Terence Dwyer

COMPOSING WITH TAPE RECORDERS

Musique concrète
for beginners

3.95

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TERENCE DWYER

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T.D.

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1 Any Number Can Play

Composing with a tape recorder is a fascinating new line of musical adventure. Depending on the attitude and ability of the composer (and, it must be admitted, to some extent on the amount and quality of the equipment) it can be anything from an amusing hobby to an advanced art. The musically ignorant owner of a simple tape recorder can learn to record and organise sounds into real compositions, and gain much pleasure in the process. The enthusiast who can afford a more elaborate machine, or even two, can extend his abilities much further. Alternatively, two or more people could pool their resources. Perhaps one of the owners is particularly interested in sound equipment and is knowledgeable on the electronic and technical side, in which case he might well take on all or most of the actual recording and machine operating: another owner might be more musical and would do all the planning and making the actual sounds. A trained musician who can already compose music of a more orthodox nature should enjoy trying his skill in new directions, where he might even find greater success than before. Children can learn tape composition: it has been tried in a few schools and should be in many more. One of the uses of this book could be to guide a teacher in taking his children through an exploration of sounds and their creative organisation. Alternatively he might prefer to go through the course himself first and then devise his own exercises for the children, who could make suggestions and help in the recording. Tape music may be used as incidental music for plays, dance dramas, etc., whether in school or elsewhere; indeed the links between drama and this kind of music can be quite strong, and will be discussed in a later chapter.

REQUIREMENTS

The ideal equipment is a three-speed stereo machine with facilities for sound-on-sound, synchro, echo, mixing and monitoring;

plus a second machine which may be a simple mono recorder. A pair of extension speakers and a pair of stereo headphones are desirable though not essential. At the other end of the scale, much can be done with a two-speed mono machine alone; further details are given in the text. It is only fair to warn the reader that little can be done with a single-speed machine, and nothing at all worth while with a small cassette recorder.

The reader is also warned that to try tape composition he will need much enthusiasm and patience, for he will be embarking on a very time-consuming activity, and he should not do so unless he is as likely to enjoy the manufacturing processes involved as the final result. (This is true of all musical composition, however.) The reader is also encouraged to believe that creative results *can* be achieved by the use of imagination and self-criticism, and that no great musical or technical knowledge is essential.

NATURE OF TAPE MUSIC

What is the nature of this 'tape music'? First we must be careful not to confuse it with 'taped music', i.e. a recording of live music in a straightforward fashion. What we shall be dealing with is the use of recorded sounds, 'musical' or otherwise, which by the composer's manipulation are sifted, altered, superimposed, edited, etc. to become a new creation justifying the title of music. Many readers will know that the correct title for this is *musique concrète* and that it was invented by Pierre Schaeffer and Pierre Henry in the 1950s. The term 'concrete music' was originally coined to distinguish it from electronic music, in which the source of sounds is the oscillator or wave generator, a purely electronic device whose signals only become sound when fed through a loudspeaker. In *musique concrète* everything begins as an actual sound which is recorded and processed and then fed through a loudspeaker. A little confusion of terminology is caused nowadays by the common use of the term 'electronic music' to cover both kinds, since they often overlap in the hands of such composers as Stockhausen.

I feel that it is better to distinguish between the types, and because *musique concrète* seems a clumsy and slightly misleading term I prefer the phrase 'tape music'. It is true this is ambiguous also, but I use it for want of better, and at least it will roll more comfortably off an English tongue.

WORKING WITHOUT A TEACHER

So far the literature published on the subject is scarce and often formidably technical. I believe my book to be the first addressed to the beginner, but I do not wish its purpose or scope misunderstood. It is intended to convey information, suggestions, and a course of action to the reader which *may* lead to the production of some worth-while music. In other words it is the equivalent of a harmony primer: it provides the exercises and gives hints for working them. No guarantee of success is implied, for, as with orthodox music, what is really needed is a skilled teacher actually showing the learner what to do, and above all criticising and correcting his efforts. Since such teachers do not appear to exist, the student is earnestly begged to apply his own powers of self-criticism at all stages. This is difficult without a standard of reference, and although in certain directions useful comparisons may be drawn with orthodox music, this will not work most of the time. The amateur who works through the course provided by this book may be tempted to play the results to a qualified musician for his comments. If he does he may well be dealing with a person whose training makes it impossible for him to judge the more liberal field of tape music, and my advice to the composer would be: feel encouraged by any praise the musician may give, but ignore censure! (At least, ignore it if generalised and particularly if it is virulent. However, constructive suggestions should always be listened to carefully.)

It is, then, assumed that the reader possesses the minimum equipment of tape recorder, tape and microphone, and that he is anxious to begin experimenting and creating. However, I must ask him to wait a little longer until he has read the next chapter.

In the meantime he should keep a look-out for examples of tape music on television, radio and cinema, where title music and incidental music are often either *concrète* or electronic, and should interest and stimulate him. There are also gramophone records which could profitably be heard; a list is given in Appendix A.

2 Sounds Galore

DEFINITIONS

Before embarking on his work, the tape composer should understand something of the nature of the sounds he will be using. First, let us be clear that we can use absolutely any sound that takes our fancy. Whether the sound be a musical one (like a violin playing), a quasi-musical one (like a bee humming or a door-bell), a sound of nature (wind, sea), or what one usually calls noise (like dustbins clattering); we may, if we wish, use it for tape music. Dogs barking, babies crying, people talking, paper crumpling, cups clinking, doors banging, men whistling—all are grist to our mill. Here the reader may possibly be taken aback. Surely, he will ask, most of the above are *noises* and cannot be considered music? All right, let's pause for definitions.

Sounds are anything perceived by the human ear. Music is sounds organised by a composer to convey significant beauty. (My definition—and I haven't time to quarrel with aestheticians and others.) Noise is unwanted sound.

I am aware that many dictionaries treat 'noise' and 'sound' as synonymous, but this is uninformed, popular usage. For many years musicians, physicists and electronic engineers have preferred to define noise as unwanted sound. Let's agree to that one. But who decides it's unwanted? you may ask. The answer is: you, me, anyone. One man's music is another man's noise. My daughter is at this moment disturbing me by practising the recorder. To her it's music, to me it's noise. A man takes a girl to a restaurant where soft background music is played. They both notice it when they enter—at this moment it's sound, in a general sense. They sit down and the girl listens to it (to her it is now music) while the man tries to talk to her (to him it is now noise). Half an hour later they are gazing into each other's eyes and neither hears anything

but the other murmuring 'I love you'. Now the music doesn't exist for them. It isn't even a sound!

Let's be clear that music cannot really exist in an abstract sense. Unless at least one listener hears it, *as music* (see above definition), there is no music—it would either be sound, or noise, or it might be completely unnoticed. To return now to our bewildering world of sounds, natural and man-made, we can see that if you dislike a sound, it's noise. If you then lose your dislike, it becomes a sound. If you use it in an organised composition in an attempt to convey significant beauty, it becomes music. Ergo, all sounds can be used to make music. It's the organising that counts!

FEATURES OF SOUNDS

Now we must consider the characteristic features of sounds, with especial reference to those aspects the composer will wish to control. The chief features are pitch, duration, timbre and volume, and the reader will be interested to learn that the tape composer can alter any of these factors at will, within limits, with regard to any recorded sound. We must also consider the behaviour of each sound. Many people are surprised to learn that most sounds are not single events but a changing sequence. In simple terms, a sound has a beginning, a middle and an end, possibly all different. For example, a piano note begins with a thudding noise of hammer striking string, is quickly followed by a rapid increase in intensity of string vibration, which then begins to die slowly away, and ends with the slight sigh of damper falling on string to cut off the vibrations. Not all sounds end clearly—a cymbal crash begins clearly enough, then continues with a lesser but much slower-dying sound which fades so smoothly into silence it is difficult or impossible to say when it ends. Few sounds are constant from beginning to end—possibly only electronic sounds lack the 'attack' and 'decay' associated with normality. Attack is especially important—it is one of the chief means by which a sound achieves its individuality. When it is removed, or the entire sound reversed so that the attack comes last, the sound may be unrecognisable. Even the middle of a sound may be subject to subtle changes. An

apparently steady flute note may change pitch, volume and timbre during its course.

But don't let's frighten ourselves with too much complexity. It will be convenient to ignore subtleties and to classify sounds into four *duration groups* thus:

(1) *Short sounds.* These are over in a flash and the ear cannot estimate their length. Examples: hammer tap, side-drum beat.

(2) *Long sounds.* These are sustained for at least half a second at the same volume level. Examples: violin, flute, singing, breathing, pouring water.

(3) *Fading sounds.* Starting with a clear attack, they die away smoothly, some quickly, some slowly. Examples: piano, guitar, cymbal, rubber-band.

(4) *Tremolos.* Rapidly reiterated sounds such as drum roll, crumpling paper, rattling a box of matches. Most sounds of the first three duration groups can be converted by repetition into tremolos, in which case it will be difficult (and unnecessary) to tell which group the single sound would have belonged to. Tremolos may appear to the casual ear to be continuous sounds but they are in fact more interesting and exciting than the calm flatness of long sounds.

Next we shall consider pitch. Exactness of pitch is not required in most tape music and the beginner need only decide whether a sound is high, medium or low in pitch. This is normally quite easy, even if the sound is not a definite note, e.g. snapping fingers is high, stamping feet on a hollow floor is low.

The volume of a sound is not very important, because the recordist can easily increase or diminish it to the desired level by his controls.

Timbre, or tone colour, is one of the most important and interesting features of tape music. So rich is the variety available that real classification of timbre is undesirable, if not impossible. I shall ask the reader to classify his sounds not by their timbre but by their manner of production, thus:

(1) *Tones:* sounds made by musical instruments playing normally.
(2) *Mistones:* sounds made by musical instruments played in an unusual way.
(3) *Pseudotones:* sounds made by anything other than a musical instrument but resembling one or attempting to sound like one.
(4) *Sones:* normal sounds made by anything other than a musical instrument.

These are my own names. The first three explain themselves; the last is an old English word for 'sounds' which may as well be put to use.

To sum up, the tape recordist can classify all sounds into four source categories, four durations and three pitches. Here are a few examples to make things clearer:

Source	*Category*	*Duration*	*Pitch*
Piano	Tone	Short/Fading	All
Xylophone	Tone	Short	High
Bass drum	Tone	Fading	Low
Piano strings with drum-sticks	Mistone	Short/ Fading	All
Cymbal with bow	Mistone	Long	Med./High
Twang rubber-band	Pseudotone	Fading	Various
Blow across bottle	Pseudotone	Long	Low
Smack lips	Sone	Short	High
Shuffle feet	Sone	Tremolo	High
Drag table	Sone	Long	Med./Low

The reader should be able to think of many others, and to allocate each sound its pitch and duration fairly easily, though it is less easy to define source categories sometimes. For example, the human voice is a rich source of sounds, but it is difficult to draw clear distinctions between singing, moaning and speaking various vowels, and to allocate these to Tones, Pseudotones or Sones. So long as a decision is made and adhered to, this is all that matters. The classifications are for convenience only.

EQUIPMENT FOR MAKING SOUNDS

The reader has already realised that many everyday objects can provide a great variety of Sones and Pseudotones. I myself have got so much into the habit of such exploration nowadays that I can hardly look at a new object without wondering what sounds it can be made to give off. One of the most versatile (and handiest!) pieces of sound-producing equipment is the human body. We can sing, speak, groan, whisper, breathe, whistle, smack lips, thump chest, clap, snap fingers, stamp, shuffle and so on. It is quite easy to make up a tape composition entirely of 'body sounds' showing the utmost variety.

Pseudotones from everyday objects may take a little ingenuity but try exploring cups, glasses, bottles, anything metal, pieces of wood, steel rulers, boxes and so on.

A few basic musical instruments are useful, though not essential. (The tape composer does not *have* to use Tones and Mistones.) A piano, preferably a grand, is versatile, especially when explored in an unconventional way. Try weird chords and tone clusters (several adjacent keys) played by fist or forearm or even long strips of wood. Exploit staccato and extreme high and low registers. Play on the strings, if accessible, with real or improvised drum-sticks (wood and felt), wire brushes *glissando*, indiarubber, nails. Do all these things with pedal both up and down and compare results. Put the pedal down and thump the case, or sing a vowel close to the strings. A guitar is also useful for similar Mistones. A cheap recorder comes in handy for long sounds and a few cheap percussion instruments are invaluable (e.g. triangle, cymbal, small drum). Music teachers will often have access to a variety of such instruments. See Appendices for further suggestions.

COLLECTING SOUNDS

I hope that the reader will become more and more interested in the sounds he hears around him every day, and will eagerly examine them for their intrinsic interest and individual character. Some may attract by their 'musical' nature, others by their

unusual charm, yet others by their weirdness or startling properties. Nothing should be rejected but the dull and uninteresting. Quite possibly, after practice in really listening to sounds of every kind, the reader may develop enough enthusiasm to compile a permanent catalogue of sounds he likes and considers useful for tape music. Until he has had some experience of actually manipulating and altering tape sounds he may not always sense at first the *potentialities* of a sound (who would have thought that striking a match could be made to sound like a moon-rocket taking off, or that a tune can be played on nails stuck in a board?) but the list can always be added to in the light of such experience. In his search for useful sounds let the reader remember that tape music does not necessarily sound anything like conventional music. It need not have tunefulness or definite rhythm. What *is* of paramount importance is that each sound shall fascinate by its effectiveness and individuality. In connection with individuality, I suggest that it would be a very useful preliminary exercise for the reader to ponder each of the following onomatopoeic words and decide what sound-source he would use to make each of them:

twang, jangle, clang, clatter, roar, hubbub, blast, blare, boom, whisper, murmur, hum, rustle, buzz, purr, splash, sigh, moan, tinkle, ripple, bubble, plop, crack, snap, smack, clap, thud, rap, tap, knock, click, crash, pop, slam, bang, thump, toot, hoot, rumble, rattle, drone, patter, clink, jingle, hiss, whiz, swish, wheeze, fizz, creak, yelp, whoop, howl, scream, screech, squeak, whine, whinny, snore, snort, grunt, bark, twitter, yap, growl, bleat, croak, gobble, quack, chirp, wail, hum, ring, ping, whoosh, flutter.

