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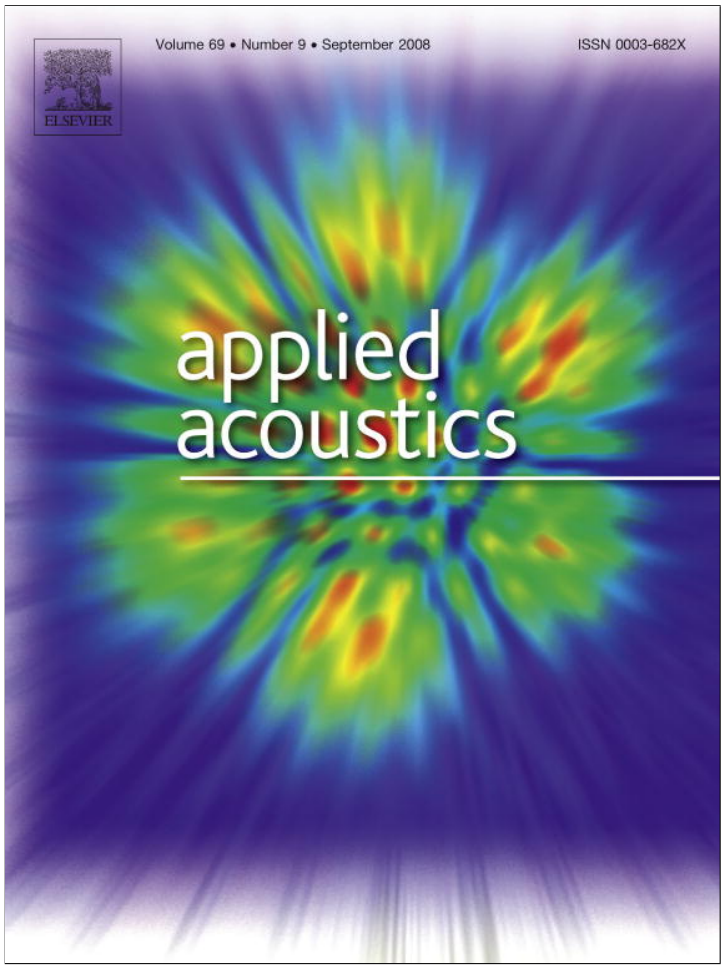

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Book review

Science and Music – The Impact of Music, Nova Acta Leopoldina Nummer 341, Band 92. Deutsche Akademie der Naturforscher Leopoldina, Halle (Saale) (2005). ISBN: 3-8047-2237-7. ISSN: 0369-5034

The "Deutsche Akademie der Naturforscher Leopoldina" with its headquarter in Halle (Saale) in Germany is one of the oldest scientific academies comparable to the Royal Society (London) or the Academie des Sciences (Paris). The book can be regarded as the proceedings of a Leopoldina Symposium held in Halle (Saale), Germany. The aim of the Symposium was to elaborate on the ties between science and music. Contributors were internationally recognized peers in both natural sciences and musicology, as well as wellknown contemporary composers.

In his opening address (Begrüßung), the President of the Academy Leopoldina, Prof. Dr. Volker Ter Meulen introduced the theme and expressed his thanks that scientists from fields like physics, physiology, psychology, and musicology as well as composers and musicians contribute to the symposium.

The first scientific article "Music and Mathematics" is authored by Manfred Schroeder who headed for decades the world famous Drittes Physikalisches Institut of the University Göttingen and at the same time acted as department head at Bell Labs. Schroeder's contribution is organized in three parts: Part 1 represents a fascinating report on the failure of "the acoustics" of Philharmonic Hall in the Lincoln Center for the Performing Arts in New York in the 1960's, and the measures taken to improve it. From this *eclat*, room acoustics as a science got a large boost and many basic studies were performed leading to the result that the listener in a concert hall wants to be "enveloped" by musical sound. To achieve this goal, strong lateral reflections are necessary which are lacking in modern halls with low ceilings but wide seating areas. In this context diffusors were developed which these days are called Schroeder-Diffusors. The second and third parts of Schroeder's contribution deal with new musical scales and algorithms to generate melodies. For the latter topic, acoustic demonstrations are available in the web: www.reglos.de/musinum. The term musinum stands for music in the numbers, i.e. music derived from number theory.

The contribution "The Domain of Tonal Melodies: Physiological Limits and Some New Possibilities" of Ralph van Dinther and Roy Patterson from the CNBH in Cambridge, UK discusses the size information in musical sounds. A model, based on the Mellin Transform is explained and applied to the perception of size information in speech and music. Using the transform, for example a human voice can go from child to male adult, or an instrument from violin to sub-bass. This way, when applying the procedures of shrinking or growing on spectra of musical sounds, new tonal material is available for modern composers. A relevant demonstration is available at the website http://www.pdn.cam.ac.uk/groups/cnbh/teaching/sounds_movies/pitch_helix.htm.

Richard Parncutt from the University Graz, Austria discusses in his contribution Perception of Musical Patterns: Ambiguity, Emotion, Culture the links between musical sciences and he humanities. Throughout the paper, Parncutt's expertise in both musicology and psychoacoustics is visible. Ingredients of music theory like root or tonic tone can be described in terms of psychoacoustically based algorithms like the virtual pitch theory of Ernst Terhardt. However, already virtual pitch usually shows some ambiguity. Of course, ambiguity and emotion can be related, but their relationship is not causal. Also associations from outside the music play a crucial role for emotions. For future research Parncutt advocates to link psychoacoustic and cultural studies.

