

The Silent Music of Mathematics¹

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The thoughts which follow result from a combination of two events which took place last Christmas. One of these was a visit from a niece of mine who has two bright children aged seven and eight. She was worried because all the mathematics they did at school was pages of sums. Shortly before this, we had heard and seen a performance of Benjamin Britten's beautiful Ceremony of Carols. This was introduced by Britten's lifelong friend Peter Pears, who related how it had been composed by Britten at sea, in a cramped cabin with no piano or other musical instrument on which Britten could hear what he was composing. Afterwards, I began to wonder how such music could be composed under these conditions. How could he know how wonderful it would sound in performance? Maybe he sang it to himself, some of it. But he could only sing one part at a time, and what about the harp? My answer cannot be more than a conjecture; but I think we may assume that like many other composers he was able to write music directly from his head onto paper because he could hear the music in his mind. The musical notation represented for him patterns of sound, sequential and simultaneous.

There are others besides composers who can hear music in their minds, and who (we are told) can get pleasure from reading a score in the same way as others enjoy reading a book. But most of us are not like this. We need to hear music performed, better still to sing or play it ourselves, alone or with others, before we can appreciate it.

We would not think it sensible to teach music as a pencil and paper exercise, in which children are taught to put marks on paper according to certain rules of musical notation, without ever performing music, or interacting with others in making music together. To start with, children are not taught to read or write music at all - they sing, listen, and move their bodies to the sounds of music. And when they do learn musical notation, it is closely linked with the performance of music,

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using their voices, or instruments on which they can play without too much difficulty.

If we were to teach children music the way we teach mathematics, we would only succeed in putting most of them off for life. It is by hearing musical notes, melodies, harmonies and rhythms that even the most musical are able to reach the stage of reading and writing music silently in their minds.

So why are children still taught mathematics as a pencil and paper exercise which is usually somewhat solitary? For most of us mathematics, like music, needs to be expressed in physical actions and human interactions before its symbols can evoke the silent patterns of mathematical ideas (like musical notes), simultaneous relationships (like harmonies) and expositions or proofs (like melodies).

Regretfully I hold Mathematicians (with a capital M) largely to blame for this. They are so good at making silent mathematics on paper for themselves and each other that they have put this about as what mathematics is supposed to be like for everyone.

We are all the losers. Music is something which nearly everyone enjoys hearing at a pop, middle-brow or classical level. Those who feel they would like to learn to perform it are not frightened to have a go, and those who perform it well in any of these varieties are sure of appreciative audiences. But Mathematicians have only minority audiences, consisting mostly or perhaps entirely of other Mathematicians. The majority have been turned off it in childhood. For these, the music of mathematics will always be altogether silent.

May I finish by asking a question? I am hopeful that many, probably most, readers of *Mathematics Teaching* will be in agreement with this general line of thinking. But can anyone tell me how we may get this message to those who need it most? By this, I mean the many who teach mathematics to children in their early years almost entirely as pages of 'sums' on paper; and who - because they think that it is for specialist teachers of mathematics, or for some other reason - do not read this journal. I ask this urgently: how?