If all these words are really considered and analysed it will easily be seen that many of them truly have a beginning, middle and end which are distinctly different. It is this *combination* which often bestows the individuality.

There are many other available sounds which have no onomatopoeic name, especially Tones, but all are available to the tape composer. Remember that nothing is a noise until you decide so—and any sound may become music.

NOTES ON THE WORKING OF THE EXERCISES

From now on exercises will appear from time to time in the text of various chapters. The following hints are meant to apply to them all.

(1) The four speeds commonly found on tape recorders are:

1 : $1\frac{7}{8}$ ips (4·75 cm/sec.); 2 : $3\frac{3}{4}$ ips (9·5 cm/sec.)
3 : $7\frac{1}{2}$ ips (19 cm/sec.); 4 : 15 ips (38 cm/sec.)

To save space I shall refer to them as speed 1, speed 2, etc. as above; but the reader should adapt these numbers to his own instrument by calling his lowest speed 1 whatever it is, therefore all two-speed machines have speeds 1 and 2 and all three-speed machines have speeds 1, 2 and 3. *Always record and play back at speed 2 unless otherwise stated.*

(2) There is nothing to prevent you from recording all your work in sequence on one long tape, or even from erasing past exercises as you proceed, but it is far better to keep all your work, and to acquire a fair number of spools of tape of the smallest size available, in order to facilitate access to individual pieces. Empty 3-inch cinespools are admirable for this purpose and are easily obtainable from chemists or photographic stores, who will often give them away. Thus it should work out cheaper to obtain these and to cut up a larger spool of tape (say 7-inch) into suitable shorter lengths.

(3) At the end of each exercise a suggested time-length is given. This is merely a rough guide and need never be adhered to strictly.

(4) All results should be played back through a large extension loudspeaker wherever possible in order to assess the true quality of the recording.

(5) When musical instruments are used, it is *not* necessary to be 'able to play' in the normal sense. Make sounds at random in

whatever way sounds fresh, interesting, weird or whatever you think fit. Avoid obvious melodies. Notes should be played in rhythmic groups, either continuously or interspersed with silences. Do not feel obliged to maintain a regular beat in this.

(6) If you possess no musical instruments or prefer not to use them, for Tones read Pseudotones and for Mistones read Sones, and find the nearest substitute for the type of sound requested when particular instruments are named.

(7) *Where certain conditions are laid down for you to follow, do not lose interest in the other variable elements. Use your own discretion about those aspects which are* not *mentioned in the exercise, basing your choice on the experience gained in previous exercises. If you are to develop as a composer, this 'reading between the lines' and expressing yourself freely where possible will prove the most important part of the exercises.*

3 First Steps

TECHNIQUE A STRAIGHT RECORDING

The first recording technique to master is that of making a recording sound as much like the real sound source as possible ('Hi-fi'). Although much of our work involves us in altering and distorting sounds, there is great value in knowing what is involved in hi-fi recording, so that we know what it is we are departing from. Besides, if we have become fascinated by the individuality of a sound we don't want to find it impossible to capture this.

As the owner of a tape recorder, you have probably had plenty of experience in making, or trying to make, realistic recordings. Your instruction book doubtless contains hints about this, or you could consult some of the books mentioned in the Appendix. You may well be limited by the low quality of your equipment and true reproduction will be impossible. If you can connect your machine to one or two large extension speakers this would help, or connect it to your radio set, provided it has a suitable input socket and your machine has a line output.

Having satisfied yourself that your recording technique is as good as you can make it, try the following exercise:

EXERCISE 1

Divide a large sheet of paper into 96 squares, 8 along the top and 12 down the side. Treating each pair of horizontally adjacent squares as one unit, head the four columns of units Tones, Mistones, Pseudotones, Sones. The 12 lines down are 4 durations: short, long, fading and tremolo; each subdivided into 3 pitches: high, medium and low. Fill the left-hand square of each unit with the name of a sound source, then make a short straight recording of these sounds in the order given. (It might be a good idea to

number them from 1 to 48 and to announce the number of each sound on the tape. It is also a good idea to make each sound three times before proceeding to the next sound.) Play over all 48 sounds, carefully checking that they fit the categories shown. The other squares are left blank for the time being. On two-speed machines record the entire exercise *twice*, once at each speed.

(5 minutes)

Two points are worth mentioning here. One is that certain categories, e.g. fading Sones, are difficult to fulfil and may have to be left out. The other is that certain Sones are irregular and spasmodic, e.g. traffic, conversation, workshop sounds, thunder; however, it is convenient to classify all these as tremolos.

TECHNIQUE B
MIKE PLACEMENT AND VOLUME CONTROL

Four mike placements are available:

Close (9 inches or less). Normally used only for very quiet sounds which would otherwise get lost.

Normal (2 to 15 feet).

Reverb Achieved by creating sound in an echoing place such as corridor or bathroom and having mike fairly distant. Avoid carpeted rooms for this effect: a completely empty room is ideal.

A possible substitute for reverb conditions is the placing of the mike inside a piano, with the pedal wedged down. The piano strings pick up and prolong sounds to some extent. Much depends on the type of sound and the type of mike, but some readers may find this a useful technique.

Muffled A coat or several thick cloths are placed over the mike. This cuts down some volume and cuts out a lot of high frequencies. If this does not work, try putting the mike in a closed drawer or wardrobe.

Volume Control

Note than when you are asked to produce a given volume, it is the final volume of the recording that is referred to. It is your business

to juggle the volume of the sound, the recording volume and mike placement to give the required result.

Monitoring

If your equipment possesses monitoring facilities (e.g. the Ferrograph output socket) and you can listen on earphones while you record, then you have a valuable means of checking volume levels. It is true that the level indicator, or 'magic eye', is some guide to the amount of sound going on to the tape, but this usually responds most to low frequencies and is provided mainly to prevent overloading of the tape. The *subjective* effect of volume is what counts, and this is best judged by monitoring. If you have no monitoring facilities, you will have to work by trial and error.

EXERCISE 2

Record the following in the given sequence:

Close, soft then loud: Breathing
Close, soft then loud: Hitting a box
Reverb, soft then loud: Clapping
Reverb, soft then loud: Singing
Muffled: Piano (loud), Drum (medium), Triangle (soft)

(40 seconds)

EXERCISE 3

Make a piece in two sections without a break:

Section 1 Soft and muffled, tremolo
Section 2 Loud and reverb, long

(40 seconds)

EXERCISE 4

Make a similar piece in two sections:

Section 1 Loud and muffled, short
Section 2 Soft and reverb, fading

(40 seconds)

EXERCISE 5

Arrange for a long or tremolo sound to be kept going continuously (e.g. alarm clock). By manoeuvring the input volume control smoothly, record as follows: crescendo from zero to loudest in 10 seconds and diminuendo back in 10 seconds, repeat in 8 seconds each way, then 5, then 3, then 1, then accelerating until you are moving the control as fast as possible. Listen to the result and decide whether this technique might be useful to you in the future.

(80 seconds)

The purpose of the above exercises is the development of an appreciation for contrast. Contrast is the basis of all musical composition, so begin now deciding which kinds of contrast appeal to you.

TECHNIQUE C SPEED CHANGE

We can record at one speed and play back at half or double that speed. On a three-speed machine it is possible to quarter or quadruple the speed by using speeds 1 and 3. With two machines, so long as one of them has at least two speeds, the same is possible by transferring from tape to tape through line input (or radio input), stepping the speed up or down each time; in fact with two machines the speed can be stepped up or down any number of times.

Note the results of halving speed:

(1) Playback takes twice as long.
(2) Tempo (see below) is twice as slow.
(3) Pitch is one octave lower.
(4) Timbre is changed (thicker, duller or richer).
(5) Rate of decay is twice as slow. This means that a short sound may now qualify as a fading or long sound.
(6) Rate of tremolo (or, in some cases, vibrato) is halved, making repetitions more perceptible as a rule.

Note the results of doubling speed:

(1) Playback takes half the time.
(2) Tempo is twice as fast.

(3) Pitch is one octave higher.
(4) Timbre is changed (thinner, brighter).
(5) Rate of decay is twice as quick. This may change a long or fading sound into a short sound.
(6) Rate of tremolo or vibrato is doubled, making repetitions less perceptible.

(Other factors are also involved: the faster the speed of recording and playback, the better quality recording, the more high frequencies are caught, the less the tape noise and the less the risk of wow.)

Tempo and Speed

To avoid confusion, use the word speed to indicate the rate of tape motion and the word tempo to indicate the rate of the events recorded on the tape, i.e. the 'speed' of the music.

Application of Speed Change

This ability to change the speed, and thus indirectly to change the pitch and tone colour, is the most important technique the tape composer possesses. He should from now on use it freely to create new sounds and to render familiar ones unrecognisable. Since the pitch is raised or lowered, it may be necessary to reclassify pitch as high, medium or low, though this need not necessarily happen. On good equipment the effect of the change can be quite startling; to hear the sound of a child's descant recorder transformed into a deep powerful note like an organ pedal, by transfer 4 or 5 octaves lower, is an awe-inspiring experience (only, however, if the equipment is free from too much wow). In most situations, though, a change of one octave is quite sufficient for good results.

In working subsequent exercises, keep carefully in mind the final playback speed and record at whatever speed will give the desired result. Remember also the following points:

(1) Playback time will be halved or doubled, so allow for this.

(2) Duration groups may be altered in the final result, especially if the recording took place under reverb conditions.
(3) Pitch area may have to be revised.
(4) Volume will be virtually unchanged.
(5) Timbre will be different, sometimes little, sometimes drastically. (Part of the fun is the expectant waiting to see how new sounds will come out under this treatment.)

EXERCISE 6

Play back your recording of Exercise 1 at (*a*) half speed, (*b*) double speed.

Listen critically and decide whether each sound represents (for you) an interesting or a fairly useless sound. Write down comments in the blank squares opposite each entry. When listening, it may prove difficult to identify some of the sound sources immediately: these are likely to prove the most useful sort of sounds in the future.

EXERCISE 7

Make an ascending 'scale' of six different pitches, all produced from hands and feet Sones, and playing back at final speed 2 as usual. (You are not trying to produce a scale which is in tune with the piano, merely six different pitches in ascending order.)

(5 seconds)

EXERCISE 8

Compose a two-section piece thus:

Section 1 Long Tones and fading Mistones (all soft, low, slow)
Section 2 Short Sones and Pseudotones (all loud, fast, high)

The catch is that *both* sections should employ sounds recorded at two different speeds. This may ruin your low, slow, fast, high, unless you allow for it. N.B. Fast and slow here refer to the *tempo*.

(40 seconds)

The purpose of the last two exercises is the gaining of experience in basic technique. If you are not satisfied that your results fit the given conditions, keep trying.

TECHNIQUE D REVERSAL

To play a tape in the opposite direction to that used in recording calls for different techniques according to what equipment is available.

A few machines have appeared with forward and reverse direction record/replay but very few readers will have such equipment.

On two-track stereo recorders one is able to record or playback on tracks 1 or 2 at will. Simply record on track 2, then turn spools over without rewinding and play back on track 1 to get reverse play.

With two mono recorders, reversed play can be achieved if one is a two-track and the other a four-track machine. Record on the two-track, turn spools over and play back on the inner (track 3) circuit of the four-track. Or it can be done the other way round.

With one mono recorder, thread the spools normally and then give a 180° twist to the tape so that the smooth side contacts the record head (and probably the other head or heads too). After recording, untwist, turn spools over and play back normally. Unfortunately this method leads to loss of volume and quality but it is the only possible method without more equipment. Incidentally it may pay to erase old recordings first, since by this method the erase head does not work so efficiently.

Application of Reversal

What are the results of reverse play? Obviously the events on the tape will come out in the reverse order, but an even more interesting effect is the reversal of attack and decay. Where fading sounds or distinct room resonance are involved the sound is often almost unrecognisable because a crescendo comes from nowhere and is suddenly cut off at its loudest. The piano now sounds like an organ, and cymbal crashes and triangle pings are like—well, you'll have to hear them. Most sounds are changed somewhat, except long ones, which change hardly at all. According to one rumour, a long-playing record of bagpipe music was actually

issued in reverse play by mistake! No one noticed it because bagpipe sounds are all long and joined together with no discernible attack, so the character of the sounds is just about identical in reverse. (As to whether the melodies are just as good backwards as forwards the less said the better!)

EXERCISE 9

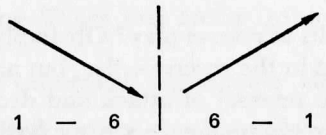
Record and reverse piano, glockenspiel, cymbal, triangle, drum, whistling, recorder (plus any similar melodic instrument such as violin, clarinet, etc. if available), foot shuffling, stamping, hand-clapping, speech. Also record (by direct line if possible) orchestral music from radio or disc.

Listen carefully and make written or mental notes about the way these sounds have changed from the originals, also their relationships to each other in their new form.

