipe, a route-map and an exhortation to perform.

Yet something in the design of a score reaches beyond the private codes of a trained musician. Whether composers write conventionally functional scores, play visual tricks (the staves of a ballad twisted into a heart shape or the face of a loved one traced in black and white piano notation) or scatter circles and wavy lines

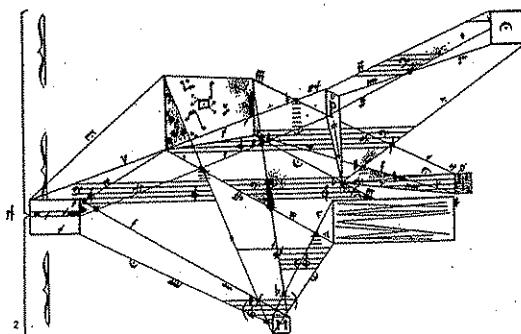
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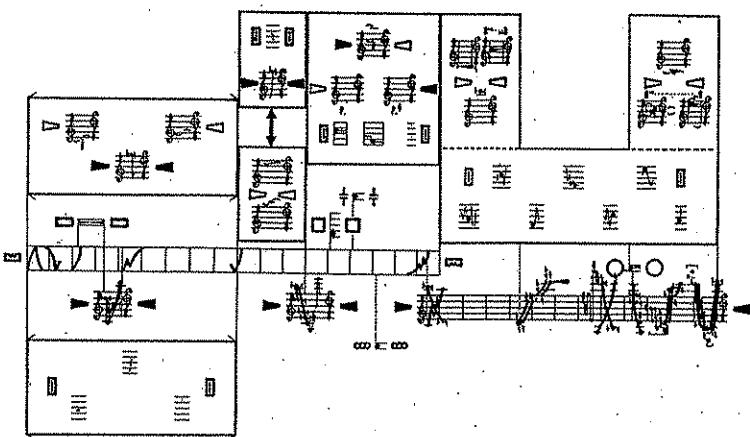
across their score paper, they are translating non-visual ideas into visual codes. The craft involved in preparing scores requires a link between ear, eye and hand.

The stave can be thought of as a two-dimensional graph, the horizontal x-axis for time and the y-axis – the vertical location of the note-head on the horizontal lines that make up the stave – for pitch. The score is an arrangement of several staves in parallel, synchronised in time: each note has a time co-ordinate plus several other parameters, including pitch, duration, timbre and intensity. Since the passage of time can be followed by reading from left to right, so simultaneous musical events are directly above and beneath each other in the score. One of the most important functions of this coded graph is to keep musicians silent at certain times – the musical equivalent of white space.

The graphical organisation of music in this way made it possible for more complex, large-scale music to be made and performed, with the attendant emergence of new roles and hierarchies. The graphic effectiveness of the musical score was central to the development of western Classical music. Playing from individual parts copied down from the score, each musician is part of a vast system whose aural architecture can be appreciated as the music unfolds in time.

Give or take a few written instructions, a Classical score by Mozart or Mahler uses the same language as, say, Stephen Montage's new piano concerto, a film score by Michael Gibbs or Rachel Portman, say, or the string

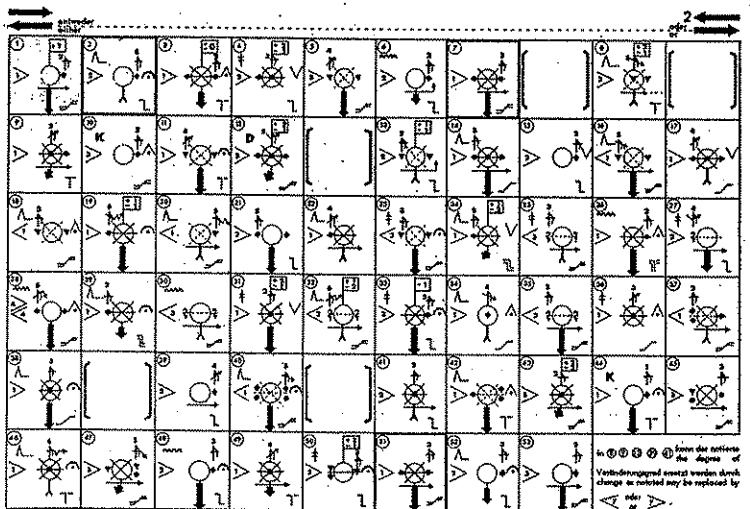




In a combination of several layers, each layer is to be represented by a characteristic sound group in which the Zentrale, Akzidentien and Nebennoten are to be differentiated (in the case of 13, heterogeneous sounds are to be introduced).

○	sounds, hard (timbre)	with precise pitches
○-	sounds, soft	
☒	noises, hard	with distinguishable pitches
☒-	noises, soft	
☒☒	sound-noises, hard	mixture
☒☒-	sound-noises, soft	
5 ○	Indeterminate (In timbre)	

If possible related to all parts of an event



4-6. Scores by the prolific and influential Karlheinz Stockhausen, whose work has embraced many different types of graphic score.  
4. *Zyklus*, 1959, for a percussionist, with symbols and shapes that can be read from either side.  
5 and 6. *Plus-Minus*, 1963. The symbols used here are explained in seven pages of detailed instructions.

Each square signifies a musical event and the central open circle represents a *Zentrale*, corresponding to one of eight chords written on a separate "note-page". The length of the individual sounds is indicated by the smaller solid symbols: triangles (short), diamonds (long), circles (long) and question marks (Indeterminate).

arrangements Jocelyn Pook wrote for The Stranglers' anniversary gig at the Albert Hall. As an international language of signs, conventional notation is hard to beat. Yet for a couple of decades, from the 1950s to the early 1970s, composers questioned every convention to produce an extravagant body of exuberant, ornate and sometimes totally baffling "graphic scores".

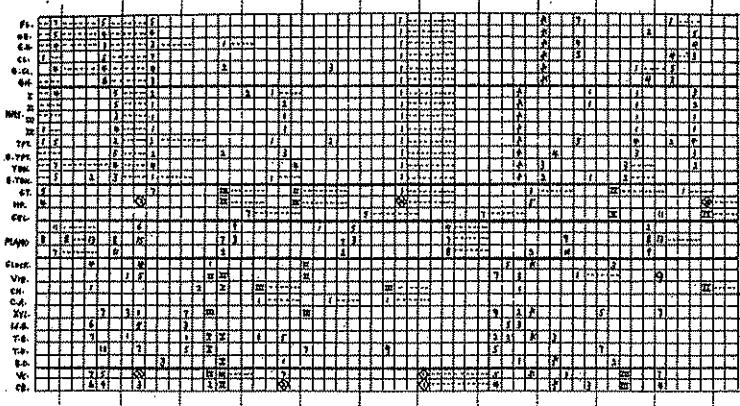
#### CAGE INFECTS THE ART SCHOOLS

The first rumblings of the graphic explosion that was to peak in the 1960s were in early twentieth-century scores that incorporated percussion. Non-pitched instruments require only single-line staves, so Edgard Varèse's *Ionisation* (1931), scored for percussion, looks as graphically stark and brutal as the music sounds. This century's fascination for non-pitched noise – continued in alternative music to the present day – was predicted by the Futurist activist Luigi Russolo, whose written music for his "intonarumori" noise instruments (1916) has similarities with experimental scores of the 1960s.

