# Foreword

Gérard Milmeister's thesis, which is now published in Springer's innovative series *Computational Music Science*, is a key text for accessing the present version of the RUBATO software. It is also the beautiful trace of a conceptual and technological completion of a development that was initiated in 1992, when Oliver Zahorka and I conceived, designed and implemented the RUBATO sofware for musical performance. This first implementation on NeXT computers, written in Objective C, was driven by the idea to implement Theodor W. Adorno's theory of an analytical performance, i.e., a performance that is defined upon musical analysis of the given score. The original architecture of RUBATO was therefore modular and split into modules for analysis (rhythmical, melody, and harmonic) and modules for performance. These modules, coined rubettes, were only conceived as organic parts of an overall anatomy. However, the successive developments and also research driven investigations, such as Anja Fleischer's work[1] on rhythmical analysis or Chantal Buteau's work[2] on motivic analysis showed that there is also a legitimate interest in rubettes without being necessarily parts of a given fixed anatomy. Successive work by Stefan Göller[3] on geometric concept spaces associated with RUBATO data formats, and Stefan Müller[4] on performance and gesture rubettes proved that there is a different approach to RUBATO, which by far transcends the original "hardcoded" anatomy.

[1] Fleischer, Anja. *Die analytische Interpretation: Schritte zur Erschließung eines Forschungsfeldes am Beispiel der Metrik*. Dissertation, Berlin 2003

[2] Buteau, Chantal. *A Topological Model of Motivic Structure and Analysis of Music: Theory and Operationalization*. Dissertation, Zürich 2003

[3] Göller, Stefan. *Object Oriented Rendering of Complex Abstract Data*. Dissertation, Zürich 2004

[4] Müller, Stefan. *Pianist's Hands—Synthesis of Musical Gestures*. Dissertation, Zürich 2004

The new requirements had to face different conceptual, soft-, and hardware conditions and challenges. To begin with, the NeXT computer had finished to exist, and the platform-dependent strategies, such as the original Objective C implementation had become obsolete by the now standard Java virtual platform environment. The other point of change was that the rubettes had to become a modular construct that would be of any size and would also be of open usage without much predefined larger anatomical preconditions. It turned out that the decisive requirements were defined by component-driven programming. However, this generic setup also entailed a radical redesign of the data format of denotators, which was invented in the early collaboration with Zahorka. The redesign was however not only affected by the component-driven data architecture, but by a meanwhile dramatic urge to step from naive (zero-addressed) denotators to functorial denotators, i.e., to quit the old-fashioned concept of a point and to introduce functorial points, i.e., morphisms defined on variable address modules and with values in not necessarily representable space functors.

All these delicate requirements set up an agenda that could not be realized except by a computer scientist with excellent programming and really solid mathematical competence. Gérard Milmeister was the ideal researcher to bring such a difficult enterprise to its completion. His award-winning doctoral dissertation, which is now in your hands, is the written counterpart of his remarkable programming work, available as a GPL software on `http://www.rubato.org`. The thesis is not only a clear and concise introduction to the conceptual and mathematical architecture of the RUBATO enterprise, but offers also precise and concrete tutorials for the programming of rubettes and their networks.

The success of Milmeister's work is, last, but not least, documented by contributions from Florian Thalmann and myself, which prove that the RUBATO software may now reach out to compositional tasks that were postponed since the early developments of a geometric composition software *presto* in the late 80s. Thalmann's *BigBang* rubette is the long-awaited extension of RUBATO to gestural strategies in composition, and it is the proof that Milmeister's work is not only the completion of a long march through the hard- and software meanders and conceptual revolutions, but also is setting a pointer to creative future music software perspectives.

Minnesota,
October 2008

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Springer

http://www.springer.com/978-3-642-00147-5

The Rubato Composer Music Software
Component-Based Implementation of a Functorial
Concept Architecture
Milmeister, G.
2009, XX, 301 p. 143 illus., Hardcover
ISBN: 978-3-642-00147-5