

Book Reviews

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Discovering the Musical Mind: A View of Creativity as Learning by J. Bamberger.
Oxford: Oxford University Press, 2013.
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9780199589838.

Jeanne Bamberger has been an important figure in the psychology of musical development for several decades, and I first got to know about her work on children's invented notations in the 1980s. I have kept in touch with her work since then, and this edited collection is valuable because it includes her main papers from the years 1972–2010, bringing together the many different aspects of her work which range from her early studies of Beethoven's original piano fingerings, right up to more recent educational experiments using computer programs.

Howard Gardner, with whom Bamberger has been associated for many years through their affiliation with Project Zero at Harvard University, has written the Foreword to this collection. He describes how both of them were attracted in their early days at Harvard by some lecture-demonstrations by Marvin Minsky and Seymour Papert, who were talking about a new computer language called Logo and its potential educational uses. Gardner also explains that Jeanne Bamberger had been a piano prodigy in Minneapolis, performing with the Minneapolis Symphony Orchestra before she became a teenager, and had also studied with pianist Artur Schnabel and the composer Roger Sessions. I have always felt that Bamberger has a very original, sometimes idiosyncratic approach in her work, and these disparate early influences may have some bearing on that.

The readings are divided into five sections. After a very short introductory first chapter in which Bamberger reflects on the development of her work, the first section, 'Beginnings', contains three more chapters on her work on children's invented notations, and describes the development of the typology that she produced, which was based on the distinction between figural and metric (sometimes called figural and formal) drawing strategies. In representing simple tapped rhythmic patterns on paper, for example, figural strategies capture the overall sense of the pattern but not necessarily its precise details, whereas metric strategies get the main details correct, but without conveying the overall sense or feel of the rhythm. This typology was developed further in her book 'The Mind Behind the Musical Ear' (1995), which Howard Gardner regards as her magnum opus, and which brought together Bamberger's main theoretical concepts in a range of different classroom settings.

The second section, 'Developing the musical mind', deals with the development of the work on notation to wider investigations of children's strategies in musical thinking. This includes the development of the distinction between 'path-making' and 'map-making', and the use of reflective conversation in developing these strategies. When asked to construct a tune with a set of bells which vary in pitch but which look identical, for example, 'path-makers' set out a sequence of bells which are arranged just to play that one tune, whereas 'map-makers' arrange the bells in some form of logical order (e.g. from lowest to highest pitch) so that more than one tune can be played. This section also contains chapters dealing with issues concerning the

musically gifted children, and with the ways in which the perception of musical structures develops. The third section, 'Designing educational environments', traces the shift of Bamberger's interest in the application of her ideas to the classroom. After a brief introduction to this area, including a reference to the visit to the Minsky and Papert lectures with Howard Gardner, this section contains chapters on 'Developing a musical ear', which describes a practical experiment reinforcing the fundamental interdependence of perception and cognition; another on the distinction between 'action knowledge' and 'symbolic knowledge', in which the computer is seen as a mediator between these two types; and a chapter on the ways in which collaboration between students can lead to the collective invention of meaning. There is also an account of the 'Math, Music and Drumming' (MMD) project which was run in a group of schools in Massachusetts.

The fourth section of the book, 'Computer as sandbox', develops the argument by exploring further aspects of the relationship between music cognition and educational application. Bamberger looks specifically at music theory and the listening experience, asking the questions 'Do we hear what we see?', and 'Do we see what we say?' This section also includes an account of the development of her version of *MusicLogo*, a program called *Impromptu*, as well as one chapter on musical intuitions, which investigates how novices listen to and compose music using structures which are meaningful to them, and one on the relationship between music and mathematics. Finally Part 5, 'Summing up', incorporates one chapter in which Bamberger looks at three different hearings of a Beethoven sonata movement by listeners with different levels of musical sophistication and instrumental training, and

another in which she reflects on the course of her life's research effort as a whole.

This final chapter, 'Recapitulation and coda', includes a return to some of her early work on fingerings of Beethoven's piano works, which is significant in that it represents another layer of notation. It also includes a summary of the five main themes running through her work: the first of these is the relationship between notation and musical thinking, the tension between which underlies Bamberger's fundamental view of creativity as learning, as the title of the book makes clear. The second and third are the distinction between figural and formal strategies in representation, which led on to that between path-making and map-making. The fourth theme is the distinction between action knowledge and symbolic knowledge, i.e. between 'knowing how' and 'knowing about', and this in turn led on to the fifth general theme of the application of computers to education, which involved investigating the relationship between musical and mathematical thinking.

These are the basic ideas which have driven Bamberger's outstanding contribution to the study of musical development: and since I previously characterised her approach to research in this area as 'sometimes idiosyncratic', it may be appropriate to conclude this review by trying to identify what I see as the distinctive features of her approach. There are six of these, and the first is the question of methods. It is important to point out that many of the chapters in this book are written with copious detailed references to practical work with individual children, such that the theoretical points which are being made derive directly from the observations of children's practical cognition. In this respect her methods are reminiscent of Piaget's method of 'clinical interrogation': Bamberger presents children with different tasks

involving music cognition, and describes their approaches to these tasks in great detail, using 'reflective conversation'. Like Piaget, she is much more interested in the processes that these conversations reveal than in whether or not children produce 'correct' responses to the questions.

Some contemporary developmental psychologists may well object that this approach, whilst having the capacity to produce rich insights into children's thinking, is nevertheless non-replicable and lacking in rigour: experimental control is not usually present. A second, related issue is the argument that the theoretical edifices constructed by both Bamberger and Piaget are founded on relatively slender databases: there is a pronounced focus on the cognitive aspects of musical processing in relation, for example, to its emotional and social aspects. However, this 'clinical' approach and experimental methods are at opposite ends of the spectrum, and each has its advantages and disadvantages. The methodological issue is also closely related to two more distinctive features of her work, namely, thirdly, that Bamberger's work is founded on in-depth practical experience with children: theoretical concepts emerge 'bottom-up' from the child's point of view, rather than starting from a 'top-down' adult perspective. Correspondingly, fourthly, it is very clear that she is just as interested in the educational implications and applications of her studies as in the theoretical advances themselves, and this is an integral feature of her approach.

The fifth issue which has always intrigued me about Jeanne Bamberger's work is her tendency to draw on ideas from the Greek philosophers, or from eminent figures in human development such as Vygotsky or Piaget, rather than to base her studies on the latest findings of empirical research. Both of these approaches are perfectly valid, of

course, but I would add that Bamberger's research is also characterised by its multidisciplinary. She draws just as much on the ideas of philosophers, composers and musicologists as on developmental psychologists and social scientists, and this is a great strength of her work. Linked to this is the sixth issue: that she considers a very wide range of musical abilities in her studies, ranging from children who are complete novices to the perceptions of experienced professional musicians.

Scholars of musical development will already be aware of the immense and distinctive contribution that Jeanne Bamberger has made to the discipline: this book gathers together papers and extracts from various books and journals, some of which are no longer in print, and so will be indispensable to all in the field.

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Computational Thinking in Sound: Teaching the Art and Science of Music and

Technology by G. R. Greher and J. M. Heines. New York: Oxford University Press, 2014. 232 pp., paperback. £22.99. ISBN: 9780199826193.

Computational Thinking in Sound: Teaching the Art and Science of Music and Technology is a very detailed case study of a collaborative teaching experiment funded by the National Science Foundation and employed to great success by the authors at the University of Massachusetts Lowell.

The book presents an exciting learning paradigm, something devolved and open, with shared resources and transparency of method. The departments of Music and Computer Science at UML cooperated with