A Microworld Approach to the Formalization of Musical Knowledge

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Abstract: This paper is about the importance of applying computational modeling and artificial intelligence techniques to music cognition and computer music research. The construction of microworlds as a methodology plays a key role in the different stages of this research. Several uses of microworlds are described. Microworlds have been criticized in the domains of artificial intelligence and the cognitive sciences, but this critique has to be seen in its proper context (i.e. in modeling of human intelligence, not as a methodology). It is shown that the microworld approach is still an important methodology in music cognition and computer music research, and a promising strategy in the design of a general representation formalism of musical knowledge.

Key Words: Artificial Intelligence and Music, Microworlds, Knowledge Representation, Music Cognition, Representation of Time and Temporal Structure.

Introduction

Music representation is a research topic with great relevance and application in the fields of music analysis and production (for instance, music notation and retrieval systems), and computational modeling of music perception and performance (for instance, describing mental representations of music). While each domain tends to develop its own specialized representations, the central issue in music representation research is to describe what is shared among these diverse representations. For example, what makes a chord a chord, and what properties can be generalized over the different representations? This task of constructing a general representation of music is difficult to imagine and to plan, especially since comparable projects of comparable complexity (for example, natural language understanding) have not as yet reached high levels of success. We still lack a general theory of representation, "a sobering fact since our systems rest on it so fundamentally" (Smith, 1991). General representation languages are under development, and there are, besides lots of technical difficulties, still theoretical and philosophical problems of enormous proportions. I nevertheless think that it is very important to look for generalizations and abstractions in the design of a representation of musical knowledge. Since the construction of a complete and general representation of music is still far ahead of us (if not fundamentally impossible), gaining understanding of what can and what cannot be represented, using certain types of formal representations, is far more important and realistic (Honing, 1993). The methodology of constructing microworlds or micro-version programs has turned out to be a successful strategy in building these formalized components of a representational system for music, components that are well understood and generalized in such a way that maintenance and extension are guaranteed.

Henkjan Honing is research fellow at the University of Amsterdam, where he is doing research on the formalization of musical knowledge concentrating on time and temporal structure. With Peter Desain he wrote the book Music, Mind and Machine: Studies in Computer Music, Music Cognition and Artificial Intelligence.

Microworlds

Many of the microworld ideas stem from the group of researchers that worked at MIT in the seventies (for instance, Abelson, Minsky, Papert,

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