John Cage was known initially as a "percussion composer", who gained a reputation in the 1930s for his modern dance scores. His simplest pieces combine graphic directness (he had worked for architect Erno Goldfinger) with a decorative charm that may be inspired by Erik Satie, whose hand-written scores contained decorative illustrations and an imaginative, eccentric use of lettering and white space. Cage's need for a low-cost percussion unit that would fit into a small performance space led to his invention of the "prepared piano", where the strings are damped or otherwise modified by the addition of metal screws, erasers and small objects carefully listed on the opening page of the score. With this system, written music takes a leap into the dark. It is impossible to *read* a prepared piano work such as *Sonatas and Interludes* (1946-48) and deduce the sound: when the piece is played on a correctly prepared instrument it produces an extraordinary sequence of percussive sounds, vaguely oriental and quite beautiful.

Here, the written music is a series of instructions for a sequence of events in time. Later scores by Cage, or others spurred on by his example, take this idea to the point where there is little correlation between what one sees and hears. The "score" to Ligeti's *Poème Symphonique* (1962), intended as a Fluxus event, is merely a command to wind up 100 metronomes and set them going.

By the 1950s graphic scores were becoming one of the dominant forces in "serious" music, with radical, visually stunning work by Earle Brown, La Monte Young, Christian Wolff and the energetic British composer Cornelius Cardew, who absorbed much by assisting (at different times) both Cage and Karlheinz Stockhausen. Earle Brown's *December 1952* is one of the more celebrated graphic scores – an ambiguous, Mondrian-like construction that has resulted in quite different performances. Yet the visual aesthetic of this work evokes an imagined music in the observer's mind, an invisible music perhaps more ascetic, beautiful and formally Modern than any earthly



9. Page 3 of .... *Last Pieces* by Morton Feldman, 1961, is a stripped-down graph, with 80 boxes to the minute. The numerals indicate the number of sounds to be played on or within the duration of each box, and broken lines indicate sustained sounds. On the final page the piano part blossoms into conventional chordal notation.

10. An extract from Mauricio Kagel's *Transición*, 1963, for piano, percussion and three tape recorders. The performer is instructed to cut out the shapes and attach them to specific pages of the score with clips or pins; the circular shapes are meant to be rotated during performance.

11. December 1952 by Earle Brown, a member, with Cage, Feldman and Christian Wolff, of the influential, impoverished "New York School" of the early 1950s.

12 and 13 (opposite). Pages 29 and 133 from *Treatise*, 1963-67, by the late British composer Cornelius Cardew. "A composer who hears sounds will try to find a notation for sounds," wrote Cardew in the "Working Notes" published later in his *Treatise Handbook*. "One who has ideas will find one that expresses his ideas, leaving their interpretation free, in confidence that his ideas have been accurately and concisely notated." Cardew thought the score would be best played by musical innocents. "Mathematicians and graphic artists find the score easier to read than musicians; they get more from it."

of the art school experimentalists (whose most famous recruit is Brian Eno) can be heard in installations and CDs by soundsmiths with no traditional musical training – people who can sculpt recorded sound in much the same way that visual artists work with materials.

#### THE BIG IMAGE

Graphic scores raise some thorny issues: does the composer have a duty to specify every note, dynamic, articulation and then demand an equivalent degree of accuracy and fidelity in the resulting performance? Should the composer delegate certain roles to specialists (conductors, drummers, say) who bring new knowledge and traditions to bear upon the work? Should they merely set musical actions in progress and sit back to hear the result? These questions address issues of autocratic power versus democratic organisation and individual creative expression: the political stirrings of the 1960s were not lost on contemporary composers, who wrestled with such implications in the music they made. Cornelius Cardew wrote: "Graphic notation is a perfectly justifiable expansion of normal notation in cases where the composer has an imprecise conception ... his conception maybe quite precise as to its overall characteristics but imprecise as to the minutiae. For example, if a composer wants a string orchestra to sound like a shower of sparks, he can interrupt his five-line staves and scatter a host of dots in the relevant spaces, give a rough estimate of the proportion of plucked notes to harmonics, and let the players get on with it."

The most prolific era for graphic scores was celebrated by the now out-of-print *Notations* (1969) edited by Cage and Alison Knowles, which showed manuscripts by Louis Andriessen, Franco Donatoni, Ton de Leeuw, Dick Higgins, Anestis Logothetis, Frederic Rzewski and James Tenney alongside minimal, text-based scraps by Mauricio Kagel, Allan Kaprow and Yoko Ono, conventional sketch scores by Leonard Bernstein and Gunther Schuller and a decorated lyric sheet for *The Word* by The Beatles. *Notations*, which also contains composers' responses to a questionnaire about the subject matter, is a typographical curiosity: the text

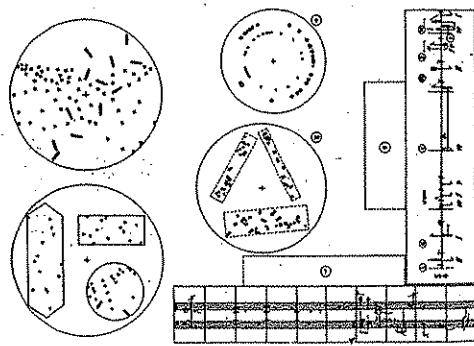
was edited and set using chance operations, so that letter size, weight and font change in mid-word.

Perhaps the greatest graphic score to emerge from this time was Cardew's *Treatise* (1963-67) a monumental work that continues to inspire musicians – improvisers, electronic soundsmiths, even DJs – to turn his inscrutable marks into sound. *Treatise* is beautifully made, baffling and 193 pages long. "The whole piece is a critique of notation," says John Tilbury, a colleague of Cardew's in the legendary group AMM. "The most profound aspect of the piece ... is the way it makes people think. It's a very precise score, but sometimes precision in notation results in an imprecise sound."

Roberto Gerhard wrote: "Notation's ambiguities are its saving grace. Fundamentally, notation is a serviceable device for coping with imponderables. Precision is never of the essence in creative work. Subliminal man (the real creative boss) gets along famously with material of such low definition that any self-respecting computer would have to reject it as unprogrammable."

Composer John Woolrich comments: "There is no clear dividing line between standard notation and graphic scores – there are always things in notation that are indeterminate – you might specify the notes, but not the instrument or the acoustic, for example.

"Unless you're Brian Ferneyhough (and you think you can notate everything), notation is to do with hints rather than absolute instruction. You are trying to convey the big image."

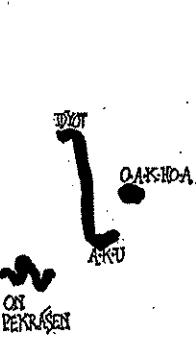


NOTES THE TITLE OF THIS WORK IS THE TOTAL LENGTH IN MINUTES AND  
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THE TITLE WAS 4'33" AND THE THREE PARTS WERE 36', 240', AND  
1'20". IT WAS PERFORMED BY DAVID TUDOR, PIANIST, WHO INDI-  
CATED THE REGISTRATION OF PARTS BY CLOSING, THE REVERSE BY OPEN-  
ING, THE KEYBOARD LID. AFTER THE WOODSTOCK PERFORMANCE, A  
COPY IN PROVISIONAL NOTATION WAS MADE FOR EDWARD FRENCH,  
IN IT THE TIMELENGTHS OF THE MOVEMENTS WERE 30', 1'25", AND 1'  
40". HOWEVER, THE WORK MAY BE PERFORMED BY ANY INSTRUMENT  
14 TALISSES) AND THE MOVEMENTS MAY LAST ANY LENGTHS OF TIME.