(1 minute)

EXERCISE 10

Take any six sounds from the list in Exercise 9 and arrange them in order of descending pitch. Record this normally and follow this by an identical recording in reverse. This of course will give the sounds in ascending order as well as reversing the order of the instruments and changing the sound characteristics. The total result is a continuous piece on this plan:



Musicians call this sort of thing a mirror structure.

(15 seconds)

This technique may prove useful in future. It is an intellectual device which may give pleasure to a listener who perceives it. However, he will not perceive it if the sounds are unrecognisable backwards. Try your recording of Exercise 10 on a listener and ask him what is happening. If he cannot tell you, perhaps you had better try again with more carefully chosen sounds.

EXERCISE 11

Using a triangle or cymbal (or metallic slow-fading substitute) you can produce six sounds (3 speeds, 2 directions). (Four sounds on a two-speed recorder.) Arrange these in an interesting rhythmic pattern and repeat this four times as nearly identical as possible. (Hint: don't wait for the sound to die away completely each time or the notes will be too long for a discernible rhythmic pattern.)

(20 seconds)

This is very difficult to bring off so that the result sounds like a repeated rhythm. Careful marking of the tape (see page 38) may be necessary, or even editing by cutting or two-machine transfer (see page 33). A loop (see page 31) is another solution, but at this stage the persevering use of one tape is good for your ultimate skill as a recordist.

EXERCISE 12

Create a gradual climax using reversed play only. Use any sounds you like.

At first	*Later*
muffled	normal
low	high
soft	loud
slow	fast

(1 minute 20 seconds)

Obviously you start at the end and make an anticlimax before reversing the tape to play back the final result. Please yourself whether the four aspects all change gradually and at the same rate, or whether they change suddenly, one at a time.

EXERCISE 13

Create a piece fulfilling the following conditions: gradual climax of Mistones, fading and long, forward and reversed, followed by

gradual anticlimax of Pseudotones using two speeds, all short sounds.

(1 minute)

In the anticlimax section, you may change the speed one or more times, but take care that in the final result there is a gradual slowing down, not spurts of different speeds. Make the first section build up to quite a loud volume so that your clatter of pots and pans (or whatever you are using) doesn't burst in too suddenly.

4 What Are We Aiming At?

So far the exercises have been elementary and concerned mainly with the acquiring of techniques. We have flirted briefly with a few further-reaching ideas such as the building of a climax. In the next chapter we shall attempt more advanced techniques and work eventually towards the composition of substantial and well-planned pieces. Unfortunately this demands, almost imperatively, two tape recorders or a stereo machine, or best of all two machines, one at least being stereo. This is not to say that the owner of more modest equipment must part company with us at this point. If he is still keen he can use the less satisfactory alternative techniques which will be suggested, or adapt the exercises within his own terms. In any case he should read on and discover what sort of things are being aimed at, and how to plan a complete piece of music.

At this stage I would like to examine further the character of tape music, and have adopted dialogue form as a convenient way of doing it. In the following conversation we overhear *A*, the author, and *B*, the beginner, discussing the subject.

A: How do you feel you've been getting on so far?
B: Well, I've enjoyed doing some of the exercises, though it's difficult to say if I've been very successful. Some of the sounds came out very weird.
A: Well, that may be a good thing. Part of the fun is in creating new effects.
B: Oh yes, I've had fun all right. The trouble is that some of the results sounded a bit of a hotch-potch—weird sounds and amusing sounds and recognisable sounds and musical instruments all mixed up. I feel that I'm a long way off making what could be called music. I know you said absolutely any sound could be used but they don't all seem to fit together somehow.
A: Yes, this is all true, but I did say everything depends on the

organisation! Up to now you've been more concerned to learn techniques and gain listening experience. Believe me, these are going to be invaluable when you really set about composing. The fact that you feel uneasy about sounds not fitting together proves that your ear has been educated during this process. You're getting critical: that's fine!

B: What I can't understand is this business of Tones and Mistones and so on. If it's a good thing to have a musical instrument, why abuse it? And if it's a good thing to abuse it, why play it normally?

A: I'm glad you raised that point. They both have their uses, of course; but the main point is that we are trying to avoid sounding like conventional music. Obviously Mistones help in that direction, and Tones are wanted for several reasons. One is that they are nice sounds! Another is that where they have definite pitch it is easier to build up pitch relationships in the music. And it's especially more easy to play a rapid succession of Tones on a piano, making some kind of melody, than to arrange pots and pans in a row and hit them.

B: Well, surely you're back to conventional music now.

A: No, because we would take care to avoid the resemblance. The piano Tones could be put in a background of everyday Sones, or they could be altered by reversal or speed change so that they don't sound quite like a piano. This way we get the benefit of good timbre and clear pitch without arousing conventional associations. Notice that we would not play conventional melodies. I said just now 'some kind of melody'. We would take care that it was a new and personal thing.

B: I see—that seems logical enough. If I may be awkward for a moment, what's wrong with conventional music?

A: Nothing! But if you want it, it's more efficient to play it live on the instruments it's designed for.

B: Suppose I were clever enough to record just one note of a piano, and then by duplicating it at different pitches, and joining up the results on tape, couldn't I make a performance of the Moonlight Sonata?

A: You would need equipment you haven't got, and even then it would be a fantastic technical feat, but what would be the point? It's quicker to play it on the piano—and better, from Beethoven's point of view. Surely it would be more sensible to use all that energy and technique on something that properly belongs to tape and tape alone?

B: Yes, of course. I just wondered. Then logically we ought to use Sones rather than Tones?

A: I don't like 'rather than'. We ought to use both. The trouble with Sones is similar to that with Tones—they can arouse associations we would rather avoid. For example, if we use breaking glass and a rattling match-box, people's minds will conjure up the appropriate image and we shall lose the abstract power of music to fascinate *by sheer sound.* Unless, of course, we process the Sones so they aren't recognisable.

B: You don't think people should know how we made our sounds?

A: Not usually. We don't even want them to *wonder* what made them. The essence of true music is that we are interested in the sound itself, not its cause.

B: Ah! I think I see why you want Mistones and Pseudotones—these are less recognisable and don't make people think immediately of conventional music or of everyday objects.

A: Exactly. Mistones and Pseudotones are already, by their nature, more fitted for tape music. Tones and Sones *become* suitable when we have processed them. But not always. There must be times when it is right to use them unchanged.

B: Well, that's cleared one point up. I'd like to ask you something else, though. What about rhythm and melody and some of the other things conventional music has? Are we going to abandon them completely? I don't see how we can be said to compose music without them, but if we use them, perhaps we get back to your bogey of sounding conventional.

A: It isn't only my bogey! It ought to be yours too. But you have put your finger on a tricky problem. Composers of electronic music have realised that their medium calls for new principles completely, and they have pretty well dropped all the old rules for composition.

B: What's electronic music got to do with us? That needs oscillators and fancy equipment, doesn't it?

A: Yes, true electronic music would not use a microphone at all. But these days the two things overlap, and a lot of leading composers have chosen electronic means of sound source rather than live sounds because they can be more exactly controlled. But quite often you can't tell the difference between some of our sounds and electronic music. On the whole we would do well to learn from electronic composers, though we can never do all the things they can.

B: In what way have they dropped the old rules?

A: Briefly: no themes, no melody, no rhythm, no harmony, thin textures, great emphasis on single sounds and their tone-colours. Also the use of several channels to make sounds move around in space.

B: That last bit sounds exciting. But surely the other things mean that it's not really music? You said music must be organised—how is electronic music organised?

A: Well, there are three answers really. One is that each composer invents his own organisation for each composition, and this may be considered successful because we can perceive it somehow, probably unconsciously. Another is that the composer may have organised his music in so private a way so that his audience *can't* perceive it. Thirdly, I can't help feeling that sometimes there's no real organisation at all, that frankly, it's bad music.

B: This all sounds very risky. Why can't I stick to the safer rules of earlier music? People would understand my sounds better then, wouldn't they?

A: This is something we all have to decide individually. It's a matter of communicating with other people. If you talk a language they are familiar with you'll communicate quickly. But in artistic matters ease of communication tends to link itself with lightness of worth. Significant depth often involves a new language. But it's a very involved subject.

B: Look here, this talk of significant depth is too much for me. I'm in this for fun and I haven't time to forge a new language. Anyway you're supposed to be showing me how.

1
Producing Mistones from a grand piano. The performer strokes across the strings with a wire brush, holding the pedal down at the same time.

2
Co-operation in tape composition—one operator strikes a chime bar while his colleague engineers the recording. Superimposition is in progress: a previous recording is being fed from the right-hand machine to the left-hand machine, where the sound of the chime bar will be added. The engineer can hear the combined result on his ear-phones and is ready to make adjustments to the controls if the balance is not right.

A: Yes, and what I'll be doing is asking you to try various approaches—sometimes based on conventional music, sometimes on the *avant-garde*, sometimes leaving you free. Eventually you can decide what you want to do.

B: Fair enough. What's next?

A: Well, funnily enough it raises the situation I've just mentioned. It's the question of texture. Conventional music, particularly orchestral, has many different things going on at the same time. We call this a thick texture. Electronic music prefers thin textures of one, two, or three sounds at once.

B: Is this because many layers are impossible?

A: Oh no—they are quite possible. It's because, having jettisoned melody, harmony, rhythm and so on, the composers concentrate on timbre, or tone colour. The listener contemplates and enjoys the individual sounds, and if there are too many at a time they tend to cancel out.

B: But if that's true, couldn't it be said of Tchaikovsky's orchestra?

A: You may have a point there. But that's the way the electronic composers look at it. Anyway, when you've tried creating thin and thick textures for yourself, you can make up your own mind which you prefer.

B: Right. Can I start on these textures now?

A: By all means. Let's go.

5 Further Techniques

TECHNIQUE E SUPERIMPOSITION

If two or more sounds are performed simultaneously and the result is recorded, it is obvious that we can begin to arrive at more or less dense textures without the need for technical manipulation. However, for a variety of reasons, some for convenience and some artistic, it is desirable to be able to add a layer of sound to one already existing on tape. This will be referred to as superimposition. Again the technique will vary according to the equipment.

Most stereo recorders have the facility known as Sound-on-sound, or Multiplay. In this method a recording is made on one track, then transferred to another track by means of the Sound-on-sound switch while at the same time a second signal is fed into the microphone or line input. Both signals now appear on the second track. This process can be repeated indefinitely back and forth, adding new signals each time. In practice there will be a limit to the number of layers because the more often the first signal is transferred the more it gradually deteriorates in quality—though this may be less drawback to us than to anyone recording straight music. For best results the engineer has a Sound-on-sound volume control as well as a separate mike control and can balance the two signals to his liking by listening on a monitor pair of earphones. This also facilitates timing. Bear in mind that the reading shown on the level indicator is the *combined* total of old and new signals and care must be taken not to let it build up too high.

Failing a stereo machine, two tape recorders can be used if one of them has separate inputs for mike and line (i.e. gram, radio, etc.), provided the impedances match reasonably well. For example, older Ferrographs have Input 1 and Input 2. Play back the first recording on the other machine with a line going into the

Input 2 socket. Meanwhile the mike feeds the new signal into Input 1. Unfortunately on some machines there is only one volume control for both inputs, so balance may have to be achieved by controlling output from the other machine and/or by varying the volume of the new sound source. On other machines we may be fortunate enough to have mixing facilities with separate volume controls.

A single mono machine makes superimposition more difficult. The only way is somehow to prevent the erase head from operating as we make our second recording. Ferrograph machines offer a way of doing this by removing the erase link from the back of the machine. Alternatively, you may be able to insert a switch into the wiring circuit which cuts off the erase head. Failing this perhaps you can thread the tape through the heads in such a way that contact with the erase head is avoided (unlikely) or as a last resort insert a temporary wad of suitable material such as paper or felt on the erase head (the first one on the left) so that the tape is kept a fraction of an inch away (too much might damage the pressure pad). This is a crude method and in any case some erasure will take place so allow for this. It might even be possible to give the tape a 180° twist as it passes the erase head *only*. This would erase the opposite track (inefficiently!). Monitoring is impossible on a two-head mono machine.

If all these methods prove impossible the dogged reader who is determined to try the exercises will have to engage enough helpers to make all the sounds the first time round, though some of the work will prove impossible even then. Before starting the exercises, practise the technique till you are familiar with it.

EXERCISE 14

Superimpose a long sound of sliding pitch upon itself to make three layers. Use siren whistle or human whistling or recorder headpiece shaded by palm.

(10 seconds)

Make the sounds slide up and down like the old air-raid warning, but time each layer (if possible) so that the rises and falls do not correspond. Another method of creating this effect is to use a long sound of fixed pitch and to

retard the movement of the feed spool by irregular finger pressure near its centre. (Don't keep this up too long or the electric motor might not like it.) Remember that slowing the spool down makes it play back at higher *pitch.*

EXERCISE 15

Superimpose the sound of crumpling paper at three different speeds. Play back at three different speeds to compare results. (Two speeds on a two-speed machine.)

(10 seconds)

EXERCISE 16

Superimpose four high sounds, one of each source-type; then four medium-pitched sounds and then four low sounds, again one of each type.

(30 seconds)

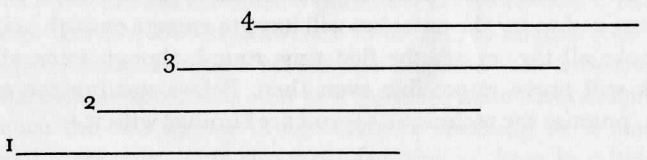
EXERCISE 17

Superimpose one high, one medium and one low sound (each from a different source) to show maximum contrast.

