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Summary of Performance Theory

A hard beginning maketh a good ending.

Performance theory is a part of music theory in its larger understanding. It is not classical music theory, which unfortunately and implicitly focuses on harmony, a miniature part of theoretical topics in music (comprising theory of motives, of rhythms, of tunings, of physical modeling of sound, orchestration, composition, algorithmic composition, representation, etc.).

Present performance theory deals with the transformation of a symbolic score into a physical sounding event set, therefore it does not (yet) deal with musical performance that is not based upon a score. For example, it does not deal with the improvisatory creation of music without scores or with scores that need essential creative competence beyond the reading of fragmentary scores, such as lead sheets in jazz.

Performance theory has two main concerns: structure and expression.

Structure theory deals with the precise and complete description of the structure of performance transformations, score → embodied sound: *What* is performance? We are aware that the level of embodied sounds is a wide field, since sound embodiment can strongly focus on the body, the gestural utterance in music, and less on sound as acoustical patterns. However, most of the present theory focuses on sound. This is not to downsize the gestural embodiment; we simply do not know enough to date.

The description of structure of performance includes a *performance cell*, a minimal set of structural components that enable performance:

- the symbolic kernel (the notes),
- a region in the kernel's parameter space, called frame of the performance,
- the initial set, a collection of events in the frame, where performance is predefined; the latter is called the initial performance.

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- Finally, we need a vector field on the frame, the performance field, which defines the performance transformation with target space being the space of physical parameters defined for the notes in the symbolic kernel.

A realistic performance is defined by a system of performance cells, which are connected by projections of parameter spaces. Such performance hierarchies build the complete information needed to perform the given symbolic notes. Performance hierarchies are used as structural components in the construction of performances from expressive data.

Expressive theory deals with the content-based aspect of performance. There is a message that is transmitted to the audience, which answers the question of *why* performance is shaped. This relates to the semantic dimension of music, namely the fact that score-based music communicates meaning. This is not the most general case, because music might be a gestural utterance, which does not communicate given meaning but produces it in the making, if meaning is addressed at all.

Expressive theory relates (roughly speaking) to three specifications of contents. First, on the psychological reality: emotions. Second, on the physical reality: gestures. Third, on the symbolic reality: analysis. *The main problem of performance theory is the shaping of performance structure as a function of these contents.* This is about rhetorics, the shaping of expression to convey contents in the best possible way. So the general scheme is that we are given any such contents and then should know how to shape performance, i.e. a performance hierarchy, in order to communicate that content. The instances that shape performance by a given content are called operators. So the general formula is Performance = Function(Contents, Operators).

While it seems difficult to deal scientifically with the rhetorical shaping of emotional and gestural contents, the analytical rhetorics have reached a detailed level of theory. The theory works on the principle that analytical processes of rhythmical, motivic, or harmonic nature yield results that can be fed into operators, which in turn shape performance.

Performance theory had its first historical roots in the shift from music theory as a theory of abstract music to a theory of human production (as opposed to the divine perspective) in the sixteenth century. The experimental aspect of performance research goes back to the eighteenth century, when the first performance recording machines were built, essentially to document inprovisation. There have been two threads of performance theory: philosophical abstract theories about performance and empirical research dealing with recording and simulation of performance. Since the Swedish research at the Kungliga Tekniska Hgskolan (KTH) in the early 1980s, the philosophical and empirical threads have been united and can now be presented as those two standard parts, theory and experiment, of any exact science that deals with nature, be it the human or the material nature.

Consequently, performance theory has been implemented also in software such that its concerns can be tested on the empirical, experimental level. Be-

sides the KTH software Director Musices, we have discussed the performance software RUBATO® developed at the Computer Science Department of the University of Zürich and at the Computer Science Department of the TU Berlin in the last decade of the twentieth century. RUBATO® is built on the modular principle that analysis is separated from performance operators. The price thereof is that analytical results must all be delivered by weight functions. The operators all use such weights. There are operators acting on the symbolic kernel, on the physical output, and on the performance fields.

We have discussed a number of case studies of such experimentally constructed performances. We have also discussed the statistical arguments for connecting analytical facts to the shaping of performance.