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10. The following table shows the number of hours worked by each employee in a company.

5

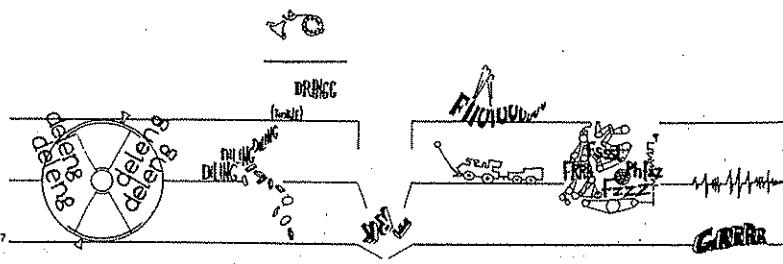


17. *Stripdyo*, 1966, by singer Cathy Berberian, the dedicatee of Cage's *Aria*. The comic-book images were the work of illustrator Roberto Zamarkin. This score provides a postmodernist contrast to the work of Berberian's husband Luciano Berio, a more ferociously Modernist composer. The piece has been championed by several other contemporary singers since Berberian's death in 1983.

*Treatise*, which is purely graphic, containing no clues or explanations for the performer(s), may have marked the end of an era. In the 1970s the graphic score activity subsided and Cardew made several dramatic, politically inspired repudiations of the notion, and began writing simple, Maoist songs "for the workers". Cage moved further into the visual realm, discovering a new vocation in fine art print-making, while his scores became more graphically simple. And many composers rejected graphic scores along with other youthful excesses such as taking drugs or wearing flowered shirts.

## PHONOGRAPHIC DESIGN

Yet the visual excitement remains seductive for later generations of composers and performers, some of whom are prepared to interpret the work with far more enthusiasm and creativity than their counterparts of the previous generation. The Brood, a loose ensemble based around Susan Stenger's Band of Susans, Scanner and Sonic Boom, with members of Wire, Elastica and the



30 EYE 26/97

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'Scapegoats, recently performed scores by Cage, Wolff and Phil Niblock at London's South Bank. "We rehearsed quite a lot to sort out the language," said the Scapegoats' Terry Edwards. "It helped a lot that Susan had worked with the composers in the past."

Neil Ardley's *Charade for the Bard* (1974) used a simple graphic language for a practical purpose – to organise a piece for jazz improvisers at very short notice. John White's machine pieces (including the notorious *Drinking and Hooting Machine* (1969), which requires the musicians to drink each other under the table) are still published and performed while George Crumb's graphic, spacious *Ancient Voices of Children* (1970) has acquired the status of a contemporary classic. The work's large-format score looks and sounds equally rich, strange and beautiful.

"The look of the score is not irrelevant," says Howard Skempton, whose hand-drawn scores are famous for their stripped-down elegance. "A score has a life of its own: its look has a lot to do with the power of the piece. When I look at a Classical score (Mozart, Beethoven and so on) you can't actually see at a glance why it works. If you look at a Modernist postwar score by Boulez or Ligeti, say, you get a much clearer idea of what it sounds like. Graphic scores turn this around.

"It might have something to do with the Constructivist aesthetic of the 1950s— the scores by Bussotti and Stockhausen look stunning in their own right. And when I look at Morton Feldman pieces from

**14-16. Scores bearing the immediately recognisable calligraphy of John Cage.**

14. The opening notes from the score to *4'33"*, the "silent piece", Cage's most notorious (and possibly the most widely performed and recorded) composition.

**15.** One of the ten sheets that make the poster score of *Water Music*, 1960, for a pianist, "using also a radio, whistles, water containers, a deck of cards, a wooden stick and objects for preparing a piano".  
*Incredibly accurate time markings*

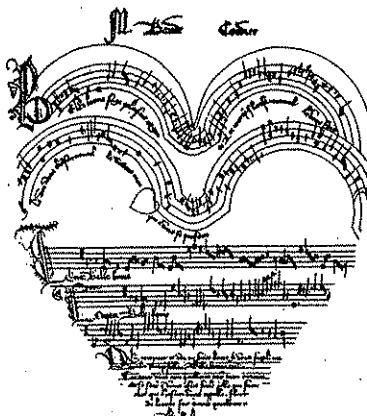
impossibly accurate time markings – 4.5825 minutes, for example – are frequent features of Cage's scores. 16. *Aria*, 1960, for solo voice (any range) can be performed alone or with *Fontana Mix* or parts of the *Concert for piano and orchestra*.

The text uses Armenian, Russian, Italian, French and English words. The thick brushstrokes that indicate the pitch and duration of the written phrases are in colour: Cage invites the performer to equate each colour with a different style of singing. In Cathy Berberian's version for the first performance, dark blue = jazz, green = folk and purple = Marlene Dietrich.

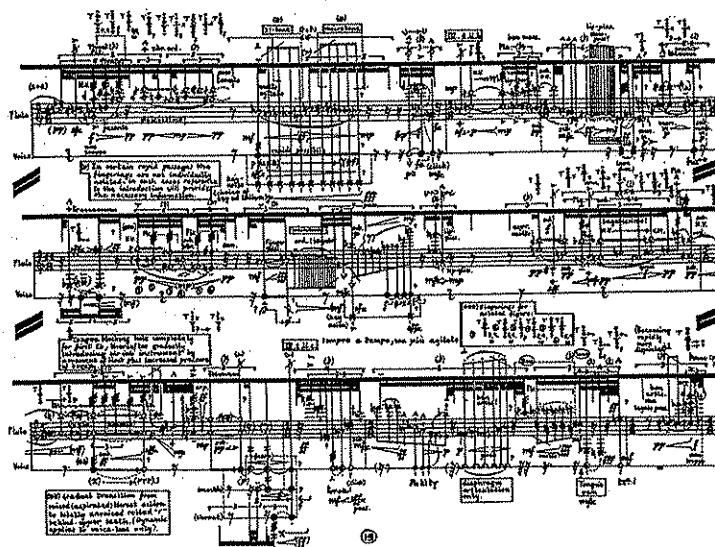
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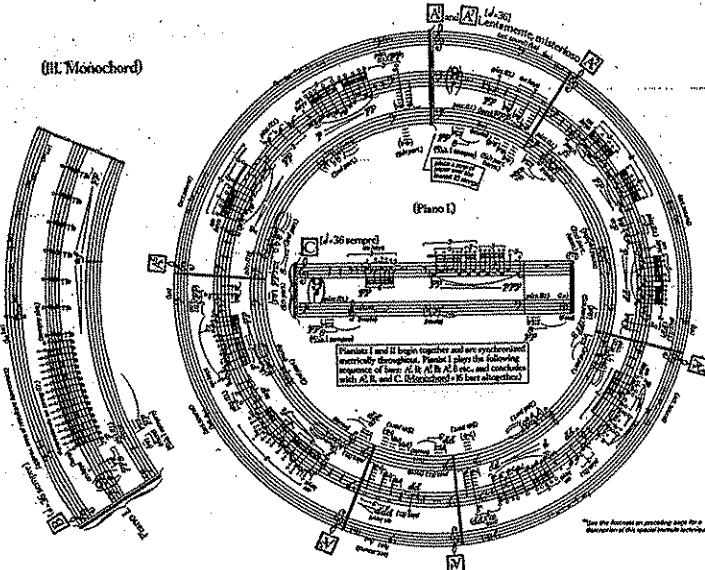
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21. *Belle, bonne, c 1400*, by Baude Cordier, a heart-shaped love song from the court of Avignon.  
22. A page from "Monochord", Part III of *Zeitgeist*, 1987, for two amplified pianos by George Crumb.  
23. A fragment of *Unity Capsule*, 1975, for solo flute by Brian Ferneyhough. Every note and sound is notated with great precision.  
24. (opposite) *Ancient Voices of Children*, 1970, by George Crumb. The "Dance of the sacred life-cycle", from this sequence of Lorca settings, contains a literal cycle of notes while the repetitive drum part, is notated more minimally. Jan DeGaetani, who sang in the first recording, wrote that "in the case of George's works, the page is always glorious to look at. It is intended to excite and stimulate."