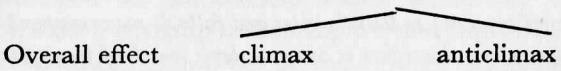
(10 seconds)

EXERCISE 18

Construct a changing texture thus:



Element 1 to consist of tremolo Sones speeded up to give medium pitch.
Element 2 to consist of low fading Pseudotones.
Element 3 to consist of low Tones slowed down to give low pitch.
Element 4 to consist of high short Mistones.



Take care that element 4 has entered before element 1 leaves off. Work out a timing scheme beforehand.

(1 minute 20 seconds)

The purpose of the above exercises is to experience various textures and to develop the ability to assess their effectiveness. Also, by the time you have worked through them you should be fairly adept at working the controls involved and should have lost any feeling that superimposition is a bothersome chore.

TECHNIQUE F LOOPS

A length of previously-recorded tape is cut, first with scissors for convenience (a trifle long) and then more exactly on a splicing block, obtainable from your hi-fi dealer. Use a very sharp razor-blade and join only with the correct jointing tape sold for the purpose, never with ordinary sticky tape which exudes gum eventually. Having made the length into an endless loop, play it on one machine (with spools removed) and feed it by line to another, where it is recorded normally. The effect is an endless repetition of the same passage. According to the length of tape used and the speed of playback, so the repetitions are more or less frequent. If the loop is very long it is passed round some smooth round-sectioned object at a convenient distance from the machine. A sand-filled jam-jar is the classic solution, but you can devise what you like. Most loops will not need this, however. As a matter of fact, the more usual problem is devising loops that are short enough to give quick repetitions when desired. The design of the average tape deck makes an irreducible minimum length necessary to negotiate capstan wheel, heads, etc. and get round the back again. In such cases use the highest available speed or even contrive to record the desired pattern more than once on the loop. Another way is as follows: make a slowed-down copy of the original pattern (slowed more than once if necessary) until it occupies sufficient tape length to make a convenient loop. Play the loop back faster and/or the receiving tape slower so that the final result achieves the desired effect. This sounds a little confusing but does work out in practice.

EXERCISE 19

Make a short loop of a steady sound, e.g. recorder, bowed cymbal, paper edge blown between thumbs. Start another recording of short and fading sounds and fade in the loop in the middle and out again. The loop transfer can be added to the second batch of sounds while they are recorded live, or the second batch can be recorded separately and a superimposition made by Sound-on-sound device.

(40 seconds)

EXERCISE 20

Make a loop of a rattling sound, e.g. box of matches or maracas shaken continuously. Inject this at ever-changing speeds (use finger to slow spool as described in Exercise 14, or keep changing speed control without stopping motor) into a recording of sharply contrasted fading Tones and long Sones. See if you prefer the result played backwards.

(30 seconds)

EXERCISE 21

Perform a rhythmic non-repeating pattern on several percussion instruments or substitutes. Cut a long loop of this, say 10 feet. Use this as an ostinato background to improvisations on mouth, hands and feet, combining the two elements into one final recording. Listen critically to the result. Fill in any weak or dead spots by the addition of piano chords, runs, etc.

(2 minutes)

EXERCISE 22

Construct a ternary piece thus:

A 3 layers, one a loop. All high and short.
B 4 layers, wide pitch texture, all long.
A Exactly as before.

'Wide pitch texture' means that the four layers should cover sounds from high to low, including intermediate pitches. Don't overlook that some of this may be achieved by speed changes.

(1 minute)

TECHNIQUE G EDITING

Editing, as in film-making, implies selection of existing material, possible rejection of any of it, rearranging the order of events, and so on. Many people regard it as the most creative part of both tape music and film-making.

Two main techniques are available:

(1) *Intermittent Feed.* Play tape on one machine and feed to the other. By the use of pause and stop controls, fade-out, etc., the material can be made to come out on the receiving tape in an edited form. Furthermore, mistakes can be corrected without losing the original form of the material.

(2) *Cutting.* This is done as described above (see Loops). Pieces of tape from different sources are spliced together to make a continuous whole (not in loop form this time!)

Marking the place becomes a problem. We need the playback head operating but not the forward drive. The pause control will achieve this, or perhaps you can thread the tape across the heads but not through the capstan drive. Move the tape backwards and forwards by hand until the required spot is found by sound. Mark with yellow chinagraph pencil the place opposite *playback* head (last on right usually). If a fraction of an inch can be spared, cut with scissors a little way from the mark. Place the two tapes to be joined on the splicing block so that the two chinagraph marks correspond, and cut with razor-blade so that the diagonal cut crosses the mark in the centre of the track being used. Pull away the two waste pieces and join. This should give an exact and noiseless connection.

EXERCISE 23

Make a loop of speech played back slower and backwards and injected intermittently on to a blank tape by removal and replacement of line plug or by quick use of volume control. Now try to fill the gaps with Mistones.

(30 seconds)

This exercise has obvious similarities to previous superimposition work but in fact is a simple form of editing.

EXERCISE 24

Take any tape-recording and feed it to another machine, using pause control of receiving machine to produce an edited result. Is this plausible? Try changed speeds and reversal. Are any of these plausible?

EXERCISE 25

Play over several of your old tapes. See if you can cut favourite bits out and join them into an acceptable final version.

EXERCISE 26

Make a Rondo in the form A1, B, A2, C, A3. A1 is a four-layer group of Pseudotones (some involving changed speeds). B and C were once two different parts of an old recording (or make one, preferably with Tones). Cut B and C with scissors and join everything into the right pattern. A2 and A3 are copies of A1. (There may be subtle differences if you wish, e.g. changed volume pattern.)

EXERCISE 27

Using only a piano to produce Tones and Mistones, employ every technique you have learned up to now (mike placement, volume control, changed speed, reversal, superimposition, loop tape, intermittent transfer and editing) to produce a fantasia of effects. Use silences carefully. (Those without a piano should use the voice, preferably singing various improvised notes to pure vowels.)

(1–2 minutes)

EXERCISE 28

The previous exercise probably resulted in a shapeless design. Repeat the exercise, adding the following conditions: invent a four-sound motive (for example, drum-stick on strings, scale-run, thump case with pedal down, staccato chord), record it and develop the recorded motive through constant variation of treatment, as indicated in Exercise 27. Try to exhaust the possibilities, then restate the first few appearances of the motive. The overall effect to start loud, fast and high, sink to anticlimax and recover.

Edit the final version if not satisfied. This is a difficult and advanced exercise.

(1–3 minutes)

There are reasons why your last two exercises may be the best pieces of music you have produced. For one thing, they have unity (caused by using only one sound source) and also variety (caused by the different processes). The last exercise has additional unity based on classical principles of theme, variation and restatement. Some may find that this method gives a result too 'orthodox' to be useful (see previous chapter), others that it is better than the result of Exercise 27. Try playing both pieces to several listeners and asking which they prefer. You will discover things about your ability to communicate through the medium of musical composition.

The owner of a simple mono recorder, with no access to a second machine, may well have been grinding his teeth at all the tricks described in this chapter: tricks he *can't* play. May I say to him now: I sympathise, and suggest you put out a small advertisement for a similar enthusiast willing to work with you. But apart from this, it is worth pointing out that much good tape music *can* be made on a mono machine, even without reversal. The two main techniques are speed change and editing. (Now please don't say your machine has only one speed! If it has, you may as well give up and I'm only surprised you got this far. You really need two speeds and preferably three.) The thing is to make a special skill of editing with scissors and razor-blade so that sounds give way to each other, sometimes with bewildering rapidity but always according to a plan. This way you can exercise creativity and be a tape composer. If all you do is to record sounds that take your fancy without any processing save selection, you may be an excellent recordist but hardly a composer. So keep editing!

The Best Method of Editing

One drawback of editing by actual cutting is the confusion caused by having a table littered with various lengths of tape waiting to be joined. Film editors are better off—they only have to hold a piece of film up to the light to see which bit they have.

No such luck for us, so write numbers on your pieces as they are cut off. Another snag of overmuch cutting is that we end up with odd lengths of left-overs, half-spools, or worse, a length of tape which is too long for the only available spool. A certain amount of wastage is inevitable, because although one may drop spare pieces into a box meaning to join them all up one day, that day seldom comes and when it does there is such a tangle that the lot goes into the waste-basket!

Editing by two-machine transfer certainly has the advantage of keeping tapes intact. It has one main drawback—the joins or transitions from one section to another may be faulty or noisy, or there may be a silent gap which is not required. This may be overcome by a combination of the two main methods. Simply cut away a very short length of tape containing the faulty join and splice the ends together with jointing tape as usual. The amount of wasted tape is negligible. I must admit, though, that splicing sections of different tapes becomes essential at times.

6 Some Workaday Matters

NOISE

Remembering what noise is (see Chapter 2) you will perhaps agree that you have been plagued by noises ever since you started the course. Let's now look at some typical recordist's noises and see what can be done about them. (Though it should be realised that there is usually an irreducible minimum of such things as hum and tape hiss in all equipment. It is a matter of getting the signal/noise ratio to an acceptable level.)

Hum. Various causes, mainly to do with faulty or mismatched equipment. (See the appropriate literature for cures.) Don't overlook two elementary pitfalls, though: try reversing pins of mains plug, and make sure mike isn't on the same table as the tape recorder, picking up motor vibrations.

Extra sounds. For example, the recordist moving about, or traffic sounds from outside. Four cures: one, record again; two, decide to accept it as sound, especially when processed; three, cover it up by adding another layer; four, hope it won't be noticed.

Tape hiss. Always present to some degree and probably unnoticed, but it can get multiplied when much superimposition or two-machine transfer has taken place. Cures: keep recording level as high as possible; avoid needless transfers; use low-noise tape; clean and demagnetise heads regularly.

Clicks. These should never be caused by the mike picking up the sound of the tape deck being switched on and off, because the best technique is to start the deck with volume at zero, then move up volume control; likewise to return volume to zero before switching off. (In any case a completed recording should always be preceded and followed by a short silence, not batter its way into the previous recording on the same tape.) If your machine causes

clicks through the record head in spite of this precaution, try first applying pause control, then switching on Record, then move tape back until the starting spot reaches the erase head, then release pause control. If you have no pause control you will just have to edit clicks out.

Fragments of previous recordings. These can sometimes get into one's work and, gremlin-like, refuse to leave, especially during Sound-on-sound work. There is only one real cure: wipe all tapes clean before beginning work.

DISTORTION

Either through faulty equipment or (more likely) through overloading the tape or the loudspeakers, a sound can become harshly distorted. I have met people who deliberately used this effect in tape music. Personally I would never use it, for these reasons: (1) It is not good for the equipment, and may prove difficult to erase from the tape. (2) Different sounds tend to sound alike when distorted in this manner. (3) I don't like it! Cure: treat as noise.

All this is a different matter from the 'distortion' effected by speed change, reversal, mike placement, etc. These are legitimate and controlled.

PLACE-FINDING

A good revolution counter is very useful for place-finding and is often sufficient by itself. For more accurate marking use a yellow chinagraph pencil. Having carefully run the tape by hand across the playback head a sufficient number of times to find the exact spot required, make one vertical line for the beginning and two close parallel lines for the end of a wanted passage. When two or more passages are contiguous, use single marks followed by numbers 1, 2, 3, etc. and end with a double mark. For obvious reasons rub off the marks when their purpose has been fulfilled. Sometimes a more visible mark is required. Cut out a tiny square of paper and stick it to the shiny side of the tape with a small piece of jointing tape at each end. The paper 'flag' can carry a number or other information and can be seen clearly as it leaves the feed spool.

STORAGE

Every recordist knows the importance of keeping spools in boxes and marking the boxes with the title of the contents. Preferably keep boxes upright on a shelf. If a spool contains recordings no longer required, mark it 'Used' to warn that it is available but not clean.

Temporary storage while editing can be effected by making a little wooden stand consisting of a base and two supports notched at the top to receive a dowel rod or knitting-needle which rests on top loosely. The dowel can be pushed through several spools of tape and replaced. Tape can then be pulled off any spool at will, suitable chinagraph marks having been already made while the spools were on the machine. (See Plate 4.)

TIME TAKEN

This is just a word of encouragement. I have found that for every minute of playing time in the final result, about one hour's work was necessary, on the average. Possibly you're doing better. There are good days and bad days. Sometimes, in spite of repeated attempts, I just cannot get what I want and have to accept less. We can gain further consolation by reflecting that orthodox live music has to be composed, the parts copied or printed, rehearsed (perhaps many times) and finally performed. Its practitioners are no better off than us, and at least when we've finished, we've finished. Live music has to be recreated at each performance.

7 Sounds in Space

By the use of more than one loudspeaker, each giving off different signals, we can exploit space and make sounds seem to move about. This is one of the most exciting aspects of tape composition and is quite easy for the owner of a stereo recorder or of two mono machines.

Most people nowadays are familiar with stereo sound as exemplified by gramophone records. If you have a stereo tape recorder you will also have produced your own stereo recordings. In both cases a 'spectrum' of sounds is produced which appears to occupy some or all of the space between two carefully sited loudspeakers. Although the tape composer may, if he wishes, produce stereo sound of this description, he is advised to think of two-channel effects rather than true stereo; and he should realise that the loudspeakers may sound more effective at a wider distance than for stereo—possibly even directly to the right and left of the audience. (The composer Stockhausen has surrounded his audience with loudspeakers, and has even visualised an auditorium of the future where the audience is suspended on a platform in space, with sounds coming from *all* directions.) The loudspeakers should be matched if possible, but unmatched and different sized ones may do at a pinch. Even two mono machines can achieve some two-channel effects by spatial separation, and as another possibility the enthusiast could listen to two-channel music on stereo headphones (*much* cheaper than loudspeakers) connected either to one stereo or to two mono recorders.

