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Synopsis and Response Report of Methodologies for Expressiveness Modeling of and for Music Performace by Givanni De Poli

This paper provides a comprehensive review of research on music expression. With his background in Information Engineering, De Poli is able to provide a clear explanation covering issues on music performance, which is a truly multi-disciplinary filed. He further categorizes previous works into several sections to introduce the various factors and approaches in studying music performance. Each model is explained systematically, analyzed in detail, and summarized with potential advantages and problems. Some psychoacoustic issues, including conceptualizing music as a non-verbal art form of human communications, are also discussed in this paper.

This paper consists of three parts. In the first part, De Poli presents the fundamental issues when computationally modeling music performance. The models can be distinguished into two types: the *complete* model which is intended to explain all the observed performance deviations, and the *partial* model which only focuses on one level. Depending on the way a model is constructed, it can be called as either a *mathematical* or *information-processing* model. A mathematical model is usually constructed by several variables/parameters obtained from observable data. And once the model is established, it can be used to predict or simulate the result under different circumstances. An information-processing model is often constructed using data mining or machine learning methods to generate salient factors for the model.

Three contributors are involved in the communication of expressive musical content: composer, performer, and listener. In general, studies of composer's idea, music structure and phrasing, are relatively better developed. In turn, the performer contributes to the study in two aspects: to clarify the composer's message, and to add personal interpretation. De Poli describes, "Expressiveness related to musical structure may depend on the dramatic narrative developed by the performer, on physical and motor constraints or programs, on stylistic expectation based on cultural norm, and on the actual performance situation." And performances are often studied in terms of basic emotions.

The second part of the paper describes information type and the representation for music performance. Three levels of information are introduced—physical, symbolic, and expressive. Physical level information includes timing of musical events, tempo, dynamics, and articulation, as well as acoustic parameters such as timbre, vibrato, and pedaling. Musical score is typically regarded as the symbolic information. However, current understanding of the expressive information is rather vague and limited, and is mostly studied in the field of Psychological research. Another key issue is concerned with how the model represents the information. For

example, time can be represented in terms of performance-time, score-time, or note inter-onset-time. Each parameter can be represented as discrete or continuous, relative or absolute.

The last part of the paper categorizes the models into three types: models for understanding, models for music production, and models for artistic creation. There are five general methods to build models for understanding: (1) analysis of deviations measured in recorded human performance, (2) analysis of the performance perception of synthesis, (3) machine learning, (4) case-based reasoning, and (5) expression recognition method. Some models are mentioned in the section of music production, including the RUBATO system proposed by Mazzola and the model defined at Centro di Sonologia Computazionale (CSC) by Canazza. However, the idea of automatic expressive music performance is questionable according to De Poli. At last, research on sound synthesis and modeling, producing and performing music by new electronic and computer-generated sound, is summarized in the section of models for artistic creation.

This paper is well organized, describing the models and methods in an orderly way, and providing useful information for future research. I was impressed by the abundance of information De Poli addresses. Many famous models, such as Todd's and the KLH system, are discussed with pertinent comments on advantages and disadvantages. Rich details, such as the choice of information and information representation, are included so that the paper is especially informative for researchers new to this filed. Particularly, I enjoyed the author's philosophical comments in the conclusion: "Music is an immaterial art that has a strong tradition of symbolic representation and abstract thinking. This attitude may explain why musicians were the most enthusiastic and successful in promoting and contributing to the joint development of art and science since the beginning of computer science."