(III. Monochord)



scores at the Workforthetheeyetodo gallery in London, a contemporary dance "score" by Bruce Gilbert was a sketch, a blueprint for the recording process with comments, shapes and shadings that organised the composer's creative thoughts within a time line specified by the choreographer. As a score, it spoke in a hybrid language of Gilbert's making.

Graphic scores have increasing importance in education. Tom Deveson, advisory teacher for music at Southwark Education in London, says: "Graphic scores manage the trick of being free, and fun, yet precise. A class of kids of mixed abilities soon agree what a red line or a green squiggle means, and by the end of the lesson they have made a piece out of it. Children love to sort out the rules and then follow them conscientiously."

"Cardew said something interesting," recalls composer Howard Skempton. "Graphic scores are designed for people who have avoided a musical education but somehow acquired a visual education."

#### FADING MANUSCRIPTS

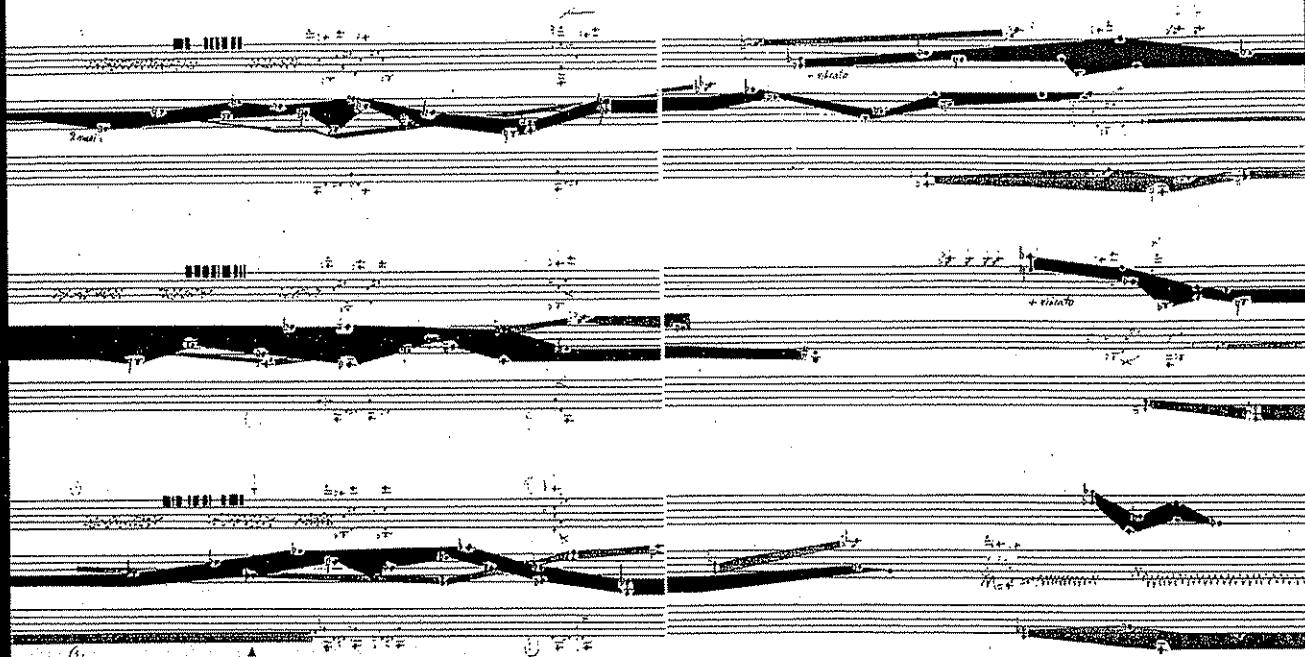
Frank Zappa warned against the fetishisation of musical scores by pointing out that "you don't eat the recipe". In some senses, the postwar avant-garde's obsession with graphic notation is a critical commentary on the redundant conventions of European art music. Yet, although such graphic excesses may have little lasting impact on "serious" music itself – Cardew repudiated such "squiggly lines" as bourgeois nonsense before his death in 1981 – they enrich the culture, and continue to reverberate in electronic studios, where a few scribbles can be more expressive, or accurate, than conventional note-heads, sharps and flats. The functional use of graphic scores as an aid to understanding (in education or entertainment) or as a way of communication between people without formal musical training (dj's and engineers, for example) is still in its infancy.

Graphic scores have an aesthetic immediacy that music can never have – the instant visuality of a well-drawn manuscript liberates the composition from the tyranny of time. In the digital domain, music has acquired some visual attributes. At one extreme we have the short, retriggered samples from which much commercial music is constructed; at the other, the on-screen analysis provided by a sound editing program such as ProTools, which can zoom out from the dynamic shape of a symphony, a pop album or a drum'n'bass opus to turn 80 minutes of music into a single image.

Like the "Eye music" of sixteenth-century Italian Mannerists, many graphic scores are now relics of a vanished era, fading manuscripts with little meaning to present-day musicians. But the seductive complexity of work by Cardew and Bussotti continues to fascinate both musicians and non-musicians, and recent work by Phillips and Skempton shows the resilience of such ideas. Each score is a chest of treasures that can be unlocked by performers and interpreters not yet born, a code or puzzle to be solved in time. **e**

H6

H7



25

TREVOR WISHART/GORGEOUS THE PANTOMIME

**VOX-5 Diffusion Score.** This score is an approximate guide to diffusion.

25 Distance L. 1000 feet. Duration 16 mins. Level 0dB

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REF IDLE FRONT LEAVES AI 100% VENTILATION +6dB 0dB

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Frigid GROWL CROWDS Thunder CLAP Thunder CLAP Final Thunder CLAP -54dB

26 OUT BEFORE END

# On Sonic Art

by  
Trevor Wishart

A new and revised edition

Edited by  
Simon Emmerson

## Musical gesture

The essential feature of this direct musical communion is what I shall describe as *musical gesture*. In a sense it would be more logical to drop the qualifying adjective 'musical' as the concept of gesture has much more universal application both to other art-forms and to human experience in general. In Chapter 6 I will be discussing in greater detail this concept of gesture. Here I will confine myself to a few important observations. Gesture is essentially an articulation of the continuum. It is therefore of special relevance to any art-form or approach to an art-form which attempts to deal with the continuum. Conventional music theory (at least in the West) deals almost exclusively with the properties of sounds on a *lattice*. We will discuss this concept a little further on.