TECHNIQUE H TWO-CHANNEL (SEPARATE)

With two mono machines, record the first track on one machine and mark carefully the beginning, end, and any important intermediate places, using rev. counter, stop-watch, chinagraph marks or flags to pinpoint these as accurately as the situation calls for.

Another method of marking the start is by recording audible warning clicks (can be made with the tongue). Give three clicks spaced equally and the music starts on the next beat. Or you can simply count aloud 'One, two, three'. These sounds can be carefully erased later. In recording the second channel on the other machine, monitor from the first machine by headphone if live mike recordings are being made, otherwise (i.e. if feeding from a third machine) play back over loudspeaker and use visual markers to achieve synchronisation. The final result is played by starting both tapes simultaneously from starting marks on the tapes. Some adjustment of volume controls will perhaps be necessary. Obviously exact synchronisation is rarely possible.

With a stereo machine the procedure is similar, though much easier. If the machine possesses a Synchro button (as in the Beocord, for instance) then exact synchronisation becomes possible.

From the musical point of view, realise that the playing back of two separate channels is pointless unless there is some significant relationship between them. The situation is fairly comparable to the creation of a two-layered texture, except that the layers appear to be in different places.

EXERCISE 29

Record body Sones on Channel 1 and object and furniture Sones on Channel 2. Decide whether you have achieved any significant relationship between the two channels. Try reversed and changed speed playbacks. Any relationship? What achieved it?

(30 seconds)

EXERCISE 30

Using only a xylophone, or any melodic instrument of small range, make a recording leaving silences. Record a second track at half this speed, playing only in the silences. Play back both tracks at speed 2.

(30 seconds)

Because the Channel 2 sounds are an octave higher than those on Channel 1 as well as spatially separate, the listener will assume that the sounds he

hears are made by two different instruments. The effect is called antiphonal, i.e. answering from side to side.

EXERCISE 31

Repeat Exercise 30, using single notes and medium-length silences. This time Channel 2 must be at the *same* speed.

(30 seconds)

Instead of answering between 'two' different instruments there should be an illusion that the sounds jump across the room. This is because the sounds are identical in type and similar in pitch register, so the listener assumes one *mobile instrument! If this illusion fails, perhaps the speakers are not well-matched. Try them closer together.*

EXERCISE 32

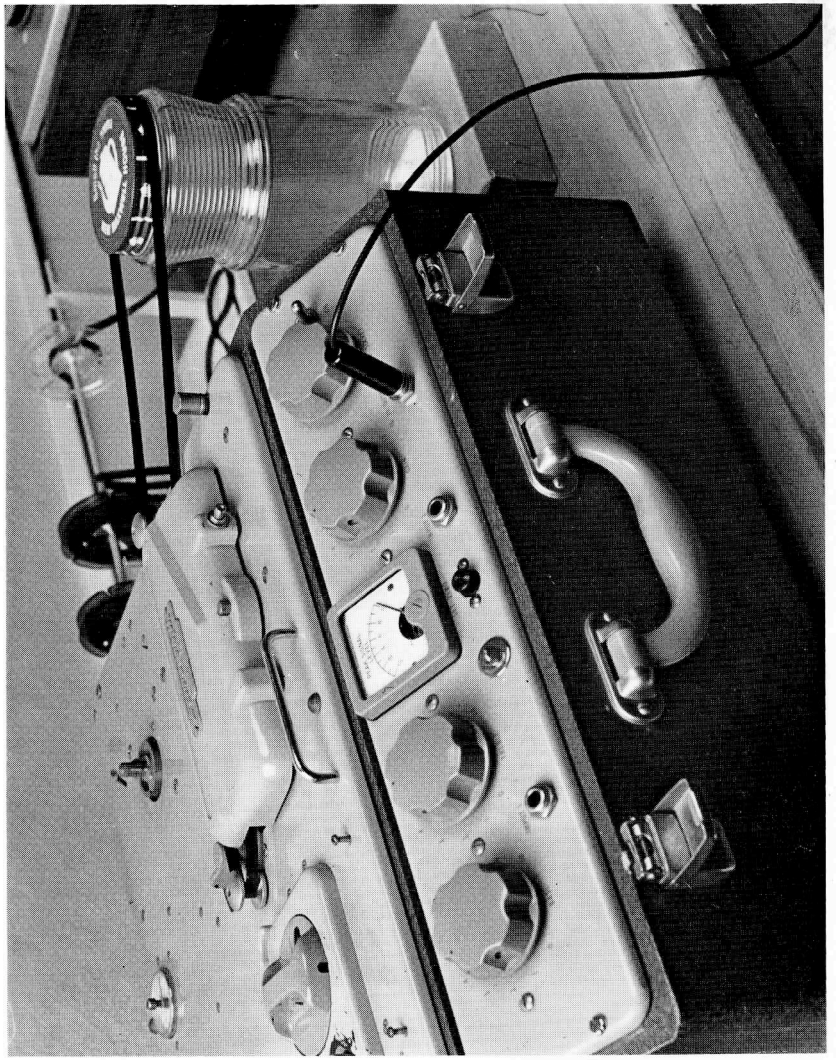
Using any sound sources, produce a two-channel recording which combines the antiphonal effect of Exercise 30 with the jump effect of Exercise 31. These two effects are to be heard *concurrently* Think carefully before starting. What exactly is the technique?

(30 seconds)

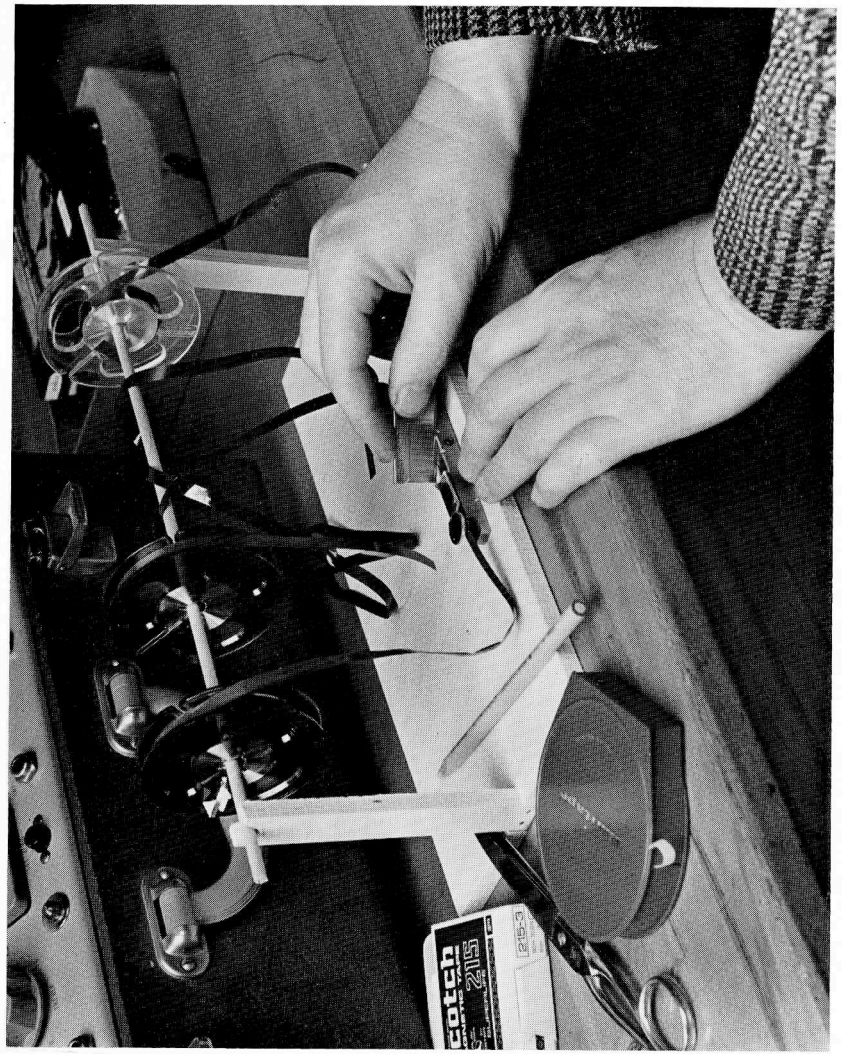
There are various ways of solving this one. You can either seek to have one 'instrument' static in one speaker and the other alternately joining it and hopping back again (keep the two in different pitch registers or different duration groups or different timbres) or you can have two static (different) instruments and a third one moving across. Remember: to get movement use the same *type of sounds from both channels; to get separation there must be some difference. The more difference the clearer the separation.*

TECHNIQUE I FLOODSOUND

The Sound-on-sound technique available on stereo machines means that any recording (whether a single one or the result of multiplay) can always be transferred *without* alteration or addition to the other track. Because this is achieved by the playback head feeding back the signal to the record head, and because these two heads are a little distance apart, the two recordings will not be dead level on the tape. This fact can be used to give a remarkably interesting effect. Transfer any recording in the manner just



3
Using a loop supported by a heavy coffee-jar. Notice the lead from the output socket, which is fed to a second tape recorder.



4
Editing, using three-inch spools on a home-made stand. The right-hand spool holds the finished tape: it is being made up of previously marked pieces to be cut from the first two spools, also the short odd piece seen draped on the stand. Besides the splicing-block and razor-blade, notice chinagraph pencil, scissors for rough cutting, and proprietary jointing tape in plastic container.

described and play back both tracks as if for stereo. Every sound on the recording comes first from one speaker, then immediately from the other. The actual time-lag depends on the playback speed (try them all). With anything but short sounds, there is usually an overlap and thus everything seems to flow out of one speaker into the other. This seems to correspond to Stockhausen's *Flutklang* as used in *Kontakte* so we may call it Floodsound.

The effect is possible with two mono recorders. Copy any recording on the second machine and start the two playbacks not quite simultaneously. (Actually you can usually achieve this effortlessly by attempting a synchronous start!)

EXERCISE 33
Make a superimposition of four layers: paper tearing (slowed down), whistling (speeded up), dropping different objects (reversed), and drum beats (muffled mike). Transfer all this to the other track without addition. Try playback at different speeds.

(20 seconds)

TECHNIQUE J TWO-CHANNEL (COMBINED)

Here we record the same signal on both channels at once but control the separate input volume controls carefully. If they are equally set, the playback should appear to come from a point midway between the speakers. If they are unequally set then clearly the sound will appear to come from a different point in space. We can control the location and make it appear to come from any point between the speakers, or solely from either speaker.

EXERCISE 34
Record any continuous or 'wild' sound, such as conversation. Have both channels recording but only one volume control up. Slowly fade this channel out and the other in. Repeat this process, getting quicker each time. The result seems to move across the room at various speeds.

(30 seconds)

EXERCISE 35

Using the technique of Exercise 34, transfer any recording from another tape recorder to give a similar effect.

(30 seconds)

EXERCISE 36

Make a piece of music which plays first from one speaker, then the other, then both (different signals), then floodsound, then gradual movement across, then both speakers (same signal). Scissor cutting may be used. Consider the result critically.

(2 minutes)

What you must assess is whether the changes of location and movement represented a logical and interesting succession. Did the various methods appear in the best order? Was each section played for the right length of time? Was one method better than the others? Would it have been good to return to any method a second time? These questions should first be answered without reference to the material on the tape. Then, with *reference to the material used, ask yourself: did the various methods of space organisation suit the material involved? Were changes made at the right moment in respect of changes in the material? If dissatisfied with your answers on the whole, try this exercise again in a different way.*

TECHNIQUE K FLOODSOUND PLUS

It is perhaps worth mentioning here that it is possible to combine floodsound with other sounds which remain in one speaker. In transferring the flood signal to the other track, simply add another layer (by mike, if single; by tape transfer, if multiple). In fact, one gets an example of this combined effect by playing back both tracks at the end of any normal multiplay operation. (Possibly you've already done this by accident.)

TECHNIQUE L ECHO

Some stereo machines have an echo button. If not, it should be possible to use the Sound-on-sound button for the same purpose, if recording in stereo. The volume of the echo is controllable by its own knob, which, if set too high, allows the echo to take over and become a purely electronic sound. The effect of the echo is something vaguely between room resonance and repeated Floodsound, but for my taste, sounds too mechanical and 'corny'. Use it very sparingly; it is no great loss if you haven't got it, except as a possible substitute for reverb conditions if you can't achieve them normally. Owners of some mono machines might manage it. The machine must have separate record and playback heads and should not automatically disconnect the loudspeaker when recording. Record with the playback volume turned up (experiment with the amount). The mike picks up the signal just recorded and repeats it at diminishing volume.

EXERCISE 37

Reconsider all the techniques available. (They are summarised at the end of this chapter.) Select *one* sound and make a short loop of it for convenience. Feeding from the other machine, transform it in various ways to make a *motive*. Make a loop of the motive. Use this to build up textures and two-channel effects.

(1–2 minutes)

EXERCISE 38

Construct a Sonatina thus:

1st subject: Tones combined with Sones (no speed change).

2nd subject: Pseudotones combined with Mistones (no speed change).

Development: Any of the above, processed as you wish.

1st subject: Exactly as before.

2nd subject: As before, but cross-edited with parts of Development injected.

Coda: Long slow fade-out of any kind.

(1–5 minutes)

SUMMARY OF TECHNIQUES

Here once again are the main techniques of tape composition, with a few brief comments.

Choice of sound source. A personal matter; but Tones and Sones generally need more processing than Mistones and Pseudotones.

Control of volume. Use instinct or obey a plan. Don't have everything at the same dynamic level.

Mike placement. Very soft sounds need close mike. Others can use muffled mike, normal placing or reverb placing. The latter is particularly useful.

