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**Computer-Representation of Music in the Research Environment** by Geraint A. Wiggins

In this paper Wiggins discussed the requirements of general computer representation for music, from data abstraction design to the syntax of representations. Various music representations have been created in the history. For examples, music notation became the main representation for teaching and research in musicology since 18<sup>th</sup> century, and audio recordings invented in the end of 19<sup>th</sup> century provide detailed information of music signals. Wiggins pointed out that those representations are too specific and unable to provide generally appropriate features of music.

Wiggins first described the goal of the paper by emphasizing the difference between knowledge representation and data encoding, where the former is performed at the theoretical level of describing the operation of a phenomenon while the latter focuses on arrangement of bits in computer. He then indicated the key philosophy of the proposal: data abstraction. He argued that explicit handling of data properties to a particular task should be supplied in library functions, and those functions should allow programs to manipulate the data without explicit reference to the actual syntax. In this way, the analysis program can perform the same tasks on different representations.

Wiggins listed ten key features of music representation systems. The representation should try to support both expressive completeness and structural generality at the same time. The representation should filter the information and provide only those are in interested. Multiple hierarchies of concepts need to be represented, as well as non-hierarchical relations. The description language must be extensible but comprehensive. The representation should also support data in multiple domains, for examples, acoustic, auditory, and graphemic (notated). Inference and operations across domains should be carefully designed. The details of sampling rate and the base for normalization also require great attentions in order to represent continuous features. The system must be able to represent uncertainty for the purpose of humanities research, and may need the representation for temporal relations between data.

In this paper Wiggins discussed the issues of music representation from a practical computer scientist's point of view. Knowledge representation is a crucial and fundamental step of modeling human concepts. This paper focuses on the design of representation for music in general computer-friendly formats. Data abstraction is another key idea in many fields of computer science, such as object-oriented programming, operation system design, and network protocol design. Wiggins provided several useful computer-science concepts for implementation, and discussed the issues that need to be considered for adapting to music research. Although the points in the paper seem very conceptual, I believe that researchers will find those ideas helpful in terms of a general guideline for their design.