Secondly, musical gesture is evidenced in the internal morphology of sound-objects and also in the overall shaping of groups, phrases, etc... In fact, the morphology of intellectual-physiological gestures (an aspect of human behaviour) may be translated directly into the morphology of sound-objects by the action of the larynx, or the musculature and an instrumental transducer. The translation of performance-gesture into the gestural-structure of the sound-object is most complete and convincing where the technology of instrument construction does not present a barrier. Thus vocal music where there is no socially-constructed mechanical intermediary — and particularly where performance practice has not become dominated by a notation-based

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first notation procedures tended to stabilise, if not to atrophy, the pre-existing ideological and musical praxes. A more significant breakthrough occurs with the emergence of analytic notation systems (see Figures 2.2b and 2.2c). Here the verbal or musical praxis is analysed into constituent elements which are notated, and the notations combined to form the meaningful or characteristic units of verbal or musical praxis. In terms of language, the earliest examples were afforded by the syllabary, as in Hebrew, where constituent, but meaningless, syllables are assigned separate written signs, and these strung together to form the combined sounds of meaningful words and utterances. However, the most significant form of analytic notation for language was the alphabet, probably invented in the Middle East but taken up by the Greeks as the foundation of the first literate, critical culture.<sup>3</sup> The alphabet takes the principle of the syllabary one stage further, notating the (idealised) sound-constituents of the syllables themselves, and in so doing achieving such a considerable economy of means — for example 26 letters in the English version of the Roman alphabet as compared to tens of thousands of Chinese ideograms — that universal literacy became a practical possibility for the first time (see Figure 2.1).

Particularly in relation to the further development of ideas in this book, it is important to bear in mind that even in almost entirely phonetic languages, like Finnish, there is not a one-to-one correspondence between the spoken sound-object and the notation of it. The distinction we have made earlier between the sequence of combinatorial sound-units in speech and the use of inflection, tone of voice, etc. in the conveying of meaning is only one level at which this comment is true. This distinction has been raised as an issue within the sphere of linguistics. The original theorists of language seem to have been committed to the discrete/ combinatorial view of the subject, but the conflict between 'discreteness' and 'gradience' is now an issue. At a deeper level, computer analyses of the sounds of speech show that the individual sound constituents (phonemes) are not spliced onto each other in a way one might achieve in an editing studio but in most cases elide into one another very rapidly in the course of the speech-act. Even more fundamental, as will be discussed later, many consonants are characterised by their morphology — the way in which they change form — rather than by their spectrum (their particular frequency or formant characteristics). All this relates very strongly to what I shall be saying about the architecture of music.

The ideogram-writer had attempted to write down what was meant by the speaker in terms of the ideograms which were notations of

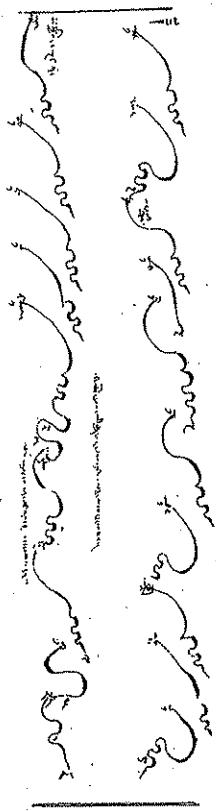


Figure 2.2a Tibetan neumes.

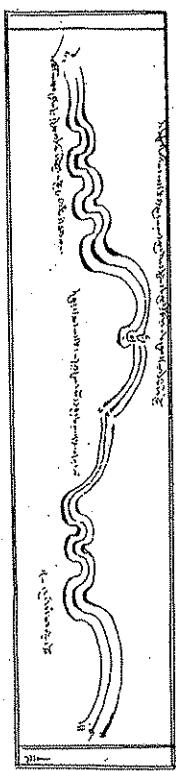


Figure 2.2b 10th century European neumes.

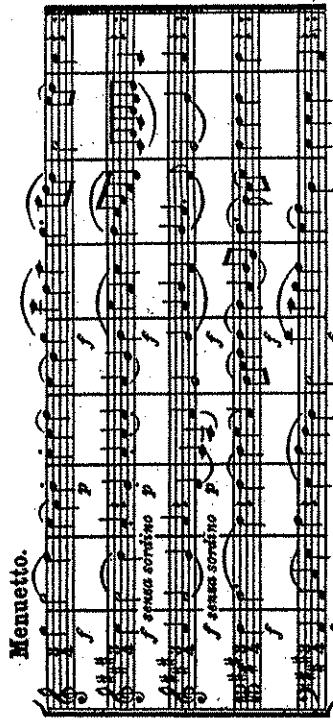
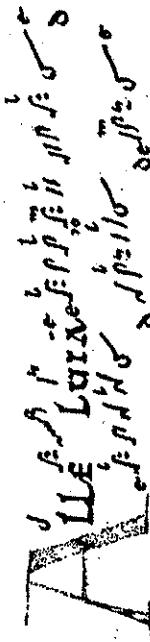
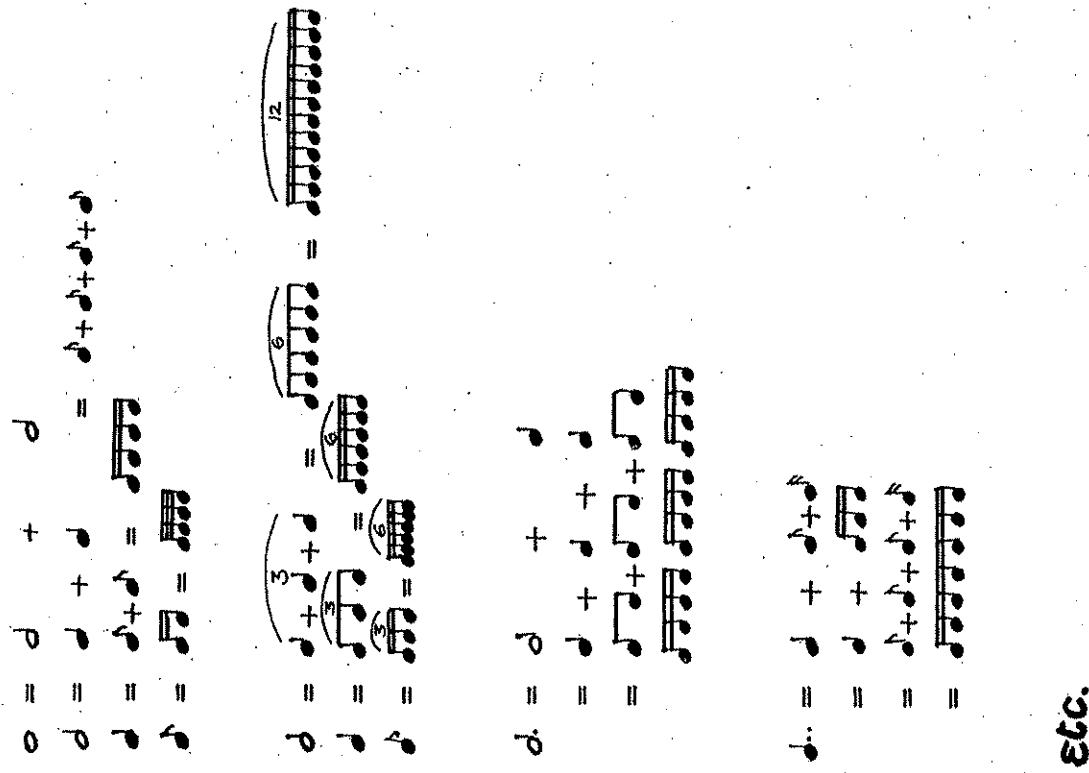


Figure 2.2c Modern European analytic notation.