Speed change. The most important technique of all; should be the first thing considered. Don't overlook the possibility of two or more removes. Slowing spool by hand makes an occasional variant.

Reversal. Has most effect on fading sounds; irreplaceable for these. Short sounds may 'disappear' or all tend to sound alike.

Superimposition. Needed to build complex textures, also for an additive approach to composition. Best indulged in by owners of sophisticated equipment.

Loops. Sometimes useful for ostinato; not essential.

Editing. Can often make all the difference to formal quality. Not essential if enough foresight used.

Two-channel effects. (Contrast, antiphony, space movement, flood-sound.) Highly desirable for advanced work.

Echo. A tiresome gimmick if not used discreetly.

8 Planning Complete Compositions

It is now time to consider the general principles of musical composition, and to give guidance and further exercises until the reader reaches the point where, safely or otherwise, I must leave him to his own devices. No new recording techniques will be explained. If he can invent his own, well and good; but I am assuming the full use of whatever techniques his equipment permits.

The overall design of a piece of music is referred to as its form. The object in formal planning is to maintain the listener's interest throughout the composition. Interest is most easily maintained by change and contrast, but it must be remembered that constant change is as tiring and uninteresting as monotony. Some form of repetition or unity is important as a rule, though less so in the view of the *avant-garde* than with 'old' music. More of this later.

DRAMA AND MUSIC

Let us start with the assumption, correct or not, that it is desirable to make a strong effect on the listener—to astound, move and impress. To put it another way, we will try to be dramatic, because in practical terms, being dramatic in music implies a high proportion of change and contrast. It is difficult to be dramatic while you go on doing the same thing (though it might be possible to maintain tension—this could be said to have a certain 'dramatic' value). Another implication of the word 'dramatic' is that the music would suggest, or fit, certain actions played out by actors, dancers or mimes. So it will be well if our next exercises are concerned with interpreting certain actions or situations in music, or of providing music for balletic or mime exercises such as are often found in school drama classes and similar places.

On first acquaintance, tape music often arouses images of space

travel, weird monsters, underground caverns and evil spirits. It is certainly well fitted for suggesting such things, but the chief reason for the association is that all these things are 'strange' and so is tape music to the average listener. When we grow more accustomed to the medium, we realise that it shares with other music a much wider range of expressive features. Let us look at some of the symbolic effects or 'meanings' that certain musical procedures may be considered to have. The equivalents given below are subjective to a large extent but will be found almost universally valid.

Rhythm:
Steady beat = constant progress
Unsteady beat = erratic action
Equal notes, or duple time = strong, masculine, square, plain
Unequal notes in recurring pattern, or triple time = weak, feminine, round, graceful
Crusis (accent followed by one or more weaker notes) = static, self-sufficient, heavy
Anacrusis (group of notes ending in accent) = dynamic, searching, moving forward
(Note that fading sounds and diminuendo are similar in effect to crusis, and reversed fading and crescendo are similar in effect to anacrusis.)

Pitch. The symbolism of registers:
High = bright, light (both meanings), ethereal, remote, small, cheerful
Low = sombre, dark, earthy, heavy, large, gloomy
Medium = neutral, normal, human

The symbolism of pitch movement:
Up = rising motion, aspiring, exciting, any outgoing effort
Down = falling motion, relinquishing, relaxing, receiving, coming home
Up and down alternately by jerky leaps = stepping, hammering or any mechanical reciprocating motion
Ditto by small smooth steps = waves, floating, flying, spinning or any circular motion
Trill or tremolo = activity within inactivity, e.g. trembling, hesitating, thinking, shaking

Texture:
Thin = simple, solo, insubstantial
Thick = complex, multitude, engulfing

Volume:
Soft = mysterious, unemphatic, sleepy, gentle
Loud = emphatic, clear, strong, menacing
Silence = suspense or rest (depends on context). Emphasises what follows.

Timbre
Symbolic meanings of tone-colours are either obvious (e.g. bells suggest church, side-drum suggests the army) or else subjective, working by less obvious associations. It is perhaps best to use tone-colours for their abstract value rather than for supposed symbolic meanings.

Hints such as the above can serve to set a composer going when he is interpreting a story or programme in music. They are not sufficient in themselves to ensure a satisfactory result, but the initial impetus is valuable and the symbolic equivalents can be drawn on at any time when inspiration is flagging. Classical composers have used such devices for centuries.

EXERCISE 39
Compose a short undramatic piece to illustrate work in a steel foundry. Use only glockenspiel, piano and bass drum (or Pseudo-tone equivalents) and make free use of ostinato (an incessantly repeated motive or pattern). Loops will obviously be useful.
(40 seconds)
Beginning with an undramatic piece should help us to pinpoint what is required for the opposite.

EXERCISE 40
A lone speaker shouts from a soap box. No one hears him at first. One by one a mob assembles. They are then lashed into a fury by the speaker until the mob explodes in a violent disintegration. Illustrate this in music, choosing your own sounds.
(1–2 minutes)

EXERCISE 41
Compose music for a ballet which is to derive its moves from your music. Use the form ABA. A is calm and ethereal, B is quick and

menacing. A reappears but keeps a quiet undertone of B in it this time. Use pitched fading sounds only.

(2 minutes)

EXERCISE 42

The sparrows launch an attack on the elephants. A fierce battle ensues. Elephants crash to the ground one by one and the sparrows are left victorious. Illustrate this in music.

(2 minutes)

EXERCISE 43

A small group of shepherds sit making music on the hills near Bethlehem. Suddenly they hear ominous rustlings and are afraid. The noise stops and, after nervous discussion, they resume their playing. The rustlings repeat and this time grow to a stupendous climax of heavenly music. The shepherds listen, awestruck, till the sound fades away. This is a difficult assignment. The music requires several well-defined styles and might therefore be a group project.

(2–3 minutes)

EXERCISE 44

A spaceship sets off from the earth and journeys towards the nethermost planets. An accidental blow from a meteorite sends the ship spinning headlong to the nearest planet, where it lands with a terrifying and destructive crash. Hordes of tiny creatures swarm excitedly over the wreckage.

(2–3 minutes)

It is very important to listen to this piece critically from two viewpoints: (1) how faithfully have I interpreted the story? (2) Is it interesting as music, in the abstract sense? You may find that the more you can say 'yes' to one question the more you have to say 'no' to the other. This should lead you to a vital conclusion.

EXERCISE 45

Invent a situation or story of your own and illustrate it in tape music.

(1–3 minutes)

EXERCISE 46

Compose a piece for its abstract qualities so far as you can. When the piece is finished (not before!) find a plot which it could illustrate.

(1–3 minutes)

Does the music now sound any better or worse for the existence of the plot?

The faithful following-out of a dramatic plot does not in itself guarantee a good piece of music. The music should stand on its own feet and be worth listening to without the accompanying action. Some plots (see Exercises 40, 42 and 43) almost guarantee a valid formal design in the music, others, such as Exercise 44, almost preclude it. The moral would seem to be: only use a story if its plot seems to promise a good musical design. Alternatively one may draw one's initial inspiration from an extra-musical idea and abandon it for a more abstract plan as soon as it is no longer useful.

TENSION AND CLIMAX

Music may be abstract in the sense of being free from a story, yet may possess the power to evoke emotion by mood establishment and the creation of tension. This can also help to fulfil the formal need for change without being fettered to a story. I now summarise the different means of creating tension and its necessary opposite, relaxation. (For the idea of the layout I am indebted to Reginald Smith Brindle, though many of the details are my own.)

TENSION	RELAXATION
Duration-forms:	
Short	Long
Quickly fading	Slowly fading
Reversed fading	
Tremolo (at first)	Tremolo (if continued)

TENSION	RELAXATION
Rhythm:	
Fast tempo	Slow tempo
Acceleration	Deceleration
Anacrusis	Crusis
Irregular proportions	Regular proportions
Pitch:	
High or very low registers	Medium and low registers
Widespread pitch differences	Close pitch differences
Rising generally	Falling generally
Texture:	
Thick (many elements)	Thin (few elements)
Contrasting elements	Similar elements
Volume:	
Loud	Soft
Unexpected silence	Silence following point of repose
Volume changes and contrasts	Similar volume levels
Timbre:	
Unusual, harsh or striking timbres	Pleasant or commonplace timbres
Sones and Mistones	Tones and Pseudotones
Contrasting timbres	Similar timbres
Form:	
Contrast	Repetition
Variation	Ostinato
Development	Recapitulation
Forms such as Variations, Fugue	Forms such as Ternary, Rondo

To maintain tension indefinitely is not a good idea, as this in itself lacks change and can lead to loss of attention. Tension (T) should alternate with relaxation (R) so that the two complement each other. Thus we have certain universally basic formulae:

(1) Two-section forms: RT
TR (see Exercises 3, 4 and 8)

(2) Variants of these: $R\nearrow T$ = Climax (Exercise 12)
$T\searrow R$ = Anticlimax

(3) Three-section forms: RTR
TRT

(4) Variants of these: $R\nearrow T\searrow R$ (Exercises 13 and 41)
$T\searrow R\nearrow T$

Extensions and combinations are possible, for example
$TR\nearrow T\searrow RT$

Whether the changes are sudden or gradual must be the composer's choice. Of course the sudden changes are more compelling but the gradual ones are longer lasting in effect.

EXERCISE 47
Reconsider your solution to Exercise 40. It is of course a gradual climax. If you are not satisfied with the increase of tension, rework the exercise in the light of recent knowledge.
(1–2 minutes)

EXERCISE 48
Compose an anticlimax for tambourine, bongos, castanets, cymbal, maracas and guitar (or their Pseudotone equivalents). Use a permutation method. (This implies varying combinations. With six elements as here, we could have each sound singly, or every possible pair, trio, quartet and quintet before finally hearing all six together. Taken in the order just given, this produces a climax, so we would use the reverse procedure. N.B. It is unnecessary to show *every* possible combination.)
(2 minutes)

EXERCISE 49
Listen to the first movement of Sibelius's *Karelia Suite*, or Grieg's 'Death of Åse' from *Peer Gynt* or Britten's 'Dirge' from *Serenade* or Wagner's 'Liebestod' from *Tristan und Isolde*. (These all embody the plan $R\nearrow T\searrow R$.) Compose your own piece modelled in method (but not in style!) on one of these pieces.
(3 minutes)

EXERCISE 50

Compose a piece for two pairs of performers. Pair A consists of a male speaker who says nothing but 'Run, shoot, burn, kill' over and over again, also a timpanist with three differently pitched drums. Pair B consists of a female speaker who says nothing but 'Rest, sleep, be still' repeatedly, and a chime bar or glockenspiel player who is restricted to three different pitches. Make up your own dramatic scheme. This is obviously a piece for two channels, if they are available. Take care that this does not end up as a recording of a live piece: use distortion techniques as usual.

(3 minutes)

CONTROLLING THE VARIABLES

In the table of Tension and Relaxation given above you will find seven types of variable factors, as well as some subdivisions (these variables are called parameters by the *avant-garde*, for some reason). In order to move from tension to relaxation it is not necessary to change *all* the variables. For example, quite monotonous music can be made to have a climax merely by gradually turning up the volume. Getting louder and getting faster are the two most obvious tension-gaining devices, but you should explore all the variables and make constant decisions to change some and retain others. Retention of relaxation in some directions is normally essential to prevent too much change, and thus a loss of the listener's attention. If you look back at Exercise 18 you will realize that a climax and anticlimax were achieved mainly through changes in texture and timbre (though it is true that the total volume and total rhythmic activity followed suit automatically—to say nothing of hidden harmonic and melodic factors: you may care to ponder these). But other variables (tempo, rhythm, form) probably remained constant, as did all factors within each of the seven individual sections of the piece. If this is not so in your solution, there is possibly too much change, and perhaps you would like to rework the exercise with a less confusing result.

Another aspect of controlling the variables is the expression of

a composer's personality through maximum use of those variables which interest him, and comparative neglect of others. Two examples of well-known composers may help to clarify this. Bach's music, on the whole, relies heavily on melody and counterpoint, with harmony and form well organised, far less interest being displayed in rhythm and timbre. The music of Delius, by contrast, relies heavily on tone colour and harmony, less on rhythm and melody and hardly ever on counterpoint or form. One could multiply examples: Brahms's richness in all directions, Stravinsky's preoccupation with rhythm, and so on. When you are an experienced composer you will know where *your* strength lies; meanwhile as a student you should practise in as many directions as possible. Try the following exercise:

EXERCISE 51

Arrange a climax and anticlimax as follows: begin with tension in (1) rhythm, texture and timbre; relaxation in (2) pitch, volume and form. (Duration-forms are free throughout.) Make your climax by gradually raising group (2) to tension, then the anticlimax by relaxing group (1) only. It may be convenient to plan this on paper first.

(2–4 minutes)

Sometimes you may keep a variable constant throughout a piece. (Classical composers often wrote, for, say, piano alone and at a constant tempo. Sometimes even melodic and rhythmic factors remain constant—see Bach's First Prelude in C.) The effect is to secure unity, of course—a desirable feature.

EXERCISE 52

Listen to *Bowery Bum* by Mimaroglu (see Appendix A, first record). See what you can do with one Sone of your choice. Vary the pitch as much as possible.

(1½ minutes)

We cannot stand much pitch monotony, but you might enjoy seeing what you can do with one pitch (say Middle C).

EXERCISE 53

Using only one pitch (this means in the final result, not *before* speed changes!) maintain interest by means of the other variables.

(1 minute)

If you can go on for as long as one minute successfully, you are doing very well.

