

be used, the quality of sound the composer wishes, and a graphic symbol to represent the procedures. In the preface the composer allows for the inevitable discrepancies in timing and sound quality that will take place in a realization. In a certain sense Schaffer's graphics fall in the symbolic category because of their representation of a sound concept (the dividing line is not always clear).

(2) Symbolic: This form is by far the least precise of all. It is graphic in the sense that it uses graphic design or symbols. What symbolic notation does is try to encapsulate a total sound event into one (or more) design(s). The approach to such a notation is on the subjective/interpretive level where a sound complex is expressed in a visual envelope. Distinction between the various parameters is not important: it is the sum effect that is conveyed. Concept is embodied in visual symbol, a sound mantra. Examples:

R. Murray Schafer. *Lustro - "Divan I Sham Tabriz"* Universal Edition 16010, "Music For the Morning of the World" Universal Edition 15550, "Beyond the Great Gate of Light" Universal Edition 16013. In this triptych for instruments, voices and tape Schafer has used a form of notation that tries to convey more the concept of the sound than just its physical characteristics. In "Music For the Morning of the World" except for page 6 the notation is "graphic". Wes R. D. Wraggett. *The Planes of Hydralen*. MS. Hydralen is for classical guitar and tape. At the top of page 3 large square blocks have the ying yang symbol growing from them.

(3) Grid or plot: Like type (1) this notation form uses graphics, the difference being that this type uses graph paper in a connect-the-dot fashion. Each box has a specific value and function depending on the assignments for x, y, and z. Very precise values can be indicated by this method but it is very time consuming in its realization unless some kind of computer correlation/print-out procedure is used. This notation is not very useful in tape-instrument pieces because it could have a confusing effect in that it might convey too much information. It is nevertheless very good for studio recreations of a piece. Examples: Karlheinz Stockhausen. *Elektronische Studie II*. Universal Edition. There are two graphs indicating frequency and amplitude on the vertical axis and duration log (tape cm per second) on the horizontal axis. Gyorgy Ligeti. *Piece Electronique No. 3*. Ahn and Simrock. Each of the four tape tracks has a separate graph with frequency (vertical) and duration (horizontal) being indicated.

(4) Alpha-numeric: This method is the most absolute form of notation. Its basis of origin is the programming information for computer generated or computer controlled sound. Instead of looking at the final product in either a symbolic or graphic form, this notation is concerned solely with the constructive procedure, the events specified and ordered. It is not even necessary to record a piece generated by computer in that the program (if stored as a score) can be performed endlessly (or as long as the program is maintained). The new era of digital generation (and perhaps hybrid control) is going to render any imprecision in re-realization as a function of program variance. In systems which utilize 'graphic' as opposed to 'alpha-numeric' terminals the graphic will only be as imprecise as its assembly program.

Examples: Any computer controlled/generated pieces.

(5) Schematic: A performance notation schematic uses the principle of module organization to provide an indication of general results sought. There is a fair degree of precision that can be attained in the schematic method when precise settings and durations are listed. On the other hand an indeterminate effect can be realized by listing module types without settings or durations. A schematic approach is best for group composition allowing maximum flexibility, while an integral quality is retained at the same time due to the modules in common use. It is unlikely however to find 'schematic' used alone; - more often than not it is combined with graphic, symbolic or traditional notations. Examples: Douglas Leedy. *Entropical Paradise*.

Modules and their corresponding settings are indicated. Thomas Wells. *12.2.72 Electronic Music*. This is a mixture of the 'graphic' and 'schematic'. Four tape tracks contain graphic contours of material and a letter indicates the patch it corresponds to.

(6) Traditional: Even with the five other methods and all the problems of adequately transcribing sound to symbol traditional notation still plays a very large part in electronic music. Very often it is combined with the other forms to indicate tempered (or non-tempered) pitch materials within the piece. It can be of immense value in giving pitch cues to performers who are working in conjunction with tape.

Examples: Karlheinz Stockhausen. *Hymnen*. Universal edition No. 15142. This ambitious work of Stockhausen uses mainly traditional notation with some graphics and text. Because the piece uses national anthems as its source material, traditional notation is the clearest way of indicating their relationships in the piece. Two books of procedures and equipment for realization also exist meaning that the score is for study purposes only.

Vladimir Ussachevsky and Otto Luening. *1952 Electronic Tape Music*. Highgate Press. Because of the concrete source material such as flute, piano, bells, voices etc., this collection of pieces by Ussachevsky and Luening are best transcribed in traditional form. Explanation of procedures such as speed variation and filtering, reverb etc. are given in summaries for each piece. Wavy stems on certain notes indicate that they were treated with head reverb. A graphic score of the traditionally notated piece "Incantation" is included and makes an interesting comparison. Cristobal Halffter. *Plaint for the victims of tyranny*. For chamber ensemble and electronic sound transformation. Universal Edition 15160. In this piece microphones (instrumental and body) are fed into a mixing console where the amplified instruments are treated by filters, ring modulation, reverberation and spatial location according to instructions in the score. This brings into play the area of live electronic transformation of instruments.

The use of live transformation of acoustic instruments is an extremely useful and (potentially) exciting field. Nevertheless a mixture of the above notation types (ie.: Instruments-traditional, Treatments-graphic) should be able to handle any performance situation that exists in the near future.

One further type of notation that is primarily grid/plot, exists. This type consists of tracings and Lissajous figures generated on an oscilloscope screen. At the time when music will be read from a colour T.V. screen, a Lissajous figure in some position on the screen could match up with a similar figure on the tape portion of the projected score. The performer cue could be the visual similarity as well as a pulsating change in colour. The most obvious benefit (at least to this author) would accrue from the visual stimuli a group of projected Lissajous figures could provide for an audience. This brings up the question of "tape music" concerts, which is out of the realm of this article.

In conclusion it must be stated that no matter which notation scheme or combination of schemes is used, clarity in presenting the recorded or treated materials must be the number one priority. If two types of notation are mixed, one must be careful to follow the confines of each system. For instance, when using traditional and graphic notation, a symbol such as  has a definite value while

 has a less defined value. When combining the two  a relationship is

formed, in this case one of a definite pitch progressively expanding its band width and then returning to its original pitch. I have, however, seen this exact same combination used to indicate a dynamic (amplitude) swelling of the note with no reference to pitch change at all. Particular care must be taken in being specific about the function of each symbol and in keeping the characteristics of each notational type constant with itself. In reality, the whole problem of notation for instrumentalists and tape can be solved by doing one thing. Listening.