Manfred Stahnke is a wellknown composer and musicologist, living in Hamburg, Germany. His contribution "(Dis-)Harmonie" explores new ways of thinking in musical harmony. Stahnke studied composition with György Ligeti and obtained his background in electronic music mainly during his studies at Stanford with John Chowning in the 1980's. Therefore, he works with conventional instruments like the accordion or violoncello, but also is open for electronic music. His paragraph on the Partch Harp is supplemented by an acoustic demonstration available on his home page (www.manfred-stahnke.de).

In his contribution "Research and Technology in the Opera *Der Sprung*", Georg Hajdu explains bibliographical, historical, musical, and technological contexts of his famous work. The full title of the work is "Der Sprung – Beschreibung einer Oper" which means approximately "The plunge – description of an opera". Hajdu holds a Ph.D. from Berkeley and is professor of multimedia composition at the Hamburg School of Music and Theater. Contrary to the usual practice, where first the libretto is written and then the music is composed, in "Der Sprung" librettist Thomas Brasch worked with the composer Georg Hajdu right from the beginning. The contribution gives some

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technical detail how the opera was realized and elaborates on the blend of science and technology, e.g. in neural nets and musical composition. English speaking readers will welcome the translation of the libretto from German into English as an appendix. From an historic point of view, Hajdu considers his opera "as a late example of the exploratory phase in computer music".

In his contribution "The Application of Physical Rules for a Perfect Musical Performance", Klaus Wogram from the Physikalisch Technische Bundesanstalt (PTB) in Braunschweig, Germany goes back to the roots and explains the physical pre-requisites for good musical sounds, a field of research, which has a long tradition at PTB. Physical effects like the decay rates of strings on a bass guitar are exemplified illustrating the background of dead spots. Vibrational modes of tom–toms and concurrent resonances of instrument and stand are related to good versus bad sound quality. Also hints are given how the dependence of pitch of a trumpet on the dynamics, i.e. a 50 cent difference between ppp and fff, can be overcome. Finally, Wogram touches on the large influence of room acoustics on music performance and shares his expertise on how musicians adapt with different playing techniques to the acoustic properties of different rooms.

The contribution "Brain Signatures of Musical Semantics" by Stefan Koelsch from the Max-Planck-Institut für Kognitions-und Neurowissenschaften in Leipzig shows that semantics, which is a basic dimension of language, is also relevant in music. More specifically, Koelsch measured event-related brain potentials, in particular N400, and could show that the semantic processing of words can be influenced by preceding pieces of music. This is taken as a further indication that the human brain processes music and language in a similar manner.

In his contribution "Wissenschaftlich exakte Musik durch elektronische Technik – eine Idee und ihre Folgen", Andre Ruschkowski, a wellknown composer of electronic music and multimedia performances, discusses the idea of "perfect" music. From his training as a Tonmeister, Ruschkowski knows all the "ingredients" of electronic music pretty well and discusses the question, whether scientific methods could really explain empirical knowledge. Ruschkowski demonstrates by two examples of his own works, i.e. "Trakl-Zyklus" and "Vom Blau umschauert" compositions which integrate scientific methods into concepts for compositions. His home page (http://ruschkowski.net/music-f.htm) presents a wealth of practical examples.

In "Wahrnehmung und Präsenz von Kunst", Helga de la Motte-Haber, from the Technische Universität, Berlin, discusses two main theories of perception: Gestalt-theory and theory of pattern recognition. She advocates that perception is not just a reflection of physical stimuli. Rather, aesthetic impressions are the result of interactions between external stimuli and subjective imagination.

Wolfgang Auhagen from the Martin Luther Universität Halle starts his contribution "Acoustical Correlates of Musical Expressiveness" by discussing the meaning of the term "expression". Professional musicians convey expressive qualities by pitch, duration, dynamics, and timbre. While timbre frequently is used to transport emotional feelings, tempo and dynamics communicate the musical structure. In addition to acoustic factors, visual parameters can strongly contribute to the expression felt by the audience.

In his contribution "The Impact of Musicality on Human Development", Heiner Gembris, from the University Paderborn, stresses the importance of music through all stages of human life. Already in pre-verbal stages, children and parents communicate by musical parameters like pitch, timbre or temporal structure quite "naturally" feelings, emotions and needs. On the other hand, even in persons suffering severely from Alzheimer's disease, music can affect emotional, cognitive and social aspects of personality.

In summary, it is safe to say that "Science and Music – The Impact of Music" is one of the few publications where science and art meet in a perfect manner. The book is well balanced with contributions from "building material" for music assessed in terms of physics, with aspects of perception in psychoacoustics and beyond, and treatises of musicians and composers. In particular the latter contributions would profit substantially, if the book would include a CD with music excerpts. Fortunately, however, some of the works described are accessible via the web and this reviewer would like to encourage more of the authors to use this medium to give access to acoustic demonstrations of the effects described. The book can be recommended to a broad audience: On the one hand, musicians may get insight in some physical and psychoacoustic phenomena underlying production and perception of music. On the other hand, the book represents an excellent appetizer for physicists or engineers to have a closer look at modern electronic music, since, as authors, the composers succeed in starting their excursions from a solid basis which is accessible also to non-experts.

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