Studies in Fuzziness and Soft Computing

Volume 406

Series Editor

Janusz Kacprzyk, Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

The series "Studies in Fuzziness and Soft Computing" contains publications on various topics in the area of soft computing, which include fuzzy sets, rough sets, neural networks, evolutionary computation, probabilistic and evidential reasoning, multi-valued logic, and related fields. The publications within "Studies in Fuzziness and Soft Computing" are primarily monographs and edited volumes. They cover significant recent developments in the field, both of a foundational and applicable character. An important feature of the series is its short publication time and world-wide distribution. This permits a rapid and broad dissemination of research results.

Indexed by SCOPUS, DBLP, WTI Frankfurt eG, zbMATH, SCImago.

All books published in the series are submitted for consideration in Web of Science.

More information about this series at http://www.springer.com/series/2941

Hanns-Werner Heister

Music and Fuzzy Logic

The Dialectics of Idea and Realizations
in the Artwork Process

Springer

Hanns-Werner Heister
Rosengarten, Germany

To Inge Rubbert

Preface: Subject, Themes and Aims

With this book I pursue a twofold objective. On the one hand, it is about appropriating fuzzy logic even more intensively for the science of music and to make it as broadly as differentiatedly usable there: for the analysis of musical works and facts, for the expansion and specification of thinking about music and thinking in music. On the other hand, it is a concern to prepare the broad field of music, at least to a certain extent, in such a way that music becomes accessible for research from the side of fuzzy logic up to its practical application in an easier, more intensive, more detailed and more differentiated way. The book goes back to studies about fuzzy logic and music, which I started in 2009 mainly due to suggestions by Rudolf Seising (See Heister 2012).

Double Approach, Hybrid Perspective

In this book I deal with numerous further aspects, which go beyond of what I have already researched and published in this context. This includes as well such aspects, that have so far not received enough attention, by research, which takes Fuzzy Logic as a starting point. For here we extend the scope of research beyond the elementary, like acoustics (in the context of space and on perception), or systems of pitch or rhythm, of elementary problems of musical tuning systems, but also beyond, what in the realm of Fuzzy Logic so far has likewise been dealt with, like the complex matters of timbre simulation and styles of interpretation, of procedures for storage and automatic finding, and many more.

Complexity and Priority of Qualitative Questioning

Due to my disciplinary competence I generate primarily *qualitative* reflections. Starting from music and different arts, they are elaborated in this perspective. From now on, it has to be taken into account to analyze such qualitative facts, as far as

possible, or as useful, with Fuzzy Logic' *quantitative*-mathematics, as it has already and in varied ways been undertaken. Thus we may achieve further and more far-reaching specifications, for instance, about problems of motivic-thematic affinities as special cases of similarities. By so to say hand-made music analysis, such similarities may be hardly, rarely and in some points even in principle never be reached.

In such cases reflected formalizing, mathematical logic, and modeling, on the basis of computerizing, just in the realm of "Soft Computing", offer plenty, new, and surely at the moment not fully foreseeable potentials of research (and practically applicable too). In the meantime, the series *Studies in Fuzziness and Soft Computing* has already published an array of relevant themes. Their main topics, such as storage and recall at databases, and similar, connected or related task areas. Automated recognition of patterns is probably one of its core areas.

Mutual Benefit for Science of Music and Fuzzy Logic: Tunnel Digging from Two Different Sides

On the other hand, experts of Fuzzy Logic may be provided by this book, depending on how far as they embark on it, with a deeper comprehension about what music means. While I have rather too little to tell, or hardly anything new and of actual relevance, about *direct practical* application of Fuzzy Logic and about practicing Soft Computing, I can tell surely a lot about music and its connections with Fuzzy Logic. I am concerned with the ontological, gnoseological, psychological, and (music-) aesthetical status and the relative importance of different phenomena of relationship between music and Fuzzy Logic.