MATHEMATICAL PROCEDURES

Mathematics and music have always gone hand in hand to some extent. The importance of calculation as opposed to instinct has been subject to various pendulum swings of fashion during the history of music. At present the climate of opinion seems in favour of certain mathematical methods in music. They certainly seem appropriate to tape music, which is after all a product of the technological age. Let us consider these possibilities:

Measured Editing

Editing has so far been done in pursuit of a formal result the validity of which was assessed by instinct. It is possible to edit tape to a preconceived mathematical plan.

EXERCISE 54

Make two contrasting tapes each having continuous music on them. Cut and edit thus: 3 feet of A, 3 feet of B, 2 feet of A, 2 feet of B, 1 foot of A, 1 foot of B, and so on down through 6 inches to 1 inch. If desired, you may also work back to 3 feet again.

(40-80 seconds)

The effect is of accelerating (and decelerating) change. This was always possible, but it is now achieved mathematically.

EXERCISE 55

Cut and edit two contrasting tapes thus: 3 feet of A, 1 inch of B, 2 feet of A, 2 inches of B, 1 foot of A, 3 inches of B and so on till 1 inch of A, 3 feet of B.

(40-80 seconds)

The effect is of a gradual takeover. If felt to be tedious, change lengths at a quicker rate, using fewer sections of tape.

EXERCISE 56

Prepare four different tapes and edit thus: $\frac{1}{2}$A, $\frac{1}{2}$B, $\frac{1}{2}$C, D, $\frac{1}{2}$C, $\frac{1}{2}$B, $\frac{1}{2}$A.

(1 minute)

Provided the material on each tape is consistent and distinct from the others, we get a mirror structure in which we seem to progress backwards after a mid-point. (Tape reversal would achieve this result with more literalness, but the effect might be unrecognised by the listener.)

Permutation

This has already been used in Exercise 48. There it was the timbre/texture that was being permutated. But any factors may be permutated. Here, for example, I permutate 3 volumes with 4 durations:

loud	1 sec.	loud	3 sec.
fairly loud	2 sec.	fairly loud	4 sec.
soft	3 sec.	soft	1 sec.
loud	4 sec.	loud	2 sec.
fairly loud	1 sec.	fairly loud	3 sec.
soft	2 sec.	soft	4 sec.

I could now record sounds to follow the above table in *any* order. (Once the permutation is worked out the order may be changed.) If they are, however, taken in the order given, we also have a simple example of serialism.

Serialism

For a full account of serialism, its history and implications in music generally, the reader should seek appropriate literature. Briefly, it may be summarised as the use of a fixed order of events (the series) constantly repeated in the same order, or in derivative variations of the order. Thus we might take a drum-stick and hit: cymbal, triangle, woodblock, drum, cymbal, triangle, woodblock, drum, cymbal, triangle. . . . Or we could play high, low, medium,

high, low, medium. . . . These are such crude examples of serialism that they are better described, perhaps, as ostinati. In practice a series is not repeated without variation of either the series itself or accompanying factors, perhaps on a permutation method. Total serialism is the use of a predetermined series in every variable of the music. It calls for much patient paper work as a rule, though a tape composer can often work short cuts. Here is a simple example:

EXERCISE 57

Use the following set of series in permutation (not necessarily exhaustively):

Timbre:	Drums, coughing, glasses clinking
Rhythm:	4 fast notes, 1 long note
Durations:	10 seconds, 4 seconds, 7 seconds, 1 second
Texture:	Thick, thinner, thinnest
Volume:	Gradual crescendo, sudden silence
Pitch:	High, medium, low, medium

Work as follows: record four fast notes and one long note on each of the three sound sources in turn. Join into a loop. Play the loop from the second machine and accept the recording on the first machine at speeds 1, 2, 3, 2 in turn (this gives required pitch series) for 5, 4, 14 and 1 seconds respectively (this gives 10, 4, 7 and 1 seconds when played back at speed 2). Keep this up for 280 seconds. ($10 \times 4 \times 7 \times 1$. Why not?) Using this tape as material build up superimpositions of 3, 2 and 1 layers lasting 1, 7, 4 and 10 seconds in permutation. Finally transfer this again, beginning volume zero, turning volume gradually up to maximum, suddenly dropping to silence and repeating, in bursts of 4, 7, 1 and 10 seconds.

(Any length)

Even this does not exhaust the possibilities. If you have stereo you could arrange a space series, e.g. L. H. speaker, R. H. speaker, movement from R to L, both speakers; using yet another variant of the four durations. If the result of the exercise is felt to be monotonous, the number of items in each series could be extended indefinitely, and the length of the piece adjusted.

The exercise just outlined contains, crudely no doubt, the essence of modern serial methods. One could and should stop to question whether the results are musically satisfying. It may be objected that the composer has lost control over tension and relaxation and form, which will now be the result of 'chance'. This is the dilemma which faces modern composers. But it is similar to the dilemma brought about by programme music (that with stories or other illustrative properties). The crux of the matter is simply stated thus: use stories by all means, use computer methods by all means, but always check that the result is musical and is interesting in itself, without a knowledge of what brought it into being. Can the result stand on its own feet? Does it maintain the listener's interest?

CHOICE OF STYLE

In an earlier chapter I urged the reader to avoid similarities with 'orthodox' music, and he may have been bothered by certain recommendations which seemed to imply an imitation of traditional methods. Then again, *avant-garde* techniques have been referred to. What is one to follow? Here's another dilemma it is time to try resolving. I shall summarise below the tendencies of traditional, or 'old' music as opposed to *avant-garde* music, especially electronic. I feel that a complete adherence to one or the other is dangerous. Following traditional methods entirely makes communication with listeners a safer proposition but may tend to ignore the true nature of tape music and the excitement of a new medium. Following only the *avant-garde* is more suitable in many ways but can we be sure they know what they are doing? (or that *we* know what they are doing?) We may fail to communicate if we don't keep *something* traditional. Please study the summary (which is necessarily oversimplified, by the way) and try to decide which methods appeal to you. Pick freely from both sides according to your own temperament and knowledge; thus in future work you will develop a personal style.

OLD	NEW
Time in general: Governed by measured beat	Governed by estimation or clock calculations
Tempo: Mainly constant	Usually variable
Rhythm: Durations in perceptible proportion	Durations in imperceptible proportion
Repetitive patterns used	Repetition avoided
Pitch in general: Definite	Less definite
Related through tonality	Atonal
Melody: Clear and continuous	Broken up, vague or non-existent
Harmony: Vertical combination of pitches important	Vertical combinations not always taken into account
Relationship between consonance and dissonance	Distinction no longer valid
Counterpoint: Always adds up to harmony	Harmony ignored
Textures: Mainly thick	Thin for preference
Volume: Instinctive, expressive, dramatic—seldom structural	Similar but sometimes structural
Timbre: Relatively unimportant or interchangeable	Of first importance
May remain static for whole piece	Ever-changing
Melodic instruments favoured	Percussion instruments favoured
Form: Sections well-related	Sections vaguely related or unrelated
Repetition	Change
Themes	Lack of themes
Development of themes	Development of ideas and concepts often mathematical
Symmetry	Asymmetry
General: Based on humanity	Based on technology

DEPLOYMENT OF RESOURCES

I would like to give advice here on a matter which is applicable to musical composition in all styles, old or new, and for that matter in a number of other fields of human endeavour. Quite simply the advice is: don't play all your cards at once. Keep a few aces up your sleeve. It is a matter of deploying one's forces intelligently. Let us consider two composers widely different in style: Giovanni Gabrieli and Mozart. Many of Gabrieli's pieces are

for two groups of performers, separated spatially and/or by other considerations such as pitch register and timbre. A common plan in these compositions is:

(1) Show 1st group for a fair period
(2) Show 2nd group similarly
(3) Show 1st group for a shorter period
(4) Show 2nd group similarly
(5) Begin to overlap alternate appearances, shortening until
(6) Both groups play together

In Mozart's mature operas we often have a duet in which two characters are at first opposing or arguing, and then agreeing. The procedure is exactly similar:

(1) The characters sing solo in turn
(2) The solos shorten and overlap
(3) The pair sing together

It isn't only performers who are presented in this fashion. Themes too are sometimes introduced separately and then combined. The principle is the same: show single possibilities before combining. It can obviously be applied to many elements of tape music, such as tempos, source categories, tape reversal, speed changes, two loudspeakers and so on.

Where three elements are involved we have a choice of methods:

A (1) Introduce the three elements separately
  (2) Combine in various duos
  (3) Combine all three
B (1) Introduce two elements separately
  (2) Combine these two
  (3) Introduce 3rd element
  (4) Combine all elements bit by bit

Another general possibility is the reverse procedure, namely revealing all at once and then dismantling into components. Or this could come after the first plan, so that we get climax and anti-climax once again.

Having pointed out the effectiveness of this approach I must

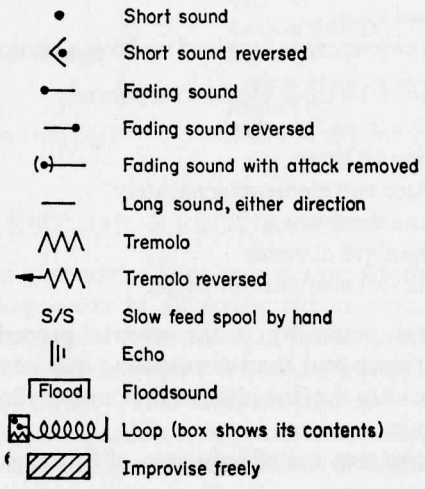
warn that it should not be given the status of a rule. It is actually a device for securing the maximum tension and clearly it would be possible to get relaxation by avoiding it. Just bear the whole matter in mind when planning a composition.

PLANNING ON PAPER

It may be convenient to plan a composition on paper. This should be attempted (*a*) if you have, or think you may have, the gift of aural imagination which enables you to hear the composition mentally as you write it down, or (*b*) if you are using computational methods. In the latter case try also to hear the result mentally before beginning work on the tape.

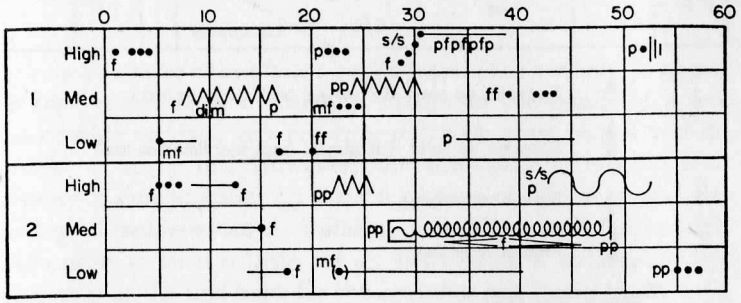
The following procedures and symbols are suggested:

(1) Use squared paper for convenience
(2) Horizontal dimension represents timing (exactly or approximately)
(3) Vertical dimension represents pitch (approximately)
(4) Volume is indicated by conventional musical signs (see Glossary)
(5) Durations and devices are symbolised thus:



A typical section of tape score is shown below. Perhaps you would like to realise it on tape. It is given as a two-track piece, but you can treat it as two pieces if you cannot manage two channels.

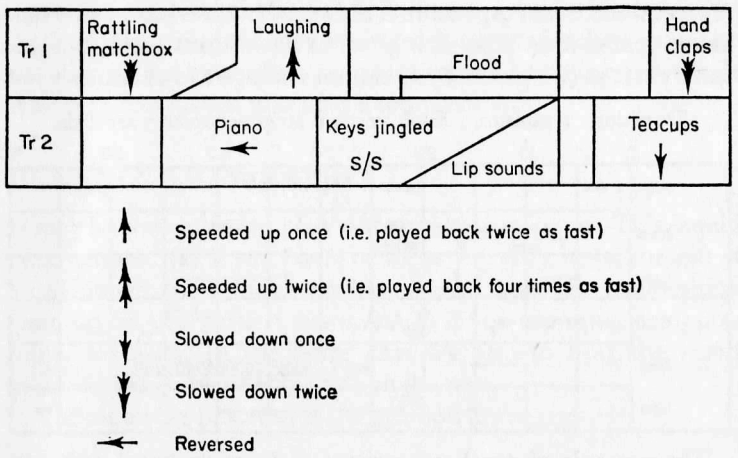
Duration: 1 minute. Each vertical strip occupies 5 seconds.



The example given shows variety of duration types, volumes, pitches and textures. For this reason it is best to simplify the tone colour aspect and confine the sound sources to as few as possible in order to give unity, for example triangle for the fading and tremolo sounds, voice for the long sounds and woodblock or box for the short sounds. Preliminary thought is needed to arrange the pitches in the right area without miscalculating the time element. For instance the final three-note motive should be roughly at the same tempo as at the beginning in spite of the speed change necessary to put it at low pitch.

The most difficult aspect of realising scores like the above is timing. A stop-watch may be necessary for some situations like the reversed sounds in track 2, though careful monitoring may be sufficient. (Use Synchro device if you have it.) In most cases, however, it is not the precise point in time which matters, *per se*, but the order of the events and their approximate proportions. Quite often a rev counter will give all the help necessary, though take care when using reversed play!

The piece just discussed exploited several other variables rather than timbre, and even had repetition. It was, in fact, 'old-fashioned'. The *avant-garde* approach of being primarily interested in tone colours would lead to a different kind of score. In this the symbols used are:



Blanks are silences. Timings can either be calculated or judged in performance. Here the composer is interested mainly in a sequence of individual tone-colours, therefore rhythmic patterns and volumes would be achieved by instinct and improvisation. This sort of thing could go on indefinitely, though it would be wise to edit the result.