<sup>3</sup> A fuller discussion of these issues is to be found in Goody and Watt (1963).



**Figure 2.3** Summative rhythm: each note value can be expressed as the sum of smaller equal note values.

fixed-timbre (or instrumental) streaming develops the lattice one stage further.

Hence music can now be viewed as taking place on a three-dimensional lattice (Figures 2.4b–2.4d). The three dimensions being made up of discrete pitch-levels, discrete durational values, and discrete timbral objects (or instrumental types). In fact, the concept of the instrumental stream is perhaps the most persistent in conventional musical thought — the lattice of both pitch and duration have been challenged by composers working within conventional notation. Even in the classical voltage control studio it was possible to conceive of a musical composition in which a single sound stream evolved, possibly diverged into separate streams which might be separately articulated, might reconverge and continue thus to the end of the piece (see Figure 2.5). The evolving streams within such a piece might be continually changing their timbral characteristics, even though they were continuously connected to the opening event (i.e. the piece need only have one attack — at its opening — and therefore in the conventional musical sense contain only one ‘note’). The conception of music as consisting of fixed-pitch, fixed-timbre entities called ‘notes’ is extremely persistent.<sup>4</sup> It even imposes conceptual limitations upon the design of digital musical instruments (where such traditional conceptions are no longer necessary). Computer music machines such as the Fairlight and Synclavier with their keyboard input and instrument definition, and even the more general Music 11 program, carry with them into the digital

<sup>4</sup> See the quote from Lejaren Hiller in Chapter 1 (Hiller 1981: 7).

the Japanese example, are more highly developed, although musical development still takes place over a fixed pitch-set (harmonic field). Even here, however, we find the use of subtle sliding inflections onto and away from the lattice pitches and the internal articulation of the sound-objects which make up the ululation-based runs. Again, these cannot be approximated by conventional Western notation procedures but are clearly a fundamental aspect of the musical structure. Jazz is clearly much more strongly influenced by the lattice-based approach of Western harmony. Yet typical jazz vocal and wind instrument production is very heavily concerned with the internal articulation of sound-objects including sliding ornaments and careful control of vibrato and other timbral modulations of the sound. All these features can now be clearly described — they are not mysterious in any way — but again would be lost in conventional Western notation.

Finally, the example from Haydn illustrates what happens to vocal production when musical conception is focused upon the lattice itself. Vocal production becomes conventionalised and aims at an idealised type of production focusing on the lattice pitches. Idiosyncratic developments of timbral and pitch articulation, which serve to identify and project particular jazz singers, for example, are to be rejected in favour of a universally stereotyped *bel canto* production. Vibrato is no longer a parameter for musical articulation but a relatively fixed feature of the required sonority. The latter example typifies music developed on a lattice where development of the parameters of the lattice itself dominate all other types of musical articulation. If we now turn to the instrumental Examples 2.5, 2.6 and 2.7 which are of Japanese shakuhachi playing, a classical chamber work (using wind instruments) and a piece of jazz, we will hear a similar development in the use of wind instruments. In fact, it is the combination of a conception of music focusing on the parameters of the lattice and the developing technology of instrument design going along with this developing conception which leads us away from the multi-dimensionally rich articulation of the shakuhachi towards the timbral uniformity of the present-day Western keyed flute.<sup>6</sup> Despite these developments, however, articulation of the continuum is still present in performance practice. As we have discussed earlier, the articulation of the continuum in intellectual-physiological gesture is transferred directly to the sound-object by the player of a wind instrument. Even in the most rationally developed notated scores,

aspects of performance gesture, often loosely referred to under the term 'interpretation', still have an important bearing on our musical experience. In certain types of music, articulation of the continuum plays a much more significant role as can be discerned by comparing the typical use of the trombone, trumpet and particularly the saxophone in jazz with the typical use of the keyed flute in classical Western music.

In this continuing technological development, the voice and the keyboard may be seen as occupying the two opposite ends of the musical spectrum. Voice, the immediate source of intellectual-physiological gesture, will be seen as an important focal model for music throughout this book. The keyboard on the other hand represents the ultimate rationalisation of a lattice-based view of music. Timbre is fixed; pitches are incapable of any sort of inflection, physiology is only allowed one single point of contact with the sound-object, at the initiation of the note, and thereafter can have no impact on the internal morphology of the sound. This distance can perhaps best be appreciated by comparing the ululated trill articulation of the North Indian vocal music example with the typical trills and turns on a keyboard instrument. Vocal articulations such as trills and turns are semi-unified objects, the apparent pitch-elements of which are bonded by subtle internal portamenti and timbre transitions. On the keyboard instrument the individual notes of the trill or turn are as close as we can possibly approximate to the individual notes on the page. It is interesting and ironic in this respect that the computer, in some senses the ultimately definable and controllable musical instrument, has for the first time begun to reveal to us the subtle inner architecture — the continuum architecture — of sounds.

It is very important to understand that the lattice is a conceptual construct. It is we who have decided to construct our musical architecture on the lattice. Because we do, however, it is very easy to fall into the mental trap of observing the world of sounds as if it divided up neatly on a three-dimensional lattice. Thus for anyone with a conventional musical training — and particularly for those with no studio experience — sound-objects appear to be divisible into three distinct categories of pitch, duration and timbre. This is of course true of most sound-objects appearing in conventional music — they have been constructed on the lattice and are therefore divisible in terms of that lattice. In fact as we proceed we shall see how the conventional (Helmholtzian) view of acoustics tends to fall into the same trap. At this stage we will merely note that lattice notation encourages the following connections:

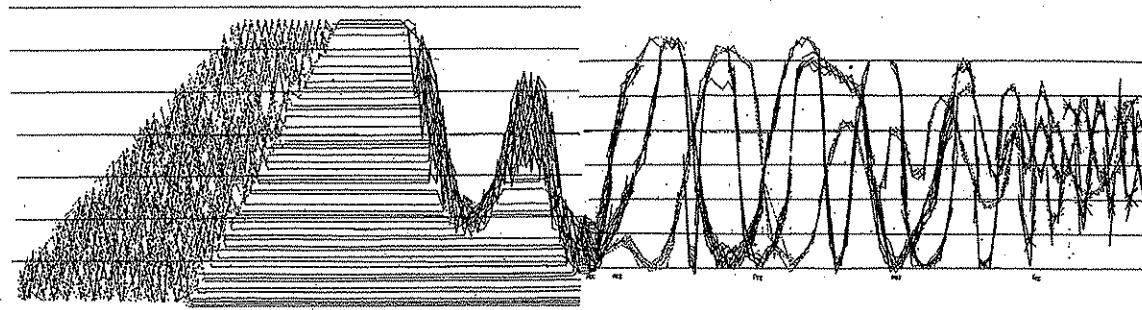
- (1) instrumental streaming leads us to suppose that timbre is a simple category like frequency;

<sup>6</sup> Contemporary instrumental composers have, of course, sought to counteract the stranglehold of technological rationalisation by exploring non-conventional modes of sound production on the Western instrument (flutter-tonguing, key-slapping, whistle-tones etc.).