This seems to be a journey full of risks: For specialists of music, this book contains to much of what is well-known in their department, while on the other side, specialists of Fuzzy Logic are commonly familiar with its content. Nevertheless, from a double access, a cross-wise, for not to say "hybrid" perspective, the combination of music analysis and fuzzy logical modes of thinking, might reveal plenty of new aspects in both directions. I took the risk of loosing the ground and falling into the abyss, but followed the path with my eyes wide-opened. But to travel on trodden routes only is unproductive. Without the risk of going astray, there will be no scientific progress. By the way, to make it clear, once and for all. What is presented in this book, remains always under the proviso "Under the actual state of affairs …"—This refers to research in general, and I concede, that naturally my knowledge about it remains rudimentarily, but also refers to my own researches, even if they only mark attempts, but nevertheless, they are new. Therefore, the theory, based on empirical knowledge, as it is hereafter unfolded, contains hypothetical components. It can be enlarged, reduced, and partially rejected.

As it is unavoidable, I am dealing with matters, that concern various scientific disciplines. As far as possible, I challenge questions of a truly interdisciplinary dialogue, which surpasses declarations and lyrical applications for research grants. It

should not be a conversation among deaf persons. And instead of being competitive, it has to be handled in a productive and cooperative way. As I had to acquire, as much as possible, concepts, presentations, questions, and results of Fuzzy Logic, conversely one should expect, that those, who are scientifically as well as practically engaged in various areas of Fuzzy Logic and its application on music, get involved with questions of music - at least, as far as they are dealing with music from the perspective of Fuzzy Logic. Facing the vast expertise of Fuzzy Logic's researchers in information science and mathematics, as well as in related scientific disciplines, I hold full respect, with all due modesty. But if someone takes 'science' only as something in combination with the utmost in mathematical formulas and logical formalizations, then such a person will be disappointed. Anyway, he or she must not continue to read. On the other hand, I cannot totally do without musical examples. Even if someone is unable to read the lines, they bear as an approach of understanding an aesthetical and sensual quality of charming, totally in the sense of Fuzzy Logic. Taken as a picture without any understanding of what is written, it somehow exposes the intended sound and purpose.

A work partly from the science of music, like this one, and partly from Fuzzy Logic, respectively, from soft computing, may be taken in such a way: We dig a tunnel from various directions. Whether we meet exactly in the middle, is however not quite sure. In case, that this may not be completely achieved, and if there were blurs, nevertheless yet undetected states of affairs will be laid bare, which were until now hidden in the darkness of ignorance. Thereby, for both sides the interests and tasks might get clearer, and it could further the studies with or about music and Fuzzy Logic.

About the Structure of This Book

The introduction gives an explanation for a number of important categories and terminologies in relation to Fuzzy Logic, focusing on their relevance to matters of music. Thereupon, correlatively and complementarily, basic categories of the musical process are outlined in the light of Fuzzy Logic. This encompasses its absorption in the individual's memory, or in external storage and forms of reflection like texts or pictures from the concept and first ideas to the different forms of storing. During this kind of process, a musical work of art is the centering focus for at least thirteen different forms of existence, with which I analyze in detail the manifold occurrences of fuzziness in the music process and thus reveal further questions for the field of fuzzy logic.

The Notion of '(Art)work': A structural, Genre-Comprehensive Concept, Not a Concept of Assessment

'Work' is not considered as a concept of assessment, but as a structural one. The characteristics of a 'work' are not confined to 'classical' music, contrary to common prejudices held by enthusiasts of either 'Pop' or 'Classics'. Here, it is meant in the sense of being free of any value judgement, just a specific aesthetic representation, taken in its concreteness and objecthood: a 'piece' of music with more or less complex qualities of character, being limited in space in its temporal and in concrete realization. In principle, such an objecthood is likewise valuable for popular music, or even for improvised, relatively completed productions, being 'pieces', or works.