Of course you may prefer to do without a score entirely, making it all up as you go along. Why not? Conventional music *needs* to be written down for the benefit of future performers; tape music can be fixed immediately and need never be written down. Just as some people can play the piano by ear, so you may be better off composing tape music by ear.

CHOOSING A METHOD

No further exercises will be given: find your own starting-points. These may be any of a number of things—an interest in certain sounds, a desire to create a piece from one source or exploring one main variable, a mental plan or shape, serial experiment, a drama programme, or an emulation of a piece you admire. The whole medium of tape music is relatively unexplored, and no one can yet say that any given method of working is the best.

9 Quo Vadis?

By now you have either fallen by the wayside or are keen to go on. As tape music is in its infancy, except in the hands of a few inaccessible experts, you are very much on your own if you do decide to carry on. However, the drawback of unchartered venture is compensated by the excitement of discovery and the feeling of achievement. Perhaps soon there will be enough enthusiasts to turn a little-known hobby into a national sport! This may be the first book for the beginner but I very much hope it will be followed by other books—better written, more advanced, more helpful, to cope with a growing demand and a growing knowledge.

What can we do in the meantime? Several things—first and foremost go on composing tape music. Next, find outlets for its performance—admiring friends, fellow composers, practical musicians, amateur play productions, etc. Seek new outlets: one possibility is the combining of live and tape music (already a commonplace with the *avant-garde*). Make friends with a musician or music teacher and discuss what could be done in this direction. Of course if you are a musician yourself you need no more than this hint to explore the possibility. Think of other uses for tape music if you can.

Get more and more acquainted with music in general and contemporary music in particular. Listen to records and read books. Visit lectures and concerts. Listen to radio and television, keeping an ear open for tape and electronic music, particularly by the B.B.C. Radiophonic Workshop. Keep learning. Most musicians and music teachers I have met have a bad blind spot where contemporary music is concerned: does this apply to you? One thing to explore when you are ready is the use of exact pitch. If you can learn to adapt serial pitch procedures to tape technique your music should gain enormously. Serialism would appear to

suit tape music to some extent, though obviously other systems are possible.

Take an interest in tape recorders and hi-fi generally. Read the appropriate magazines and join a local tape recording club—or start one. Increase your equipment as you can afford it. If you still haven't done a combined equipment project with someone else, take the plunge. Explore further technical possibilities, e.g. four-channel recordings, interchanging attacks and decays of different sounds by skilful editing, etc.

Keep your ears open always and develop further your ability to analyse sounds and sense their potentialities. Enlarge your stock of musical instruments, real or substitute.

The appendices which follow contain suggestions which should help you. Good hunting!

Appendix A Recommended Records

in order of priority

Electronic Music (*Various Composers*) TV 34004S
Although the music is by minor composers, this record of seven pieces makes an excellent introduction to the subject. In spite of the title, the pieces are fairly evenly divided between electronic sounds, *musique concrète* and 'live' sounds. The pieces are about the length an amateur might aim at.

Stockhausen: Kontakte and *Gesang der Jünglinge* SLPM 138 811
Kontakte (Contacts) is purely electronic, though a second version exists (not on record) with two live performers added. The Children's Song is a mixture of electronic sounds and *musique concrète* derived from the human voice.

Varèse: Déserts (and other pieces) SBRG 72106
Interesting juxtapositions of tape and live music by a venerable pioneer of the *avant-garde* style.

Stockhausen: Gruppen and *Carré* DGG 137 002
Though examples of live music, the pieces are enormously instructive of contemporary methods which can be applied to tape music. *Gruppen* (Groups) is at least 19 years old and an acknowledged masterpiece.

Switched-on Bach CBS 63501
An amusing version of some favourite Bach pieces. The sounds are produced electronically and their spatial deployment is very instructive. Apart from this, the record is a winner and should appeal to all tastes.

Dissevelt: Electronic Movements 430 736 PE
Popular-type melodies treated conventionally as to harmony, rhythm, etc., but using a miscellany of fascinating electronic timbres. Should prove enjoyable to those who cannot stomach the *avant-garde*.

Electronic Music by Berio, Cage and Mimaroglu TV 34046S
Three substantial pieces: *Visage* by Berio, *Fontana Mix* by Cage and *Agony* by Mimaroglu. Outstanding use of human voice by Cathy Berberian.

Music by Schoenberg, Webern and Berg ASD 2349
Three important composers of the earlier twentieth century who influenced the *avant-garde* and initiated many procedures used in contemporary and electronic music.

In case any of the above records are unobtainable, consult dealers and The Gramophone *catalogue of classical records. New recordings of electronic music are constantly appearing.*

Appendix B Recommended Books and Magazines

grouped by subject and in order of priority

Traditional Music for the Beginner

Boyden	*An Introduction to Music*	Faber
Thorpe Davie	*Musical Structure and Design*	Dobson
Holst	*ABC of Music*	Oxford
Tovey	*The Forms of Music*	Oxford

All the above give information about traditional forms and compositional methods.

Contemporary Music and Composition

Routh — *Teach Yourself Contemporary Music* — E.U.P.
An excellent concise exposition of modern music.

Brindle — *Serial Composition* — Oxford
An exhaustive survey of modern compositional methods. No reference to electronic music, but indispensable for the serious student of tape music.

Die Reihe (several vols.) Universal
Actually a periodical, but the English translation is perhaps available at public libraries. Contains important articles by Stockhausen and others.

Dennis — *Experimental Music in Schools* — Oxford
Although intended for teachers it has some ideas useful to the tape composer.

Scores for Study by the Non-musician

Self	*New Sounds in Class*	Universal
Self	*Two Groups*	Novello
Bedford	*Whitefield 1*	Universal
Stockhausen	*Kontakte* (performing version)	Universal
Cardew	*Four works* (UE 14171)	Universal

None of the above needs a knowledge of music reading for its understanding, but all are full of stimulating ideas appropriate to tape music.

Simple Instrument Making and Playing

Roberts	*Musical Instruments Made to be Played*	Dryad
Mandell & Wood	*Make your own musical instruments*	Sterling Pub Co., N.Y.
Blades	*Orchestral Percussion Technique*	Oxford

Tape Recorders and Equipment; Sound Generally

Lloyd	*The All-in-one Tape Recorder Book*	Focal Press
Judd	*Electronic Music and Musique Concrète*	Spearman
Nisbett	*The Technique of the Sound Studio*	Focal Press
Hack	*The Tape Editing Guide*	Focal Press
Peters	*Modern Tape Recording and Hi-fi*	Faber
Wood	*The Physics of Music*	Methuen
Schafer	*Ear Cleaning*	Universal

Monthly Magazines

Studio Sound & Tape Recorder	Link House Publications
Tape Recording Magazine	Print Press Services
Hi-fi Sound	Haymarket Publishing Group
The Gramophone	General Gramophone Publications
The Musical Times	Novello

Appendix C Useful Instruments

in order of priority

N.B. These are mostly cheap percussion instruments. (The usual orchestral instruments are omitted here, though they may certainly be used if available.) There are three possibilities:

(1) Buy good quality instruments made for school use. Send for catalogues from Boosey & Hawkes Ltd., 295 Regent Street, London, W1A 1BR; Studio 49, c/o Schott & Co., Ltd., 48 Great Marlborough Street, London, W1V 2BN; Premier Drum Co., Ltd., 87 Regent Street, London, W.1.

(2) Make substitute instruments at home, as described in the books by Roberts and Mandell & Wood (see Appendix B).

(3) Use Pseudotone equivalents as given in the second column below.

INSTRUMENT	PSEUDOTONE EQUIVALENT
Piano	No real equivalent
Cymbal on stand	No real equivalent. Buy best you can afford
Hard drum-sticks	Dowel rods or wooden knitting-needles
Soft drum-sticks	Dowel rods with felt, cloth or cork heads
Descant recorder or tin whistle	Human whistling
Woodblock	Block of wood with slit or cavity
Hand drum	Table or desk
Maracas	Dried peas or sand in tins or jars
Triangle	Steel cutlery on tablecloth
Triangle beater	6-inch nail
Xylophone (Orff type)	Lengths of wood on foam-rubber supports
Glockenspiel (Orff type)	Lengths of metal tubing or glasses tuned with water
Bass drum	Oil drum or cupboard; blown-up balloon held by mouthpiece and banged on other hand
Finger cymbals	Two small pieces of steel dangled on string
Claves	½-inch dowel or meat bones
Chime bars (3 or 4 sufficient)	No real equivalent
Guitar or Dulcimer	Rubber-bands stretched on cigar-box

Scraper	Bamboo with saw-cuts
Pair of cymbals	Saucepan lids
Side drum	Large tin or inverted saucepan
Castanets	Sea-shells, coconut shells or hollow wood-blocks
Tambourine	Metal bottle caps nailed loosely to a stick
Sleigh bells	Bunch of keys
Cowbell	Empty tin can
Gong	Tin tray
Wire brushes	No real substitute (N.B. Do *not* use domestic type intended for cleaning off rust, etc.)
No equivalent	Bottles struck or end-blown
No equivalent	Clay plant-pots struck
No equivalent	Wobble board (4 ft × 2 ft hardboard)

Appendix D Suggestions for Mistones

N.B. Some of the suggestions here might be regarded as legitimate methods of playing; however they are included because they may be unfamiliar to the reader and because exact classification is undesirable.

INSTRUMENT	METHOD OF PRODUCING MISTONES
Piano	Tone cluster by hand, arm, piece of wood.
	Hit strings with various sticks, wire-brushes, indiarubber, nails.
	Hit case or iron frame with pedal down.
	Sing loudly at strings with pedal down.
Violin family	Glissando (slide) with finger on string while bowing.
	Bow heavily to make crunching sound.
	Play on wrong side of bridge.
	Tap body.
Flute and recorder	Play head only, shading with palm at different angles.
Reed instruments	Play with section of body removed.
	Play reed only.

All woodwind	Thump keys loudly without playing (especially down the scale).
Brass instruments	Play with section of body removed. Play mouthpiece only.
Guitar	Pluck and damp strings immediately. Thump body in various places. Stroke bass strings up and down.
Drums, cymbals, gongs	Strike and damp with hand immediately. Use all types of sticks and wire-brushes. Hit different parts of instrument. Play edge of cymbal with violin bow.

Appendix E Suggestions for Sones

Mouth. Smack lips, whistle under breath, breathe heavily, utter single vowels, utter single consonants, click tongue, cough, yawn, gargle, tap cheek with mouth open, crunch celery or potato crisps.

Body. Clap hands, snap fingers, rub hands, thump chest, stamp feet, shuffle feet.

Paper. Rustled, crumpled, torn. Stretch a small piece between thumbs and blow it like a reed. Tubes of paper blown down or used to amplify vocal sounds. Pages of thick book flipped.

Box of matches. Rattled, hit full, hit empty, two boxes rubbed together on sandpaper, end of box blown out, match struck.

Water. Poured, splashed, gurgled with straw.

Furniture. Door slammed, table dragged, chair banged around.

Domestic machinery. Vacuum-cleaner, washing-machine, food-mixer, sewing-machine, hair-dryer.

'*Wild*' *sounds.* Conversation, laughter, traffic, birdsong, kitchen clatter, workshop sounds, rain, wind, thunder.

Glossary

antiphony	answering effect from two sources sited opposite
atonal	avoiding the use of key: freely using all possible pitches
attack	initial impact of a sound
channel	set of sound-reproducing components from tape track to loudspeaker inclusive
chinagraph	soft wax pencil able to mark glossy surfaces
crescendo	gradually increasing volume
decay	fading end of a sound
diminuendo	gradually decreasing volume
edit	select, reject and arrange into final form
electronic music	that deriving its sounds entirely from electronic oscillators
f	*forte*, Italian for loud
ff	*fortissimo*, Italian for very loud
flag	small piece of paper used to mark place on tape
floodsound	sounds heard first from one channel, then immediately afterwards from another
head	electro-magnetic device which contacts the tape
line	direct wire feeding electrical signal from gramophone, radio or tape recorder, usually latter
hi-fi	high fidelity, or extreme realism in sound reproduction
loop	length of tape in circular form, for repetition
machine	tape recorder
mf	*mezzoforte*, Italian for moderately loud
mike	microphone
mirror structure	piece sounding similar backwards
Mistone	see page 8
mono	using one loudspeaker, or several issuing same signal
monitor	listen to signal during recording process
motive	brief group of sounds with recognisable overall character
mp	*mezzopiano*, Italian for moderately soft
music	see page 5

musique concrète	music derived from recorded sounds, af processing
noise	unwanted sound
ostinato	incessantly repeated sound or pattern
p	*piano*, Italian for soft
pp	*pianissimo*, Italian for very soft
Pseudotone	see page 8
recorder	(*a*) simple wind instrument, (*b*) tape record (context usually makes clear which is referr to)
register	general area of pitch level
reverb	reverberation
serial	using series, i.e. predetermined order of events
signal	desired part of recording, as opposed to noise
Sone	see page 8
sound	anything perceived by the ear
speed	rate of tape movement
stereo	using two loudspeakers issuing different signa
superimposition	addition of one layer of sound to another
tape music	*musique concrète*
tempo	prevailing rate of movement made by sound of music
ternary	of three parts (always ABA in music)
texture	consideration of simultaneous events or layer
timbre	quality of sound, distinguishing it from othe sounds independently of pitch, volume an duration
tonality	relationship of different pitches to a centra pitch: the use of key
Tone	see page 8
tone-colour	timbre
tremolo	rapid reiteration or alternation, as in a roll o trill
vibrato	regular rapid fluctuation of pitch and/o volume, usually deliberately introduced fo expressive purpose
wow	fairly slow fluctuation of pitch due to irregular running of tape spool or motor