

sticks of various sizes and materials, feathers and needle files (as bows), and natural elements such as sun, wind, rain and ice (Leif Brush's very highly amplified outdoor Terrain instruments), and a gas flame (Richard Lerman).

The activity of many of the inventors of new instruments who work regularly with amplified sounds arose from an involvement in working in the electronic music studio, and, sometimes, in live electronics. Here the sounds of conventional instruments, other objects (producing both 'sounds' and 'noises') and, occasionally, electronic oscillators or environmental sounds are electronically treated in real time by means of devices such as filters, ring-modulators, reverberation units, 'chopping', tape delays and potentiometers (for loudness control). In my own case these methods were particularly explored in the group *Gentle Fire* (1968–75), in which the music was heard over two or four loudspeaker channels. A similar interest in the control and distribution of sounds in the concert space has also been reflected in many of my invented concert instruments; some of the earliest (going back to 1968) are stereophonic, and since 1980 several have been quadraphonic (with a single exception built as early as 1969).

The decision to become an instrument inventor, however unconsciously arrived at, is one that depends on several factors. These include preferences for live performance involving the kind of sounds otherwise created in the studio, as well as for acoustic, albeit amplified sounds over electronically generated ones, however intricate their treatment. Individuality of timbre is always important, and this often implies an adherence to older technology. Such a 'low-tech' approach could in many cases (as least as far as the actual hardware is concerned) have been employed fifty or even a hundred years ago – but wasn't. Amplified instruments can also explore different sound qualities equivalent to those used in live electronics, such as effects that resemble modulation, from the interaction of the vibrations of two adjacent sounding objects, and reverberation, by careful positioning of two or more microphones. Filtering can be approximated by placing several microphones (sometimes ones with different frequency response characteristics) in different positions, individually selectable and mixable, as well as by interposing materials with different absorption qualities between the vibrating object and the microphone, or, as with the 'instrumental loudspeakers' of David Tudor, by inserting such materials between a small loudspeaker and a microphone, both of which are fitted inside a container.

Typically, as in my own case, such an involvement does not necessarily exclude occasional compositional use of complexly generated or processed electronic sounds (including computer music), motivated by an interest in exploring less obvious possibilities of the equipment concerned, sometimes