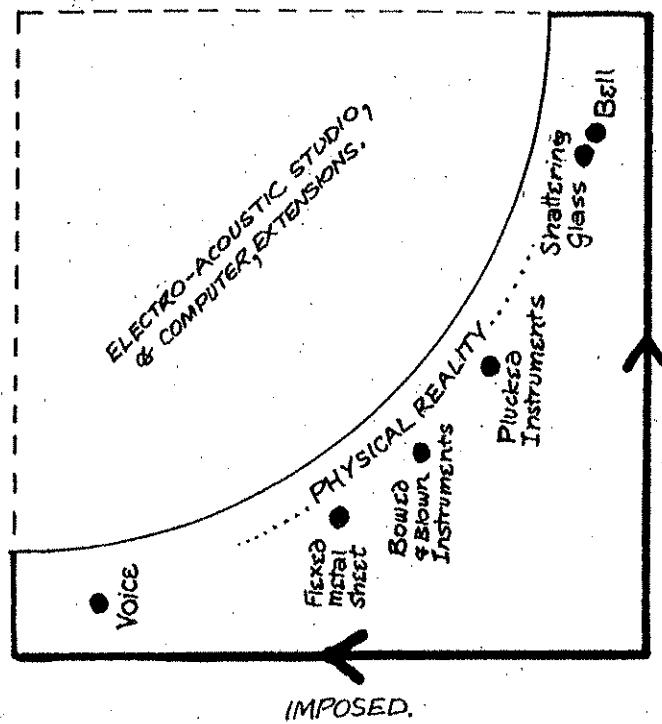
a rationalised analytic notation system. Within this same tradition, however, composers have made attempts to abandon the lattice-dominated aesthetic. Consider now Examples 2.8, 2.9, 2.10 and 2.11. In Example 2.8, from the Webern *Symphonie*, we hear the apotheosis of the rational extrapolation of lattice aesthetics. In Example 2.9, from Penderecki's *Polymorphia*, we have a fairly typical example of this composer's approach to composing music which no longer conforms to the traditional lattice. In particular, he uses thick groupings of pitches only a quarter-tone apart (thus destroying the twelve-note chromatic lattice) and also textural aggregates of sounds with no, or ambiguous, pitch content. The sonorities are very striking, but the overall architecture does not seem so strong. The music seems to develop monophonically and tends to fall into long blocks of a particular sonority. We can say that the composer has broken free quite successfully from the domination of the lattice but as yet no strong and sufficiently articulate means of organising the new material has emerged.

In Example 2.10, from the end of Xenakis' *Pithoprakta*, we have a more interesting example of non-lattice-based musical organisation. The written score for this piece is superficially impenetrable, but if we sketch out the various notated pitch glissandi on a sheet of graph paper in which pitch and time form the axes the architecture of this particular section is quickly revealed (see Figure 2.6). Xenakis has grouped individual short glissandi on the string instruments into larger arching glissandi (glissandi of glissandi).<sup>9</sup> At the same time the sounds are grouped into three contrasting string sonorities and the three resulting timbre streams arch up and down independently. In this way a pitch-based counterpoint of timbre streams is created which in no sense depends on the typical pitch lattice of conventional music. At the end of the section, as will be seen clearly from the figure, the glissandi of glissandi thicken out and unfold into a sustained chord, a wonderful process of pitched evolution which has no real parallel in typical lattice aesthetics. Although the processes of musical organisation here seem more articulate and evolved than in the Penderecki example, they have what Pierre Schaeffer has described as an architectural feel, that is to say that the gestural unfolding of events is quite slow and controlled. There is as yet not a moment-to-moment feeling for the gestural development of musical form. This is partly due to the essentially cumbersome nature of the orchestra when it comes to attempting to define non-lattice structures. Inevitably such structures must be constructed from individual elements which are notated on the lattice or in relation to the lattice and it becomes difficult to notate a

Figure 2.6 Glissandi of glissandi in Iannis Xenakis's *Pithoprakta*.



<sup>9</sup> Figure 2.6 is from Trevor Wishart's PhD Thesis (University of York, UK 1973).



**Figure 9.6** Real sounds in relation to imposed or intrinsic morphology.

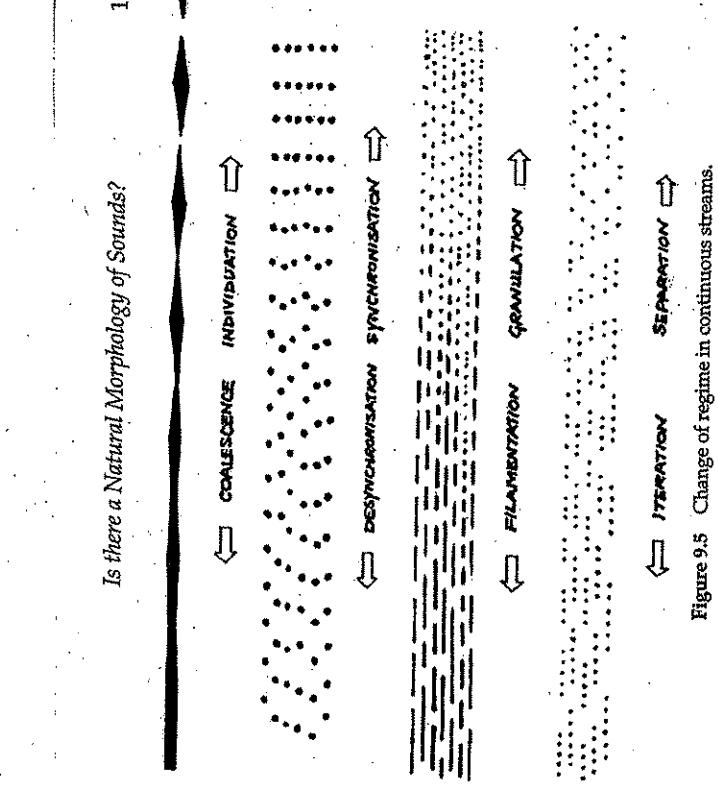


Figure 9.5 Change of regime in continuous streams.