On the other hand, there is no reason to dismiss the concept of work altogether, as it became a trend in modernity and post-modernity. If firmly outlined characters are missing during processes of art or actions, like in the case of a 'Happening', then the action, as a whole, stands for the 'Work'. No matter how much it is emphasized by the ideology of the 'Open Form' or similar concepts: Actually, even such actions may be reproduced, for example, by filming. Since the 1980s, this is done by 'Performance', which indeed is nothing but performance, only that most of the time there is nothing to be performed. Although in a regularly screened video-reproduction it becomes a work. As will be further explained below (see 2.), the work as a whole appears in and through its different forms of existence as a 'processing identity'; as a whole, that, in the end, may never be absolutely completed.

The main part of this book treats the four principles and five manifestations or phenotypes of Fuzzy Logic in musical process. The pivot rests basically in the dialectic, which is multi-dimensional, multi-layered, involved (encapsulated) and folded in its fuzziness and sharpening along with blurring, for intentionally compositional-artistic utilization of fuzziness in its different facets of art.

Towards a 'Philosophy of Fuzzy Logic'

A brief and final part recapitulates and outlines some further perspectives of future research, above all, interdisciplinary, especially for the realm of theories of art. Apart from that, I am generally tempted to draw some consequences from Fuzzy Logic's way of thinking for the world view in general, and specifically in a musically-artistic context. Seen from this angle, some reflections about analogies and isomorphies are even for those productive, who are hardly interested in music. May be, this book has in a direct way only little to contribute to the methods of Fuzzy Logic, but probably

for its meta-theory. Anyway, the book offers a small contribution in this direction. Bluntly, it might even be labeled as being a piece of 'Philosophy of Fuzzy Logic'.

Rosengarten, Germany   Hanns-Werner Heister
September 2020

Acknowledgements

Contents

Bio-Bibliography of the Author

Hanns-Werner Heister

Prof. Dr. phil. and Scientist with focus on music, born in 1946 in Plochingen/Neckar (Germany, Baden-Württemberg)

1965–1977 Musicology, German studies and Indo-European studies/linguistics in Tübingen, Frankfurt a.M. und Berlin (University of Technology)

1977 Ph.D. in musicology at Technische Universität Berlin, Germany, supervised by Carl Dahlhaus. Dissertation published in 1983 with the Title: "The Concert. Theory of a Cultural Form" (2 volumes).

1993 Habilitation at the Carl von Ossietzky-University Oldenburg on the subject *Musical analysis (including methodological studies)*

1992–1998 Professor for history of music and music communication at the Musikhochschule „Carl Maria von Weber" in Dresden, Germany

1994/95 und 1995 Visiting Professor at the Musikhochschule "Franz Liszt" Weimar, Germany

1998–2011 Professor for musicology at the Hochschule für Musik und Theater Hamburg, Germany

Themes of research and publications:

Methodology of musicology; aesthetics, sociology, history, and anthropology (in particular music and human perception, origins of language and art) of music; political, popular music, new music, jazz; music and musical culture in Nazism, resistance movement and exile; aesthetics and history of music theatre; media/technology and institutions of music culture; music analysis; music and: other arts, psychoanalysis, play, maths, cybernetics, fuzzy logic; gardening.

Books

The Concert. Theory of a Cultural Form, 2 vols. (1983) *Jazz* (1983)

Of the Universal New. Analyses of Engaged Music: Dessau, Eisler, Ginastera, Hartmann (2006)

In/Finity. Encountering Görgy Ligeti (2008)

Background Sound Art (2009)
Heinz Gellrich—Times, Paths, Signs (2014)

Editor and Co-Editor of Series and Books (Selection)

Over/Tones. Music and Other Arts, series since 1995
Music/Society/History, series since 2005
History of Music in the 20th Century, Vol. III: 1945–1975 (2005)
Charles Ives, 1874-1954. American Pioneer of New Music (Atlantische Texte, vol. 23) (2004)
Layers, History, System. Geological Metaphors and Forms of Thought in Art Studies (*Over/Tones, New series* vol. 6), 2016
(with W.-W. Sparrer) *Contemporary Composers* (loose leaf lexicon, since 1992, till April 2020 66 deliveries, ca. 12.700 pages)
For more details see www.Hanns-Werner-Heister.de.