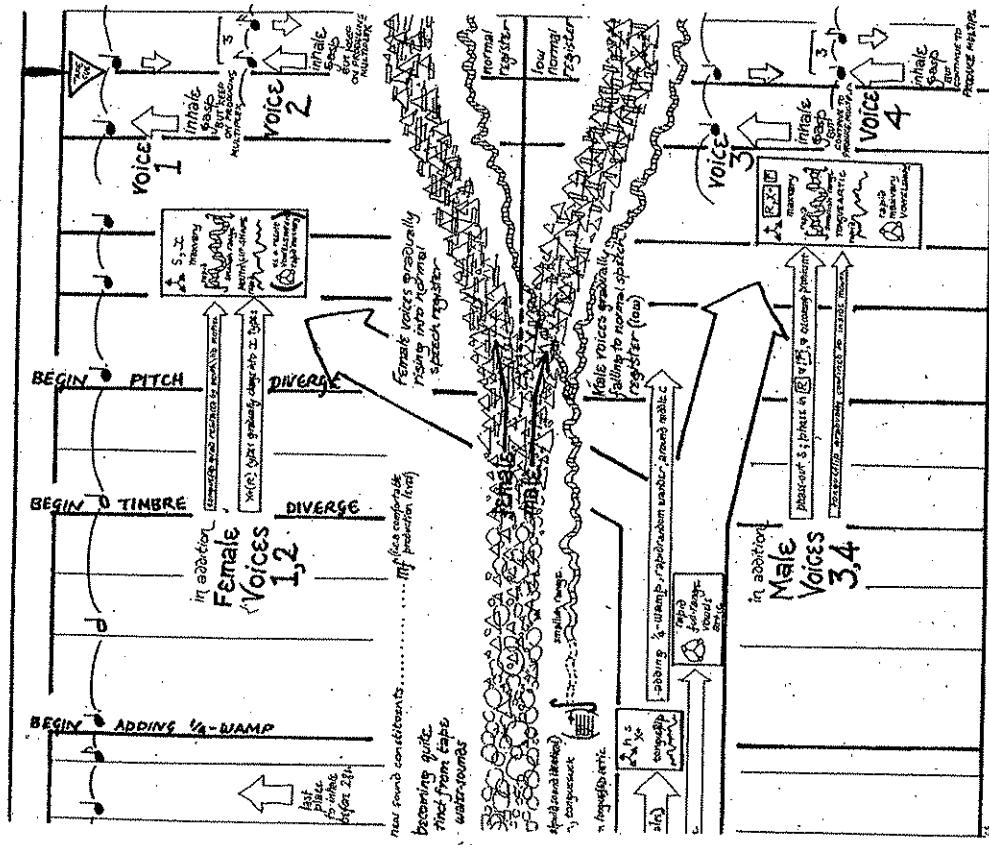
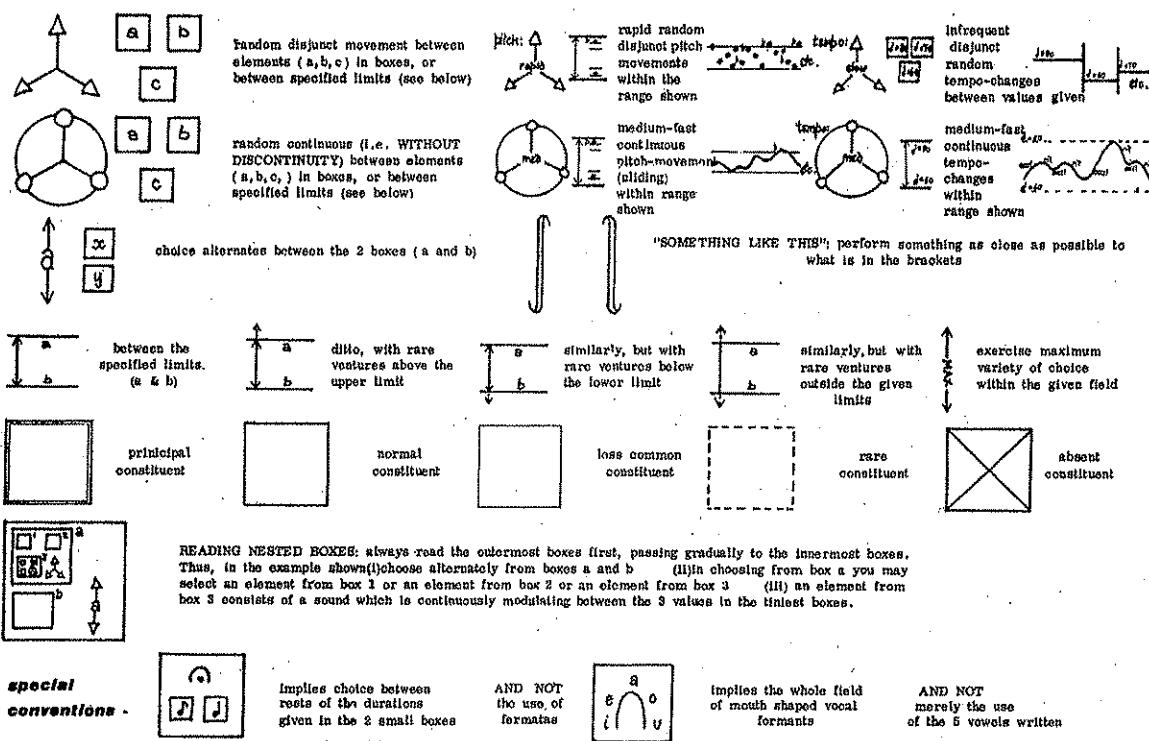


Figure 10.4 Spatial motion and sound evolution at start of Vor-1

## PROCESS NOTATION

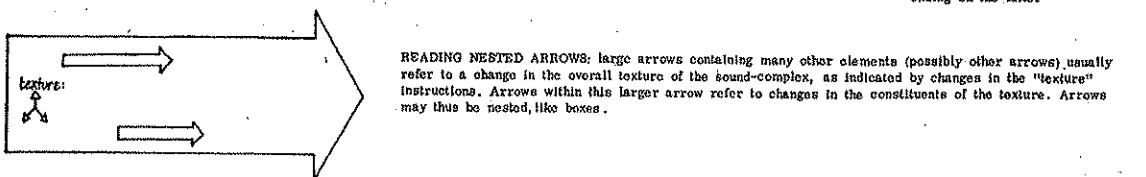
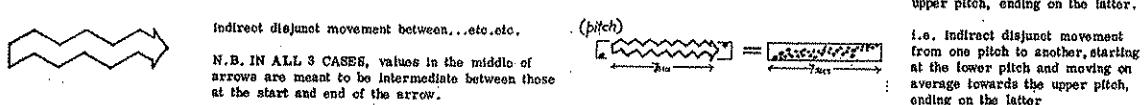
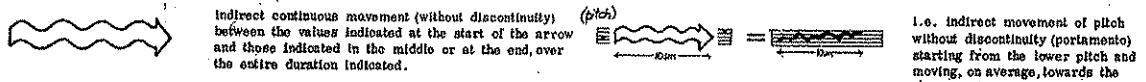
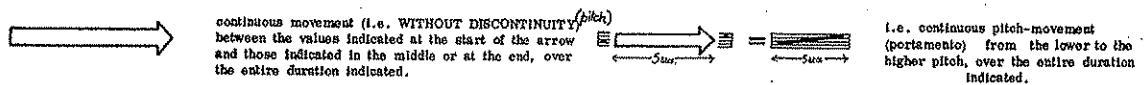
## MODULATION SIGNS (variation within given field)



In the above, and succeeding definitions, the term "RANDOM" is meant to imply "in a non-repeating sequence". Thus immediate repetitions of an element or repetitions of a set or pattern of elements should be avoided, and the whole available field of possibilities called upon, where feasible.

## TRANSFORMATION SIGNS (change in parameters through time)

## examples



NO HIATUS between the 2 musical elements thus linked

indicates continuing application of previous instructions (no transformation taking place in constituent referred to)

Figure 5.3 Process notation (from Introduction to Tuba Mirum).